Northern Sphere Area
Water Quality Assessment
Technical Appendix

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1 INTRODUCTION

1.1 Purpose

This report addresses the potential impacts of the proposed Northern Sphere Area Development Project (Project) on the water quality of local surface waters and groundwater. The evaluation for surface water impacts is based on water quality modeling that takes into account local precipitation and the effects of land use changes on runoff volume and quality. Source of data used in the modeling include local water quality data collected in the San Diego Creek watershed and regional and national sources.

1.2 Organization

Section 2 of the report summarizes the analysis methods and significance criteria. Section 3 describes local water quality and the water quality constituents of concern. Section 4 summarizes the results of the water quality model and assesses the potential impacts of the project. Section 5 lists the references.

Attachment A describes the construction and post-construction BMPs under consideration and the proposed process for selecting the BMPs.

Attachment B describes the water quality model, the input data, assumptions used in the modeling, and modeling results.

1.3 Project Description

The Northern Sphere Area, which includes Planning Areas 3, 5B, 6, 8A and 9A, is in the unincorporated portion of Orange County and is proposed for annexation to the City of Irvine. The Northern Sphere Area lies to the north and west of the former El Toro Marine Corps Air Station and is generally bounded by State Route 241 to the north, the El Toro Marine Station to the east, Trabuco Road to the south and Jeffrey Road and existing residential development to the west. The total project area is approximately 7,743 acres.

Table 1 shows the approximate existing and proposed land uses for each Planning Area. Existing land uses are primarily open space and agriculture. Agricultural uses include row crops (e.g., strawberries and tomatoes), avocado orchards and nurseries. The nurseries are of two types: container nurseries, and shrub/ground cover nurseries. Some land also is used for grazing.

These land uses were modeled using water quality monitoring data from similar land use catchments in Ventura County and Los Angeles County, as discussed in the Modeling Attachment B, "Water Quality Model Description." Planning Area 3 was not modeled because there are no anticipated changes in land use.

Storm water runoff from the Northern Sphere Area development site discharges into several drainage channels: the Central Irvine Channel, Trabuco Channel, Marshburn Channel, Bee Canyon Channel, Round Canyon Channel, and the Agua Chinon Wash. Runoff from Planning Area 9 is discharged to the Jeffrey/Trabuco Retarding Basin, which in turn flows to the Central Irvine Channel. Planning Area 6 spans three drainage areas, and discharges runoff to the Agua Chinon and Marshburn Retarding Basins and the Agua Chinon Wash, Bee and Round Canyon Channels, and Marshburn Channel. Planning Areas 5B and 8A are currently routed to the Central Irvine Channel. Flows from the Central Irvine Channel enter Peters Canyon Wash, and flows from the Marshburn and Agua Chinon channels enter San Diego Creek (Reach 2). Thus, portions of the development drain to Peters Canyon Wash and other portions drain to the upper reaches of San Diego Creek.

The project proponent proposes to include as part of the project design a feature (the Project Design Feature or PDF) to improve the quality of storm water runoff from the development area. The PDF consists of two components. First, the existing Trabuco Retarding Basin will be modified to treat over a 24-hour period the volume of runoff produced by a 24-hour, 85th percentile storm event (runoff from a 0.75 inch, 24-hour storm) over the 1226 acre Planning Area 9, which constitutes approximately 40 percent of the development area. Second, for the remaining 60 percent of the development area (those areas within Planning Areas 5B, 6 and 8A which are not tributary to the Trabuco Retarding Basin and which will be developed), BMPs (for example, BMPs that achieve similar performance per National BMP Database ratings as catch basin inserts) will be designed to infiltrate, filter or treat the volume of runoff produced by either (a) a 24-hour, 85th percentile storm event (runoff from 0.75 inch, 24-hour storm), or (b) the maximum flow rate of runoff produced by a rainfall intensity of 0.2 inch of rainfall per hour. For the purposes of modeling, a network of catch basin inserts has been assumed. It has further been assumed that the density of inserts (e.g., the number per unit acre) would be sufficient to meet the standard described above.

Table 1: Land Use (acres) and Modeling Assumptions (Acres)

Land Uses & % Imperviousness			Project Planning Areas					Totals	Modeled as
			2/3[1]	**5B**	**6**	**8A**	**9A**		
Existing Conditions	Open Space	0	3,745	32	1,304		132	5,213	Open
	Ag – Nursery	10		224	231		344	799	Row crop
	Ag – Strawberries	50		63	110		573	746	Row crop
	Ag - Other Row Crops	0			81[3]	73	228	382	Row crop
	Ag – Orchards	0			378			378	Orchards
	Ag – Grazing	0			200			200	Open
	Water Bodies	100			25			25	Water
	Totals		**3,745**	**319**	**2,329**	**73**	**1,277**	**7,743**	
Developed Conditions	Preservation[2]	0	3,745		852			4,597	Open
	Recreation	0			258		72	330	Open
	Commercial Recreation	0					51	51	Open
	Water Bodies	100			25			25	Water
	Medium Density Res.	60		319	866	73	678	1,936	SF Res.
	Medium-high Density Res.	70					89	89	MF Res.
	Multi-use	90			20		60	80	Commercial
	Community Commercial	90			20			20	Commercial
	Medical and Science	90			285		317	602	Commercial
	Institutional	70			3		10	13	Education
	Totals		**3,745**	**319**	**2,329**	**73**	**1,227**	**7,743**	

Notes:

1 – Planning Area 3, Implementation District "P" in Planning Area 2 and the Trabuco Retarding Basin were not included in the water quality model because there are no land use changes proposed for these areas as part of the Project. As a result, water quality in these areas would not be affected by the proposed development.

2 - Preservation: open space areas that will be preserved in their existing condition

3 – Agricultural uses including some equipment and material storage

Sources: Northern Sphere Area Pre-Annexation Development Agreement, Screencheck Draft (Table 2-2), and table of leased agricultural acreage provided by P. Changala, TIC.

2 METHODS FOR EVALUATION OF IMPACT SIGNIFICANCE

The impact analysis addressed stormwater flows, dry-weather flows, and groundwater.

2.1 Stormwater Flows

Two criteria were used to evaluate the anticipated changes in stormwater flows: (1) post versus pre-development flows, water quality and loads, and (2) applicable state water quality criteria.

2.1.1 Post vs. Pre-Development Water Quality and Loads

One method for evaluating the potential effects of the project is to assess the change in pollutant loadings and concentrations that would occur with the project. Federal, state and local laws, including the Clean Water Act do not require that projects demonstrate no changes or increases in pollutant loadings and concentrations unless (1) there has been a TMDL established for a water body with this specific requirement for selected pollutants, and/or (2) the water quality in the waterbody is such that any increase in pollutant load would be prohibited by the Clean Water Act anti-degradation policy. Nonetheless, if no increases in pollutant loads or concentrations were predicted, then it is unlikely that the project would cause an increase in the exceedances in a receiving water of water quality standards, an increase in sediment pollutant concentrations, or would be considered an additional source of pollutants in general. If a small increase in pollutant loads and/or concentrations would be expected to occur, then other factors would need to be evaluated. For example, if loads are projected to increase, but concentrations are lower than pre-project, the assessment would depend on the behavior of the constituent (e.g., bioaccumulation characteristics) and regulatory status (e.g., on 303(d) list).

2.1.2 Water Quality Criteria

The water quality criteria are those that apply to designated beneficial uses of receiving waters as described in the Santa Ana Basin Plan. The specific criteria are included in the Basin Plan and in the California Toxics Rule (CTR). Water quality criteria cited in the Santa Ana Basin Plan and in the CTR provide concentrations that are not to be exceeded in receiving waters more often than once every 3 years. The criteria include both acute and chronic values. Due to the intermittent nature of stormwater runoff (especially in Southern California), the acute criteria are considered to be more applicable to stormwater conditions and therefore used in assessing project impacts. Water quality criteria do not apply directly to discharges of storm water runoff. Nonetheless, water quality criteria provide a useful benchmark to assess the potential for project discharges to affect the water quality of receiving waters. If the project discharges were expected to be below water quality criteria values, than the project would be unlikely to have an adverse effect on downstream water quality.

2.2 Dry Weather Flows and Water Quality

Dry weather flow and water quality changes were evaluated by applying a multiple regression using existing in-stream dry weather flow and water quality data as the independent variables and land uses (agriculture, residential, commercial, open space) as the dependant variables. This and other information were used to qualitatively assess the potential impacts associated with dry weather flows and loads for selected pollutants (nitrate and bacteria).

2.3 Groundwater Impacts

Impacts to groundwater were evaluated qualitatively based on current data on groundwater levels and quality, and the potential changes to infiltration associated with land use conversion and water quality basins.

3 CONSTITUENTS OF CONCERN AND RECEIVING WATER QUALITY

3.1 303(d) Listed Constituents

There are three classes of constituents that have been identified by the Santa Ana Regional Water Quality Control Board as not meeting water quality criteria in San Diego Creek and Upper Newport Bay, and for which TMDLs have been developed:

- nutrients
- pathogens
- siltation (sediment)

The Regional Board also is in the process of developing a TMDL for toxic constituents.

Nutrients - Nutrients (especially nitrogen compounds) are believed to be contributing to algal blooms in Upper Newport Bay, which in turn contributes to low dissolved oxygen concentrations. During two intensive weeklong studies the average nitrate nitrogen concentration in the Bay was 9.04 mg/l in September 1999 and 2.84 mg/l in June 2000 (OC PFRD NPDES Annual Progress Report, 2000). According to the 1998-303(d) list, the major sources of nutrient runoff are plant nurseries, urban runoff, high nutrient groundwater, agricultural lands, and soil erosion from open lands (including construction sites).

Pathogens - There are frequent elevated concentrations of fecal and total coliforms in San Diego Creek and Upper Newport Bay waters. For example, bacteriological monitoring conducted over a 10-month period in Costa Mesa Channel (located in a nearby watershed) indicated a median fecal coliform concentration of about 4000 MPN/100ml (OC PFRD NPDES Annual Report, 2000). Total and fecal coliform are used as indicators of pathogens in the bay and tributary waters. The indicators have been relatively successful in assessing human pathogens in sanitary system discharges. The indicators are relatively poor when used for storm water. Sources of indicator bacteria as cited in the State Board's 1998 303(d) list include: urban runoff (pet waste), domestic wastewater spills and leaks, some agricultural practices (e.g. grazing), and wildlife.

Sediment – According to the State Board's 1998 303(d) list, the sediment load in the Upper Newport Bay and San Diego Creek comes from a variety of developed and undeveloped land uses. Sources may generally include agricultural land uses, construction sites, hill slope landslides, and in-stream sediment sources (channel erosion).

<u>Toxic Constituents -</u> Water in San Diego Creek has been found to be occasionally toxic to sensitive freshwater organisms (e.g., *Ceriodaphnia Dubia*) in laboratory bioassay tests. Approximately half of the toxicity is believed to be attributable to the organophosphate pesticides diazinon and chlorpyrifos, which are used in urban areas and nurseries for structural, lawn and garden pest control. EPA is currently phasing out these pesticides for most urban uses. There is also concern that metals (e.g., copper) and metalloids (e.g., mercury, selenium) may be causing or contributing to the observed toxicity. Sources of these and other trace metals include natural and anthropogenic sources. For example, natural sources of selenium in soils can be leached out with groundwater flows and discharged to surface waters. Anthropogenic sources of copper include pesticides, leaks of radiator fluid and lubricants from vehicles, vehicle wear from metal parts (e.g., brake pad wear), and copper used in building construction.

Table 2: 303(d) Listing of Constituents

Water Body	**TMDL Priority**	**Pollutant or Stressor (start date)**	**Probable Sources**
Upper Newport Bay Biological Preserve	High	Metals[1]	Urban Runoff & Storm Drains
		Nutrients (1/96)	Agriculture
		Pathogens	Urban Runoff & Storm Drains
		Pesticides	Unknown Non-point source Agriculture
		Siltation (1/96)	Urban Runoff & Storm Drains Construction
San Diego Creek, Reach 1	High	Metals[1]	Unknown Non-point source
		Nutrients (7/96)	Agriculture Unknown Non-point source Nurseries
		Pesticides	Unknown Non-point source
		Siltation (1/96)	Unknown Non-point source
San Diego Creek, Reach 2	High	Metals[1]	Urban Runoff & Storm Drains
		Nutrients	Nurseries Agriculture Unknown non-point source
		Siltation (1/96)	Construction
		Unknown Toxicity	Unknown non-point source

Reproduced from the State of California 303d lists - http://www.swrcb.ca.gov/tmdl/docs/303dtmdl_98reg8.pdf

1 – According to the SARWQCB TMDL for Toxic Substances (Dec. 2000), dissolved copper in Newport Bay and dissolved selenium in San Diego Creek are the metals most likely contributing to toxicity.

3.2 Constituents of Concern

Storm water runoff from the development site will be discharged to Peters Canyon Wash and San Diego Creek, and ultimately into Upper Newport Bay. Thus TMDL constituents for these water bodies are constituents of concern. In addition to the 303(d)-listed constituents, trace metals including lead and zinc, and hydrocarbons are commonly associated with urban runoff at significant concentrations and are also included in the following list of constituents of concern.

- Sediment
- Nutrients (Phosphorus and Nitrogen)
- Trace Metals (Copper, Lead, and Zinc)
- Metalloids (Selenium)
- Pathogens (Bacteria, Viruses, and Protozoa)
- Hydrocarbons (Oil and Grease, Polycyclic Aromatic Hydrocarbons)
- Pesticides (especially Diazinon and Chlorpyrifos)

3.3 Modeled Constituents

Constituents of concern were analyzed quantitatively when sufficient input data for modeling were available; otherwise the constituent was evaluated qualitatively. The following constituents of concern were not modeled due to limited storm water monitoring data.

1. Various forms of hydrocarbons are common constituents associated with urban runoff; however, these constituents are difficult to measure because of laboratory interference effects, sample collection challenges (hydrocarbons tend to coat sample bottles), and they are typically measured with single grab samples, making it difficult to develop reliable Event Mean Concentrations (EMCs) based on collecting and analyzing flow composite samples.

2. Pesticides in urban runoff are often at concentrations that are below detection limits for most commercial laboratories; and therefore there are limited statistically reliable data on pesticides in urban runoff.

3. Actual human pathogens are usually not directly measured in storm water monitoring programs because of the difficulty and expense involved; rather indicator bacteria such as fecal coliform are measured. Most indicators are not very reliable for storm water conditions; in part because storm water tends to mobilize pollutants from many sources, some of which contain non-pathogenic bacteria. For this reason, and because holding times for bacterial samples are necessarily short, most storm water programs do not collect flow composite samples that potentially could produce more reliable estimates of averages vs. the traditional single grab samples.

The following constituents were chosen for modeling because statistically significant monitoring data are available. Data for these constituents have been collected over a range of storm events using flow composite sampling methods, and the data are consistently measured at levels well above laboratories' method detection levels.

- Total Suspended Solids (sediment)
- Total Phosphorus
- Total Kjeldahl Nitrogen
- Nitrate-Nitrogen
- Total Copper
- Total Lead
- Total Zinc

3.4 Surface Water Quality

The County of Orange conducts a comprehensive monitoring program in compliance with the County of Orange area-wide NPDES permit. Automatic water quality samplers have been installed at various locations throughout the watershed in order to collect flow composite samples during wet weather runoff events. Table 3 shows data collected on Peters Canyon Wash and San Diego Creek (at Harvard) from 1994 through 2000. These data represent the mean concentrations of the flow composite samples collected from 15 to 18 storm events depending on the site. These locations were selected, as they are the closest monitoring stations to the Project site having reasonably robust data sets. The data indicate that San Diego Creek tends to carry more sediment than Peters Canyon Wash, probably because of the larger upland portion of the watershed located in the open steep terrain, and extensive down cutting in some tributary streams (e.g., Serrano Creek). On the other hand, Peters Canyon Wash has higher nitrogen levels, which is thought to result from the infiltration of groundwater high in nitrogen into Peters Canyon Wash and tributary channels. The concentrations of metals are quite similar in both streams. As discussed in more detail in Attachment B, these data are consistent with the results of the water quality modeling.

Table 3: Wet-Weather Water Quality in Peters Canyon Wash and San Diego Creek (Reach 2)

Development Condition	Units	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
San Diego Creek at Harvard[1]	(mg/l)	1517	n.a.	n.a.	3.79	0.047	0.022	0.204
Peters Canyon Wash [2]	(mg/l)	800	n.a.	n.a.	6.05	0.048	0.023	0.137

n.a. – not available
1 – stormwater monitoring (03/94 to 03/00) average of 15 storm event EMCs
2 –stormwater monitoring (01/94 to 02/00) average of 18 storm event EMCs

3.5 Hydrogeology and Groundwater Quality

Groundwater in the Northern Sphere Area follows two regimes (NMG, 2001). Groundwater in the mountainous and foothill regions, comprising the northern and eastern portions of Project area, is typically represented by perched groundwater tables within alluvial filled canyons and by groundwater seepage from fractured bedrock into streams. Depths to perched water tables vary from canyon to canyon, generally ranging between 10-25 ft, up to 50-70 ft. Groundwater seeps are present in the foothill areas and are most prevalent near agriculture areas (NMG, 2001). The regional groundwater table underlying the mountainous regions is thought to be hundreds of feet deep (NMG, 2001).

Groundwater in the Tustin alluvial plain, comprising the western and southern portions of the Project area, generally flows in a westerly direction corresponding to regional topography. The alluvial plain within the Project area ranges in thickness from a few feet in the foothill areas up to 300 feet in the Southwest corner. Recharge areas are in the foothill plain regions where sandy soils are predominant. Clayey and less permeable surface materials occur in the southwest portions of the Project Area, providing less opportunity for recharge. Depth to groundwater within the Tustin plains range from 45 ft in the southwest corner up to 125 ft in the northeast corner. A shallow perched groundwater table (depths 15-25 ft) to the west of the Project area is not present on the site (NMG, 2001).

There are no potable water supply wells within the Northern Sphere Area (NMG, 2001 and Samuel, 2001). Consequently, groundwater quality information within the Project area is sparse. Limited historical data from deep agricultural production wells are available from the Irvine Ranch Water District (Samuel, 2001). Nitrate concentrations in water samples collected in two off-site wells at depths ranging between 200-1500 ft, were between 1.4 to 15 mg/L (federal drinking water standard is 10 mg/L as nitrogen). These data were collected between 1953-1965 and in 1983.

Limited historical and recent groundwater quality information is available from several monitoring wells (about seven total) located in residential areas immediately west and southwest of Northern Sphere Area (Defense Facilities Assessment Section, 1993). These wells withdraw water from the shallow aquifer west of Northern Sphere Area, at depths generally between 10-25 ft. Historical data (1981-89) indicate nitrate concentrations generally below or slightly above 10 mg/L in most samples, with a few wells showing high concentrations above 20 mg/L. Concentrations of total dissolved solids ranged from 230-2150 mg/L. Data collected in June 1999 show increased nitrate levels in comparison with historical data; nitrate concentrations in nearly all samples were above 10 mg/L, typically ranging between 15-35 mg/L. The location of these shallow groundwater wells is down-gradient of groundwater flow emanating from Northern Sphere Area, thus suggesting that the source of elevated nitrate is either within the residential area, or more likely from agricultural practices in the up-gradient Northern Sphere Area.

Elevated concentrations of nitrate and TDS in the shallow wells west of the Northern Sphere Area are indicative of general basin characteristics, although TDS levels in the development area may be naturally elevated as a result of groundwater movement through soil. IDM1 is a multilevel monitoring well about two miles west of the Project area, constructed and maintained by the Orange County Water District. Groundwater samples from December 1997 show high nitrate and TDS concentrations (above recommended levels) in the shallow zone (85-95 ft) and low concentrations (<1000 mg/L TDS and under 10 mg/L nitrogen) in the lower zones (270-1060 ft) (Defense Facilities Assessment Section, 1993). The sources of nitrate and TDS are generally attributed to agricultural practices and leaching of natural mineral deposits.

The limited data did not indicate the presence of organic compounds (solvent, fuels) in groundwater within the Project area. A large plume of groundwater contamination by number of organic compounds including trichloroethylene (TCE) is present beneath the former El Toro Marine base directly south of the Project area. This plume should have no impact on groundwater quality within the Project area because it is down gradient of groundwater flow emanating from the site.

Elevated selenium concentration is also of concern within the groundwater basin. Available information, however, indicates that sources of selenium contamination are primarily in shallow sediments within historical marshland areas down gradient of the Northern Sphere Area (Hibbs and Lee, 2000).

4.0 WATER QUALITY ASSESSMENT

The following sections present the results of the water quality modeling for wet weather; and the evaluation of dry weather impacts, groundwater impacts, impacts on stream channel stability, and construction-related impacts.

4.1 Wet Weather Assessment

The wet weather assessment was based on two measures: predicted changes in loads and concentrations, and exceedances of water quality criteria

4.1.1 Post Versus Pre-Development Concentrations and Loads

Table 4 presents the predicted pre and post-development pollutant loads and Table 5 presents the pre and post-development concentrations calculated in the water quality model. These load and concentration estimates represent average annual runoff conditions. During high or low rainfall years, pollutant loads and concentrations could increase or decrease depending on hydrologic and watershed conditions. The percent changes in the tables are calculated by dividing the difference between post-development and existing conditions by the existing conditions value (i.e. [post – existing]/existing × 100%). As described below, post-development results are presented with and without the PDF proposed by the project proponent.

Table 4: Pollutant Loads and % Changes

Development Condition	Units	Annual Q (ft^3)	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
Pre-Dev	Load (lbs/yr)	32,824,101	2,222,400	4,153	12,297	16,821	245.1	79.9	527
Post-Dev (w/o PDF)	Load (lbs/yr)	78,350,588	445,283	1,757	13,710	3,708	107	55.2	614
% Change (pre vs. post w/o PDF)		139%	-80%	-58%	11%	-78%	-56%	-31%	17%
Post-Dev (w/ PDF)	Load (lbs/yr)	78,350,588	333,685	1,393	10,907	3351	81.5	43.7	467
% Change (pre vs. post with PDF)		139%	-85%	-66%	-11%	-80%	-67%	-45%	-11%

Table 5: Pollutant Concentrations and % Changes

Development Condition	Units	Annual Q (ft^3)	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
Pre-Dev	Conc (mg/l)	32,824,101	1085	2.03	6.00	8.21	0.120	0.039	0.257
Post-Dev (w/o PDF)	Conc (mg/l)	78,350,588	91.0	0.359	2.80	0.758	0.022	0.011	0.126
% Change (pre vs. post w/o PDF)		139%	-92%	-82%	-53%	-91%	-82%	-71%	-51%
Post-Dev (w/ PDF)	Conc (mg/l)	78,350,588	68.2	0.285	2.23	0.685	0.017	0.0089	0.095
% Change (pre vs. post with PDF)		139%	-94%	-86%	-63%	-92%	-86%	-77%	-63%

The following summarizes key modeling results for the three cases modeled.

Existing Conditions - The model results indicate elevated concentrations and loads for suspended sediments and nutrients (nitrogen and phosphorous) under existing conditions, reflecting the contribution from exposed soils and more intense fertilizer applications associated with agriculture and nursery uses.

Post Development without PDF – Model results under post-development without the PDF reflect the predicted changes in water quantity and quality associated with land conversion only. Runoff volumes are estimated to increase by about 140% because of the increase in impervious areas. Total suspended solids (TSS) loads are predicted to decrease by about 80% and TSS concentrations are predicted to drop from about 1100 mg/l to about 90 mg/l. Nutrient loads are also predicted to decrease by about 80% for nitrate-nitrogen and about 60% for total phosphorous. (The load of organic nitrogen in the form of Kjeldhal nitrogen is predicted to increase by about 10%; however this form of nitrogen is generally not bio-available and, therefore, of less concern than the other nutrients.) Loads and concentrations for the metals copper and lead are also predicted to decrease compared to the existing conditions, whereas the load for zinc is predicted to increase by about 17%.

Post Development with PDF – Model results under post-development conditions with the PDF show a further reduction in loads and concentrations. The PDF is predicted to reduce zinc and TKN loads to below the levels of existing conditions.

4.1.2 Other Constituents

This section describes predicted changes in constituents of concern that were not modeled. These constituents are: pathogen indicators (e.g., fecal coliform), hydrocarbons, and pesticides. These constituents are addressed qualitatively for evaluation of the possible changes in runoff concentrations for these pollutants, based on anticipated pre vs. post land use conditions and current knowledge regarding the effects of land use on agricultural and urban runoff quality.

Pesticides

Pesticides are currently being used for agricultural purposes (including nurseries). Pesticide use will decrease substantially as some agricultural activities are phased out. In the post-developed condition, pesticides would be applied to common landscaped areas and in residential areas. However, some reduction in diazinon and chlorpyrifos (commonly used urban pesticides) is anticipated because of EPA's ban. Source control measures such as landscape contractor education would be employed to help manage fertilizer applications to common landscape areas.

Hydrocarbons

Concentrations of hydrocarbons are likely to increase under post-development conditions because of the increased levels of traffic and parking. Because of the nature of the development (mostly housing), the major source of oil and grease will be from roads and driveways. Data from parking lot studies conducted by CalTrans in California indicate that concentrations of oil and grease are typically low (below 10 mg/l). Hydrocarbons are hydrophobic (low solubility in water), have the potential to volatilize, and most forms are biodegradable. Hydrocarbons in urban runoff also can attach to particulates and would be treated in BMPs being proposed as part of the Project Design Feature. Hydrocarbons have not been identified as contributing to toxicity in the San Diego Creek watershed according to the Final Problem Statement for the TMDL for Toxic Substances prepared by the Santa Ana RWQCB (December, 2000).

Pathogens

The change in concentrations of pathogens associated with development of the site compared to the existing open space and agricultural land use is difficult to evaluate for a number of reasons. Measurements of indicator organisms are not necessarily reliable indicators of viable human pathogenic viruses, bacteria, or protozoa. Moreover, there are numerous sources of pathogens including existing grazing, birds and other wildlife, as well as domesticated animals and pets.

The presence of pathogens in the post-development condition is not expected to substantially change as a result of the project. The conversion of the existing grazing areas to residential and commercial development will eliminate grazing animals as a source of pathogens. Development of the site into residential, commercial, and research and development office uses will reduce some of the natural sources of pathogens by eliminating the row crops and orchards which tend to attract birds and other wildlife searching for foraging and habitat areas. Additionally, the development will be a new development with new infrastructure, thus no leakage from the sanitary sewer system would be expected. This would help minimize the human pathogen loading to the receiving waters. While existing pathogen sources are expected to be reduced, the proposed development will introduce new sources. Urban runoff characteristically contain indicator organisms from known and unknown sources, including, for example, pets. On balance, however, no substantial change is anticipated.

Although it is not possible to quantify, the proposed PDF is expected to reduce pathogens in storm water runoff. Some fraction of pathogens in storm water runoff will adhere to larger particles. Particles in runoff tributary to the Trabuco Retarding Basin will then settle out in that basin; particles in runoff tributary to other water bodies will be filtered out by other means of treatment, as specified in the PDF.

Selenium

Selenium is a bioaccumulative trace element, which, under certain conditions, can become bioavailable, enter the food chain and cause toxicity to fish and wildlife. In the Santa Ana RWQCB Final Problem Statement for the Total Maximum Daily Load for Toxic Substances in Newport Bay and San Diego Creek (Santa Ana RWQCB, 2000) 100 % of the measured dissolved selenium concentrations (20 samples) in San Diego Creek at Campus Drive exceeded the chronic CTR objective of 5 ug/l. The maximum concentration observed was 65 ug/l.

The causes of the elevated selenium observed in channels downstream of the project site is attributed to a combination of high selenium concentrations in shallow groundwater down-gradient of the project site, and groundwater flow from this area into the streams (Hibbs and Lee, 2000). Concentrations in shallow groundwater are believed to be as high as 478 ug/l, with the highest concentrations located near the confluence of El Modena Channel, Santa Fe Channel, and Peters Canyon Wash. This area, unlike the development area, is within the historical location of the Swamp of the Frogs, which, according to Hibbs and Lee, is where selenium became sequestered in the peat soils of the anoxic marsh environment. Hibbs and Lee hypothesize that today selenium is being released as oxygenated groundwater flows through the soils where the marshes once existed.

In the Project area, Hibbs and Lee conducted sampling at 6 stations below Hines Nursery and one station below Bordiers Nursery and found most samples were below detection (less than 4 ug/l). No groundwater samples were obtained in the Project area. The closest groundwater sampling location was near Marshburn Channel and I5 where the concentration was 7 ug/l. Moreover, current groundwater levels below the Project area are quite deep; varying from approximately 50 feet in the southwestern portion of the development to over 100 feet to the northeast (NMG, 2001). Thus groundwater infiltration into stream channels in this area is unlikely.

Significant changes in the groundwater levels are not anticipated with development of the Project. Moreover elevated concentrations of selenium in the groundwater do not occur in the Project area. Thus it is unlikely that the Northern Sphere Area Project will result in an increase in selenium discharges to local channels.

4.1.3 Post Development Water Quality Compared to Water Quality Criteria

The project drains into Peters Canyon Wash and San Diego Creek (Reach 2), which are waters of the United States and subject to the California Toxics Rules. Although the CTR criteria apply to receiving water quality and not to stormwater discharges, CTR provide criteria that, along with other criteria, can be used as a benchmark to evaluate the significance of potential impacts of stormwater runoff to receiving waters.

The model results for metals are given as total metal loads and concentrations because the majority of EMC and effluent data are in this form, while the CTR acute criteria are in terms of dissolved metal concentrations. In order to evaluate the potential for dissolved metal concentrations to exceed CTR criteria, estimates of the dissolved metal concentrations were made based upon results from Sansalone at a highway site (1997) and LA County monitoring data.

Table 6: Predicted Dissolved Metals Concentrations (ug/l)

Metal	**Pre-Development**	**Post Development Without PDF**	**Post-Development with PDF**	**California Toxics Rule Acute Criteria Dissolved Metal Concentration (ug/L) *(Hardness as CaCO3 300 mg/L)***
Copper	68	13	9.7	38
Lead	11	3	2.4	208
Zinc	140	71	53	297

Table 6 shows that the predicted dissolved metal concentrations in the storm water runoff are well below the acute CTR criteria for post development conditions without and with the PDF. These runoff concentrations are average conditions and will fluctuate from storm to storm and within storms. Despite fluctuations in discharge concentrations, this analysis would indicate that it is unlikely that these metals will exceed the CTR acute criteria for the receiving waters.

4.2 Dry Weather Assessment

Dry weather flow data have been obtained by Orange County Public Facilities & Resources Department (OCPFRD, 2000) at several locations whose catchments represent a mix of open, commercial, residential, and agricultural land uses. A multiple regression of these data indicates that dry weather flows (per unit acre) from agricultural and residential areas are comparable and much larger (by about a factor of about 5) to open and commercial land uses. Although preliminary results from a limited database, these results suggest that irrigation practices (and other urban inputs: car washing, pavement washing, etc) for these two types of land uses result in comparable dry weather flows. Therefore the conversion of land from agricultural to urban land uses is not likely to significantly change current dry weather flows.

Dry weather flows are typically low in sediment because the flows are relatively low and the more coarse suspended sediment tends to settle out or are filtered by algae and other plants at the bottom of drainage systems. As a consequence, pollutants that tend to be associated with suspended solids (e.g., phosphorous, some trace metals, and some pesticides) are typically found in very low concentrations in dry weather flows. Therefore, the focus is on constituents that tend to be dissolved, e.g., nitrate; or constituents that are so small as to be effectively transported, e.g., pathogen indicators, whose presence has been noted in dry weather.

A regression analysis, similar to that conducted for dry weather flow, was conducted for total nitrogen concentrations using data obtained by Orange County PFRD. The preliminary results indicate that the total nitrogen in dry weather flows attributed to agricultural areas far exceeded the total nitrogen attributed to residential and other land uses. This analysis, although preliminary and based on limited data, indicates that the conversion of land from agriculture to residential land uses will result in a reduction in nitrogen concentrations and loads during dry weather conditions.

The principal sources of pathogens during dry weather flows is leaking septic systems, cross-connections between sanitary sewers and storm drains, or leakage from the sanitary sewer system into groundwater, which feeds the dry and non-storm flows. Pet wastes can also be a source of pathogens. However, the Northern Sphere Area project will be a new development with a new storm drain and sanitary sewer system, which is expected to have minimal if any leakage, the development should not result in increased dry weather pathogen levels.

4.3 Groundwater Impacts

The concern for groundwater impacts from the Northern Sphere Area Development focuses on the potential for infiltration of water containing pollutants associated with urban runoff. Particular concern would be associated with infiltration of stormwater collected and treated in water quality basins, and in other types of water quality controls (e.g., landscaped areas used for bioretention). Research conducted on the effects on groundwater from stormwater infiltration by Pitt et al, (1994) indicate that the potential for contamination is strongly dependent on a number of factors including the local hydrogeology and the chemical characteristics of the pollutants of concern.

Local hydrogeologic data indicate that the depth to groundwater varies from about 50 feet in the southwestern portion of the site (near the Jeffrey Trabuco Retarding Basin) to over 100 feet in the northwestern portion of the site (NMG, 2001). The site is primarily underlain with alluvium, which varies from a few feet near the foothills to over 300 feet in the southwest corner of the site, where there are interlayered clays and silts. The surficial soils in the southwestern portion of the site are also indicated to have poor to moderate permeability whereas soils near the foothills have moderately rapid permeability. Thus the site can be generally characterized as having relatively deep alluvium, shallower ground water, and less infiltrative soils in the southern part of the site associated with the Tustin Plain; tending towards the northwestern portion of the site (nearer the foothills) where the alluvium is relatively shallow, groundwater levels are deeper, and surficial soils are more infiltrative.

Chemical characteristics that influence the potential for groundwater impacts include high mobility (low sorption potential), high soluble fractions, and abundance in stormwater. For example, as a class of constituents, trace metals tend to adsorb onto soil particles and are filtered out by the soils. This has been confirmed by extensive data collected beneath stormwater detention/retention ponds in the City of Fresno (Fresno Nationwide Urban Runoff Program Project, 1984) that showed that trace metals tended to be adsorbed in the upper few feet of the pond bottom sediments. More mobile constituents such as nitrate would have a greater potential for infiltration.

Pollutants associated with urbanization often include hydrocarbons, trace metals, pathogen indicators, nutrients and pesticides. According to the analysis conducted by Pitt et al, most of these pollutants are less mobile and would pose a low to moderate threat to groundwater quality. Certain pathogens and salts would have the greatest potential for impacting groundwater. With respect to nitrogen, the conversion from agriculture to urban land uses would likely result in a reduction in nitrate because of the reduced application of fertilizers in urban versus agricultural areas.

4.4 Erosion and Siltation Impacts

Runoff volume, flow rate, and duration tend to increase with urbanization because of the increase in impervious surfaces and the installation of drainage facilities that more efficiently convey runoff from the site to the local water bodies. This combination of factors tends to increase the energy available to mobilize sediments in stream channels and cause down cutting and/or slope instabilities.
In the case of the Northern Sphere Area development, many of the streams have lined slopes and alluvial bottoms and therefore slope instability is not an issue for these channels as long as the toe of the slope is adequately protected. Moreover, additional channel protections will be provided as part of the Northern Sphere Area Development project.

Channel grade control is more the issue and depends on the extent to which the proposed development adds to current flows, and the effectiveness of existing grade control structures designed as part of the County's Flood Control Master Plan. The Master Plan does incorporate a number of grade control structures (drop structures throughout the San Diego Creek watershed) that will limit the effects of increased flows on channel down cutting.

As most channels in the area that would be affected by discharges from the Northern Sphere Area Development currently have or plan to have channel protection in the form of stabilized slopes and/or grade controls, the potential for stream destabilization is limited.

4.5 Construction Related Impacts

The potential impacts of construction on water quality focus primarily on sediments and turbidity and pollutants that might be associated with sediments (e.g., phosphorous). These constituents currently are listed in the State Water Resources Control Board (SWRCB) 1998 303(d) list as impairing beneficial uses in San Diego Creek, and are currently regulated under a sediment TMDL and a nutrient TMDL. The TMDL for sediment identifies construction sites as an important source of sediments.

Construction-related activities that are primarily responsible for sediment releases are related to exposing soils to potential mobilization by rainfall/runoff and wind. Such activities include removal of vegetation from the site, grading of the site, and trenching for infrastructure improvements. Environmental factors that affect erosion include topographic, soil, and rainfall characteristics. The Northern Sphere Area Development is located in a relatively flat area that is subject to a mean annual rainfall of about 12 inches per year, although storm events can have high intensities.

Impacts will be minimized through the development and implementation of erosion and sediment control BMPs, which are required by existing regulations. Erosion control BMPs are designed to prevent erosion, whereas sediment controls are designed to trap sediment once it has been mobilized. (Erosion control is considered the more effective strategy.) A Storm Water Pollution Prevention Plan (SWPPP) will be developed as required by, and in compliance with, the SWRCB's State General Construction Permit. This Permit requires BMP selection and implementation for various phases of construction, and BMP maintenance. In the recently revised General Permit, water quality monitoring is required in addition to visual monitoring. Specific BMPs that will be considered in the development of the SWPPP are described in Attachment A.

Drainage from a major portion of the development is directed to the Trabuco Retarding Basin, which will be effective in settling out coarser sediments that could be discharged during the construction phase. The combination of on-site controls implemented as part of the SWPPP, and the Trabuco Retarding Basin should result in substantial control of sediment (and pollutants associated with sediment) in runoff that ultimately enters Upper Newport Bay.

4.6 Conclusions

Wet Weather - A comparison between predicted post and pre-development concentrations and loads during wet weather runoff conditions indicate a reduction in all constituents modeled except for zinc and TKN loads. Zinc loads are predicted to increase by 17% under post-development conditions without the PDF; but would be reduced with the PDF to levels comparable to pre-development conditions. TKN concentrations are predicted to increase by about 11% under post development without the PDF and are predicted to be somewhat less that existing conditions with the PDF. Hydrocarbon concentrations and loads may increase because of vehicle emissions and leaks; although this would be offset somewhat as most vehicles would be well maintained and relatively new. Pathogen indicator levels may increase because of urban sources; although this is expected to be substantially offset by a reduction in wildlife sources and the elimination of grazing. Some reduction in hydrocarbon and pathogen concentrations is anticipated to occur in the PDFs as some fraction of both of these constituents will adhere to particles and be subject to treatment by settling and filtration.

Dry Weather - A preliminary analysis of dry weather flow and water quality data collect by the County of Orange indicates that conversion of agricultural lands to urban would not likely change dry weather flow rates. On the other hand, the analysis indicates that dry weather nitrogen concentrations would likely be reduced under post-development conditions.

Groundwater - Groundwater impacts (if any) would most likely be associated with infiltration beneath water quality basins, and would tend to be associated with those constituents that tend to remain in dissolved form in groundwater (e.g., nitrate, salts). Basins located in the southwestern portion of the site (e.g., Trabuco Basin) are likely to have limited infiltration because soils in that area have low infiltrative characteristics.

Erosion and Siltation - Channel instabilities caused by the increase in runoff volumes will be minimal as most channel side slopes in the Northern Sphere Area Development are stabilized and the channel bottoms are protected by downstream grade controls.

Construction Effects – The proposed project will incorporate erosion and sediment control BMPs suitable to local conditions and in compliance with the Construction General Permit. Also most of the development is on flat land, which is less prone to erosion.

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ATTACHMENT A PROJECT SPECIFIC BMPS

Consistent with the applicable laws and regulations, the proposed development will include as part of its design and implementation BMPs meeting standards defined in applicable permits and federal, state, and local agencies, and complementing the regional, programmatic water quality measures. In addition, the project proponent proposes to include as part of the project design a PDF that contains BMPs that will further protect (and may benefit) receiving water quality. Use of BMPs is a recognized approach to protecting receiving water quality.

What follows is a discussion of the process for identifying BMPs for inclusion in the final WQMP and SWPPP. The decision tree to be used to select project BMPs is shown in Figure A-1 and is described in the following.

Step 1: Select BMPs to be considered. The first step is to develop a list of BMPs to be considered. This list will include a variety of BMPs that address source control and site planning, and treatment-type controls. It will be based on information provided in the DAMP, the California BMP Manuals, the ASCE/EPA Nationwide Storm Water BMP Database, other sources, and local experience gained by the project proponent in previous projects. (See discussion below regarding range and types of BMPs.)

Step 2 : Select BMPs that address constituents of concern. The second step is to select, in accordance with the MSW Permit and the DAMP, those BMPs that have been shown to be effective in controlling one or more of the pollutants of concern. These pollutants have been identified in Table 4 and are based on regulatory TMDLs in place or planned, other regulatory requirements, and local concerns. In this step, the form of the pollutant is also considered as BMP effectiveness varies depending on whether the pollutant is in the dissolved or particulate form.

Step 3: Select BMPs consistent with source areas. Select those BMPs that address the types of pollutant sources in the proposed development. For example, in the proposed project, potential sources of pollutants will be building roofs, roads, parking lots, and landscaped areas. For each of these types of source areas certain BMPs may be more effective than others.

Step 4: Select BMPs compatible with site environmental conditions. Evaluate the site environmental conditions and constraints that might limit BMP feasibility. In this step, environmental conditions that would either enhance the performance of a type of BMP or significantly reduce the performance of a BMP would be identified.

Step 5: Select BMPs that are compatible with each other. In the last step BMPs would be selected that assembled in a treatment train that would enhance the effectiveness of the overall system of BMPs. This concept of treatment train is based on the desire to first remove gross pollutants (litter, debris, trash, and coarse sediment) from the runoff stream, followed by removal of finer sediment sizes, and if necessary dissolved constituents. The final selection will be made consistent with the feasibility criterion that capital costs and maintenance requirements are proportional in comparison with anticipated environmental benefits and the overall size of the project.

All BMPs selected for the project will be selected to complement one another forming a treatment train of pollutant removal practices and devices. Such treatment trains work by relying on several BMPs, each designed to remove different types of pollutants or forms of pollutants. For example, street sweeping and litter control programs before a storm may remove trash, debris, and coarser sediments and particulate metals. Then finer sediments, nutrients, pathogens, pesticides, and metals can be addressed through additional BMPs during storm events. Using the treatment train system better ensures pollutant removal, because multiple systems are utilized and each device or practice is designed to complement the other. Table A-1 is an example of the range and types of controls that will be considered for both the SWPPP and WQMP. The BMPs shown are for consideration only. The assessment of each BMP for the proposed project will follow the decision tree described above, including an assessment of environmental conditions and constraints that might limit BMP feasibility and an proportional analysis of capital costs and maintenance requirements with potential cumulative environmental benefits. Inclusion of a BMP in the following table does not imply that it will ultimately be included in the SWPPP or WQMP. The BMPs that make up the PDF, however, will ultimately be included in project design.

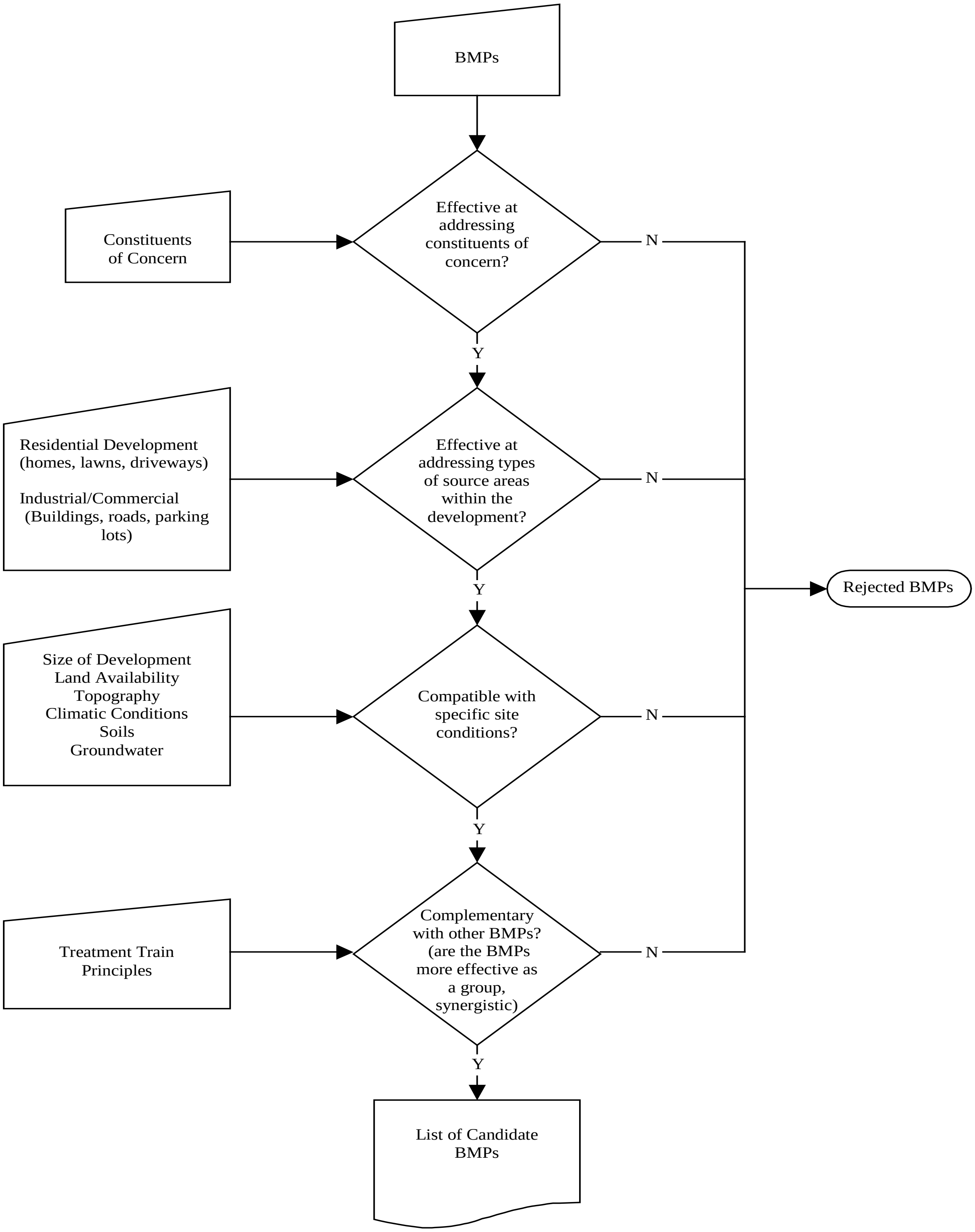

Figure A-1 BMP Selection Process

Table A-1 Example of Range and Types of BMPs to be Considered							
Phase of Project	**Typical BMPs to be considered in selection process**	**Constituents addressed by BMPs**					
		Sediment	**Nutrients**	**Pathogens**	**Pesticides**	**Metals**	**Other**
Construction	<u>Soil and slope stabilization</u> utilizing the appropriate combination of natural and synthetic matting, geotextiles, mulches, and temporary and permanent seeding	X	X			X	
	<u>Temporary desilting basins</u> constructed where necessary and consisting of ponds with outflow pipes designed to retain or detain runoff sufficiently to allow sediment to settle	X	X			X	
	<u>Storm drain inlet protection</u> utilizing an appropriate combination of barrier devices such as sand bags, straw rolls, hay bales, fiber rolls, gravel, silt fencing, screens, and temporary drain signs (raising awareness and limiting construction wastes from entering the storm drain system)	X	X			X	
	<u>Energy dissipation devices</u> installed where necessary and consisting of physical devices such as rock, riprap, concrete rubble intended to prevent scour of downstream areas	X	X			X	

Table A-1
Example of Range and Types of BMPs to be Considered

Phase of Project	**Typical BMPs to be considered in selection process**	**Constituents addressed by BMPs**					
		Sediment	**Nutrients**	**Pathogens**	**Pesticides**	**Metals**	**Other**
	On-site dust control and street sweeping employed when and where necessary paying close attention to paved areas and areas susceptible to wind erosion (such as soil stockpiles)	X	X			X	
	Stabilized construction entrance consisting of pads of aggregate and located where traffic enters public right-of-ways; when and where necessary, wash racks or tire rising may be employed (tire rinse waters being directed through on-site sediment control devices)	X				X	
	Diversion structures utilized where necessary to divert storm water flows from disturbed areas, and consisting of devices such as silt fencing, temporary or permanent channels, V ditches, earthen dikes, down drains, straw bales, and sand bag check dams	X				X	
	Adherence to De Minimis Permit conducting required testing, monitoring, and discharge provisions for activities including dewatering, hydrostatic line testing, fire hydrant testing, and water line disinfection	X				X	Chlorine

Table A-1
Example of Range and Types of BMPs to be Considered

Phase of Project	**Typical BMPs to be considered in selection process**	**Constituents addressed by BMPs**					
		Sediment	**Nutrients**	**Pathogens**	**Pesticides**	**Metals**	**Other**
	Construction housekeeping practices consisting of practices such as barricading catch basins and manholes during paving activities; utilizing plastic sheeting, secondary containment, or bermed areas for construction materials when necessary; removing construction debris in a timely fashion; designating and lining concrete wash out areas; and berming or locating sanitary facilities away from paved areas	X		X		X	Trash
	Fertilizer, pesticide, and soil amendment management not over-applying such materials and adhering to the County's Management Guidelines for such materials (located in the DAMP)		X		X		
Post Construction (Source Controls)	Street sweeping occurring as necessary or otherwise on a routine basins and including, at a minimum, sweeping of the streets and parking lots prior to the beginning of the rainy season (October 15th each year)	X		X		X	
	Catch basin inspection and cleaning including the inspection and cleaning of privately-owned catch basins prior to the rainy season	X				X	Hydrocarbons
	Drain and catch basin stenciling with "no dumping drains to ocean" or equivalent						Hydrocarbons Trash

Table A-1
Example of Range and Types of BMPs to be Considered

Phase of Project	**Typical BMPs to be considered in selection process**	**Constituents addressed by BMPs**					
		Sediment	**Nutrients**	**Pathogens**	**Pesticides**	**Metals**	**Other**
	Landscape efficient irrigation system preventing excess irrigation and reducing dry weather runoff by implementing irrigation controls consistent with County Water Conservation Resolution or City equivalent and including, if necessary, water sensors or programmable irrigation short cycles times		X		X		
	Landscape fertilization and pesticide controls minimizing potential discharges by storing and applying such materials in accordance with County Management Guidelines for fertilizers and pesticides (located in the DAMP)		X		X		
	Dumpster areas diverting drainage from adjoining roof and pavement area around such areas						Trash
	Common area runoff minimizing landscape design grouping plants with similar water requirements in order to reduce excess irrigation and promote surface filtration		X		X		

Table A-1
Example of Range and Types of BMPs to be Considered

Phase of Project	Typical BMPs to be considered in selection process	Constituents addressed by BMPs					
		Sediment	**Nutrients**	**Pathogens**	**Pesticides**	**Metals**	**Other**
	Common area litter control designing and implementing a litter control program which may include litter patrols, emptying of trash bins, maintaining trash bins, and educating tenants regarding litter reduction						Trash Hydrocarbons
	Public education distributing brochures at the time of initial sale or lease describing to homeowners, tenants, occupants, and employees of resident businesses topics such as the management of fertilizers, pesticides, chemicals; introduction into storm drains of oil, paints, and other pollutants; effective cleaning practices; proper landscaping practices; and impacts of over-irrigation	X	X	X	X	X	Trash Hydrocarbons
Post Construction (Treatment Controls)	Inlet trash racks where appropriate to reduce floatable debris, installing such racks where drainage from open areas enters the storm drain system						Trash
	Filtration where practicable, directing runoff to landscaped or vegetated areas, or to inlets with drain inlet filters	X	X	X	X	X	
	Energy dissipation devices installing such devices where new storm drains enter unlined channels	X	X			X	
	Detention basins designed to store stormwater runoff for a sufficient period of time to allow for the removal of pollutants through sedimentation						
	Mechanical Screening/Sedimentation devices designed to separate trash, debris and sediment from runoff	X					Trash

ATTACHMENT B WATER QUALITY MODEL DESCRIPTION

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1.0 INTRODUCTION

Urbanization changes the hydrology of a watershed by reducing infiltration and evapotranspiration and increasing runoff. The replacement of vegetated open space with roads, rooftops and other impervious surfaces increases runoff rates, velocities, and volumes. Urban structures and activities also introduce pollutants that are mobilized during rainfall events. These hydrologic and water quality changes are analyzed to determine the effect of the project on pollutant loads and concentrations discharged to receiving waters.

A water quality model was used to estimate pollutant loads for existing and post-development conditions. The model is based on observed relationships between rainfall and runoff, and water quality and land use. The model is adapted from an empirical method referred to as the Simple Method (Schueler 1987). The model was developed to provide a simple yet reasonably reliable method for predicting runoff volumes, pollutant loads, and resulting pollutant concentrations that occur as a result of development; and to provide estimates of the improvement in water quality from the implementation of Best Management Practices. The model steps for calculating runoff volumes are based upon observed relationships between runoff volumes and impervious areas in urban development. Pollutant load estimates are based upon observed pollutant concentrations in stormwater runoff from specific types of urban land uses. The model was originally based upon data collected in the Washington D.C. area and by the National Urban Runoff Program (NURP, EPA 1983) for development of the model parameters.

Empirical models of this type are commonly used to estimate pollutant loads and/or concentrations from small development sites to large watersheds (Wong et al., 1997). This method allows for selection of model inputs to reflect regional conditions, while the procedure of estimating runoff volumes and loads can be applied anywhere. Adaptations to the model used for this water quality analysis include a more detailed rainfall analysis; the use of specific water quality characteristics derived from local monitoring when possible; and use of the National Stormwater Best Management Practices Database for estimating the performance of planned Best Management Practices (BMPs).

The following constituents were modeled:

- Total Suspended Solids
- Total Phosphorus
- Nitrogen (TKN and nitrate)
- Total Copper
- Total Lead
- Total Zinc

These pollutants were chosen because they are commonly found in runoff from residential and commercial land use and reliable land use water quality data in the form of event mean concentrations (EMCs are the flow-weighted composite concentrations) are available.

As with all environmental modeling, the accuracy of model results is dependent on how well the hydrologic, water quality, and structural BMP effectiveness data describe the actual site characteristics. Consequently, local and regional data (as opposed to national data) are used to the fullest extent possible, and model results are evaluated carefully based on experience.

1.1 Project Design Features

Storm water runoff from the Northern Sphere Area development site discharges to several drainage channels: the Central Irvine Channel, Trabuco Channel, Marshburn

Channel, Bee Canyon Channel, Round Canyon Channel, and the Agua Chinon Wash. Runoff from Planning Area 9 is discharged to the Jeffrey/Trabuco Retarding Basin, which in turn flows to the Central Irvine Channel. Planning Area 6 spans three drainage areas and runoff discharges to the Agua Chinon and Marshburn Retarding Basins and the Agua Chinon Wash, Bee and Round Canyon Channels, and Marshburn Channel. Planning Areas 5B and 8A are currently routed to the Central Irvine Channel. Flows from Central Irvine Channel enter Peters Canyon Wash, and flows in Marshburn and Agua Chinon channels enter San Diego Creek (Reach 2). Thus, portions of the development drain to Peters Canyon Wash and other portions drain to the upper reaches of San Diego Creek.

The project proponent proposes to include as part of the project design a feature (the Project Design Feature or PDF) to improve the quality of storm water runoff from the development area. The PDF consists of two components. First, the existing Trabuco Retarding Basin will be modified to treat over a 24-hour period the volume of runoff produced by a 24-hour, 85th percentile storm event (runoff from a 0.75 inch, 24-hour storm) over the 1226 acre Planning Area 9, which constitutes approximately 40 percent of the development area. The release rate of this basin will be 24 hours, during which time pollutant removal will occur, primarily through settling of suspended solids and associated pollutants.

Second, for the remaining 60 percent of the development area (those area within Planning Areas 5B, 6 and 8A which are not tributary to the Trabuco Retarding Basin and which will be developed), BMPs (for example, BMPs that achieve similar performance per the National BMP Database ratings as catch basin inserts) will be designed to infiltrate, filter or treat the volume of runoff produced by either (a) a 24-hour, 85th percentile storm event (runoff from 0.75 inch, 24-hour storm), or (b) the maximum flow rate of runoff produced by a rainfall intensity of 0.2 inch of rainfall per hour. For the purposes of modeling, a network of catch basin inserts has been assumed. Catch basin inserts are screens or filters that can be installed in existing or new storm drains. For this project, the performance standard has been assumed to require a BMP or set of BMPs that would capture and treat the volume or flow rate of runoff described above. This assumes that a sufficiently large network of catch basin inserts will be installed throughout Planning Areas 5B, 6 and 8A to provide the required level of treatment.

1.2 Modeling Steps

The modeling method consists of the following steps:

1. Estimate the mean annual volume of rainfall a watershed receives that exceeds its infiltrative and evaporative capacity over a given period (one year).
2. Evaluate pre- and post-development land uses, land areas, and percent impervious values.
3. Estimate runoff using observed relationships between percent imperviousness and runoff volumes.

4. Estimate runoff water quality based on observed statistical data from similar land-use types.
5. Compute pollutant loads by multiplying the concentration in stormwater runoff by the predicted runoff volume.
6. Estimate the treatment performance of BMPs in terms of effluent quality achieved or percent reduction in loads or concentration.
7. Sum flows and loads from individual sub-areas just upstream of the BMPs. Estimate the reduction in concentration and load (and possibly flow) based on anticipated BMP performance.
8. Sum flows and loads from the project area to estimate predicted average annual pollutant loads and average concentrations.
9. Compare predicted post-development concentrations (from step 8) to pre-development conditions (from step 5), appropriate water quality criteria, and/or water quality design standards.
10. Compare post to pre-development loads.

The data analysis and evaluation of steps 1, 2, and 4 are discussed in the section on model parameters (Sections 2.1, 2.2, 2.3 respectively). The model calculations described by steps 3, 5, and 8 are discussed in Section 1.3. The evaluation of the model results described by the modeling steps 9 and 10 are contained in the Water Quality Assessment – the main part of this report.

1.3 Model Calculations

Runoff Volumes (Step 3)

An analysis of local rainfall data is performed to estimate the annual depth of rainfall that is likely to result in surface runoff (step 1, Section B.2.1). The annual volume of stormwater runoff, resulting from the annual rainfall, can be predicted with the following formula (based upon the rational formula, only using depth rather than intensity to result in volumes rather than flow rate).

$$Q = Rv \times I \times A$$

Where:
- Q: runoff (volume/year)
- Rv: mean annual runoff coefficient
- I : rainfall (depth/year)
- A: drainage area

The runoff coefficient (Rv) is a unit-less value that is a function of the imperviousness of the watershed and is approximated in the model by the equation:

$$Rv = 0.007 \times (\%\ \text{impervious}) + 0.1$$ (FHWA 1990).

Mean annual runoff volumes are calculated for each type of land use utilizing the above method based on land use runoff characteristics, mean annual rainfall, and drainage basin area.

Pollutant Loads & Concentrations (Step 5)
Flow and EMC values are used to calculate the yearly load of a pollutant as shown in the equation below.

Load Runoff EMC Conversion Factor

$$\frac{lbs}{year} = \frac{ft^3}{year} \times \frac{mg}{L} \times \frac{6.2428 \times 10^{-5}\ {}^{lbs}\!/\!{}_{ft^3}}{{}^{mg}\!/\!{}_{L}}$$

This process gives yearly load calculations for each land use type for each area (or sub-basin) modeled.

Average Annual Pollutant Loads and Concentrations (Step 8)
Once the average annual runoff volume and pollutant load have been determined for each land use within each planning (or drainage) area these result are combined into average annual results by planning area (or drainage area or other delineation).

The average annual concentration is calculated for each pollutant for each planning area by summing the pollutant load results for the individual land uses within the area and dividing this by the summation of the total stormwater runoff volumes of the areas.

Concentration Total Load Total Runoff Conversion Factor

$$\frac{mg}{L} = \left[\Sigma \frac{lbs}{year} \div \Sigma \frac{ft^3}{year}\right] \times \frac{6.2428 \times 10^{-5}\ {}^{lbs}\!/\!{}_{ft^3}}{{}^{mg}\!/\!{}_{L}}$$

2 MODEL PARAMETERS

2.1 Annual Rainfall Depth

National Climatic Data Service (NCDC) hourly rainfall data from the Fullerton Dam and Santiago Dam weather stations were analyzed to develop descriptive rainfall characteristics for the site. Fullerton Dam is close in elevation to the project site, but it is about 14 miles to the northwest, while the Santiago Dam gauge is much closer physically, but at a higher elevation. Analysis was conducted at both station to evaluate effects of distance and elevation between the stations on rainfall characteristics. The differences in location and elevation do not result in significantly different average annual rainfall or storm characteristics.

Hourly rainfall data is analyzed with the synoptic rainfall analysis program SYNOP developed by USEPA (USEPA, 1989), which converts the data into individual storm events and computes event and annual rainfall statistics. This analysis used an inter-event time of 6 hours (USEPA, 1989) and a minimum storm event size of 0.10 inches. This results in rainfall periods separated by less than 6 hours being aggregated into a single storm event. Storm events equal to and less than 0.10 inches on average are not expected to contribute significantly to runoff.

Additional investigations into available rainfall data revealed average annual rainfall information for the El Toro Marine Corps Air Station. Hourly rainfall data were not available at this site, which prevents rainfall analysis to estimate the rainfall depths from storms that are expected to result in stormwater runoff. Due to the close proximity of the station to the development site, despite the lack of hourly data, this station was felt to be most representative of the project site. The average annual rainfall used in the water quality model is based on the El Toro rainfall data.

Table 1: Parameters Used for Selection of NCDC Rainfall Station

Location	Latitude	Longitude	Elevation (feet)
Project Site	33° 41' N	117° 44' W	≈ 300 - 400
Fullerton Dam Station	33° 53' N	117° 53' W	340
Santiago Dam Station	33° 47' N	117° 43' W	855
El Toro Station	33° 40' N	117° 44' W	383

Table 2: Rainfall Analysis Statistics (analysis for storms > 0.1 inches depth)

Station	Average annual rainfall (inches)	Average number of events	Average duration (hours)	Average intensity (inches/hr)	Average Storm Depth (inches)
Fullerton Dam[1]	13.0	17	12.1	0.065	0.75
Santiago Dam[1]	12.7	16	11.6	0.069	0.80
El Toro[2]	12.4[3]	Unknown	Unknown	Unknown	Unknown

1 – Source: SYNOP analysis of NCDC Hourly Precipitation data from Hydrosphere Data Products, Boulder, CO. 1999.
2 – Source: NOAA website http://www.wrh.noaa.gov/sandiego/eltoro.html
3 – includes all storm events

2.2 Land Use Areas and Percent Imperviousness

Pre-Development Condition

The existing land uses for the project area are approximately 2,505 acres of agricultural and nursery land uses, and 5,213 acres of open space of which the majority (3,745) is in Planning Area 3. Percent imperviousness values were estimated as 0% for open space, 0% for crops not covered by plastic, and 50% for crops which are covered by plastic (strawberries), and 100% for the water body in PA 6 (i.e. all rainfall on the water surface is considered to contribute to stormwater runoff volumes). Where plastic mulch is used, the plastic covers most of the planted area. Runoff from the plastic covering the soil flows into the unlined ditches between the rows of berries, where some of the water may infiltrate into the soils. Based on these considerations we have assumed an effective imperviousness of 50% for the areas having plastic mulch. The nursery land use has been estimated as 10% impervious, resulting in a runoff coefficient of 0.17, to account for compacted soils, buildings, roads, and greenhouses. This value is comparable to the estimate for cultivated flat sandy loam soils of 0.2 provided by Novotny and Olem (1994). Runoff coefficients listed at a Purdue University website for crop land use range from 0.2 for crops with conservation water rates (i.e. low water use) and well drained soils to 0.3 for poorly drained soils. The runoff coefficients used in the water quality model (Table 3) for row crops and nurseries ranged from 0.1 to about 0.2, except for strawberries, where the runoff coefficient was estimated at 0.45 because of the presumed effects of the plastic mulch.

Post-Development Condition

The project area development plans include 2,740 acres of urban development. Approximately 4,597 acres will be preserved including 3,745 acres in Planning Area 3. The acreages for both pre- and post-development conditions and the assumed percent imperviousness assigned to each type of land use are listed in Table 3.

Table 3: Land Use (acres) and Modeling Assumptions (Acres)

Land Uses & % Imperviousness			Project Planning Areas					Totals	Modeled as
			2/3[1]	**5B**	**6**	**8A**	**9A**		
Existing Conditions	Open Space	0	3,745	32	1,304		132	5,213	Open
	Ag – Nursery	10		224	231		344	799	Row crop
	Ag – Strawberries	50		63	110		573	746	Row crop
	Ag - Other Row Crops	0			81[3]	73	228	382	Row crop
	Ag – Orchards	0			378			378	Orchards
	Ag – Grazing	0			200			200	Open
	Water Bodies	100			25			25	Water
	Totals		**3,745**	**319**	**2,329**	**73**	**1,277**	**7,743**	
Developed Conditions	Preservation[2]	0	3,745		852			4,597	Open
	Recreation	0			258		72	330	Open
	Commercial Recreation	0					51	51	Open
	Water Bodies	100			25			25	Water
	Medium Density Res.	60		319	866	73	678	1,936	SF Res.
	Medium-high Density Res.	70					89	89	MF Res.
	Multi-use	90			20		60	80	Commercial
	Community Commercial	90			20			20	Commercial
	Medical and Science	90			285		317	602	Commercial
	Institutional	70			3		10	13	Education
	Totals		**3,745**	**319**	**2,329**	**73**	**1,227**	**7,743**	

Notes:
1 – Planning Area 3, Implementation District "P" in Planning Area 2 and the Trabuco Retarding Basin were not included in the water quality model because there are no land use changes proposed for these areas as part of the Project. As a result, water quality in these areas would not be affected by the proposed development.
2 - Preservation: open space areas that will be preserved in their existing condition
3 – Agricultural uses including some equipment and material storage
Sources: Northern Sphere Area Pre-Annexation Development Agreement, Screencheck Draft (Table 2-2), and table of leased agricultural acreage provided by P. Changala, TIC.

Roads within the project are incorporated into the residential and commercial acreages for the purposes of estimating contaminant concentrations used in the water quality model. The street areas have been included in the residential and commercial use areas because the stormwater monitoring data used in the model is obtained from basins that include the runoff from residential and commercial streets. Planning area 3 will not be affected by the proposed project. Therefore, to allow for a more meaningful comparison between pre- and post-development pollutant loads and concentrations, the 3,798 acres of open space (preservation and recreation) areas in planning area 3 were not included in the water quality model (including this large land area in the model analysis would mask changes in the areas proposed for development).

2.3 Event Mean Concentrations (EMCs)

The type of land use within a watershed has been shown to affect the types and concentrations of pollutants found in runoff. Numerous studies have been conducted to characterize runoff quality as function of land use. A review of available water quality monitoring data in southern California was conducted to obtain more recent local and regional EMC data in order to estimate the levels of contaminants expected to be associated with the pre- and post-development land uses on the project site. The counties of Los Angeles, San Diego, and Ventura have conducted stormwater monitoring studies that differentiate the monitored basins by type of land use (e.g. residential, commercial, open space). Tables 4 displays the mean stormwater concentrations of pollutants from the LA and Ventura County monitoring data. These values have been used in the model to represent the stormwater EMC values.

Table 4: Event Mean Concentration Data: Values for Selected Land Uses

Parameter	Units	LA County Monitoring Data[1]					Ventura County[2]	
		Open Space / Parks	Schools	Single Family Res.	Multi Family Res.	Commercial	Agriculture	
							Row Crops	Orchards
TSS	mg/l	186	95	95	46	66	1176	4267
Total Phos	mg/l	0.16	0.31	0.39	0.19	0.39	2.70	2.02
TKN[3]	mg/l	0.79	1.65	2.89	1.96	3.4	7.65	9.23
NO_3	mg/l	1.05	0.51	0.86	1.10	0.48	11.13	3.79
Total Copper	ug/l	15	24	15	12	39	132	465
Total Lead	ug/l	2.5[4]	4.9	10	5.8	18	47	108
Total Zinc	ug/l	46	140	79	150	241	324	397

1) LA County data, mean values, from Los Angeles County 1994-2000 Stormwater Monitoring Report
2) Ventura County data, mean values, from Ventura County Flood Control Department Stormwater Monitoring Reports November, 1997 through July, 2001 (ten events for crops, nine for orchards).
3) Total Kjeldahl Nitrogen (organic nitrogen and ammonia)
4) Insufficient data above detection limit to determine EMC, EMC set to 0.5 ×detection limits

The mean values from monitoring of row cropland uses are also used to represent nurseries, while the grazing land use is represented with open space monitoring data. The basis for representing these agricultural practices with data available from other types of land uses is discussed in Section 3.1.

3.0 MODEL RELIABILITY

The reliability of a water quality model is traditionally evaluated by comparing model predictions with actual field data. This approach is not appropriate here as projections are being made for conditions that currently do not exist. However, there are a number of indicators that can be applied to help address model validity.

3.1 Representativeness of Land Use Water Quality Data

The characteristics of the drainage areas from which the model data was obtained are similar to those of the proposed project site, primarily flat lands used for row crops and more hilly areas used for orchards. The mix of row crops grown in the Ventura County drainage area is similar to the mix grown in the Northern Sphere Area, although at any given time, the specific crops planted at both sites are likely to vary. The orchards in the Ventura County drainage area are largely avocado orchards located on slopes, as are the orchards located in the Northern Sphere Area. Topography, soils, and precipitation appear to be similar. Irrigation and mulching techniques also appear to be similar.

Existing water quality conditions for the nursery uses were estimated using row crop data from Ventura County. This data is considered to be representative of the nursery uses because both areas have similar topography (relatively flat) and are expected to have similar practices with respect to irrigation and chemical use (fertilizers, pesticides, and herbicides). Existing water quality conditions for the grazing uses were estimated using open space data from upland Los Angeles County. This data is considered to be representative of the grazing uses because both areas have similar topography and are expected to have similar practices with respect to irrigation and chemical use (neither uses irrigation or chemicals). In addition, the grazing is highly managed to avoid over-grazing with its associated erosion.

For these reasons, the estimates in the analysis below are considered to be reasonable approximations of existing storm water quality conditions for development areas within the project site.

The following provides more detail on the sites from which data were obtained and the extent to which these sites appear to be representative of conditions in the Northern Sphere Area.

Description of Ventura County Agricultural Sites

As part of its Municipal Separate Storm Sewer System Permit (MS4 Permit), the Ventura County Flood Control District conducts storm water monitoring to determine water quality of stormwater runoff from areas with specific land uses. These sites include two stations monitoring catchments with predominantly agricultural uses that have been used to represent specific land use types in the water quality model: Wood

Road at Revolon Slough (station A-1) and La Vista Avenue (station W-3) in the Upper Revolon Slough.

The Wood Road at Revolon Slough Station is located on Revolon Channel just downstream of Laguna Road in Oxnard, Ventura County. The station receives runoff from a watershed that is approximately 350 acres, and is used primarily for row crops. The watershed contains a small number of farm residences and ancillary farm facilities for equipment maintenance and storage. With regard to irrigation practices, sprinklers are used for plant establishment; once the plants are established, farmers switch to drip irrigation. Plastic mulch is required during certain life stages of some crops, namely strawberries.

Stormwater samples are collected as either grab samples or flow-based composite samples. The water quality data from water years 96/97, 97/98, 98/99, and 2000/01, are available for the Wood Road site. During this period 9 grab samples and 10 flow composite samples were obtained during runoff events. The data from the flow composite samples were used in the modeling as these are more appropriate for estimating pollutant loads.

The mix of row crops grown in the Wood Road watershed are similar to those grown in the Project area; although at any given time, the specific crops planted at both sites are likely to vary. Based on field visits to the site and review of precipitation data, topography, and soils, conditions at the Ventura County site appears to be quite similar to those at the Project site. Irrigation and mulching techniques also appear to be similar. The data set (10 sampling events) includes flow composite samples that have been taken over a range of storm events and is therefore reasonably robust.

The La Vista Avenue Station is located south of Center Road in the Upper Revolon Slough Watershed in foothills to the north of the city of Camarillo and south of the Santa Clara River in Ventura County. The watershed draining to this monitoring location consists of 752-acres and is used for avocado orchards, which are estimated to cover approximately 85% of the land area. The watershed is less than 2% developed with the developed areas consisting of facilities used to support the farming practices. The remaining areas are undeveloped open spaces. The orchards located in the Northern Sphere Area are largely avocado orchards located on slopes and are similar in both crop type and topography to the watershed monitored by the La Vista Avenue Station. The stormwater monitoring data collected by Ventura County at this site is considered to be a reasonable approximation of existing orchard land uses at the development site for these reasons.

Stormwater samples are collected as either grab samples or flow-based composite samples. The water quality data from water years 96/97, 97/98, 98/99, and 2000/01, are available for the La Vista Avenue site. During this period 10 grab samples and 6 flow composite samples were obtained during runoff events. Data included in the EMC estimates for three storms during the 97/98 water year were collected by grab sample during peak flow condition due to equipment malfunctions or vandalism preventing collection of composite samples. All other data consisted of composite samples, which is generally more representative of EMC values. The data set (10 sampling events) includes flow composite samples that have been taken over a range of storm events and is therefore reasonably robust.

Description of Los Angeles Urban Sites

Los Angeles County has been monitoring stormwater quality since the mid 1990s. The monitoring includes flow composite sampling at various “land use stations” that contain primarily one type of land use including single family, multi family, and mixed residential land uses. Table 5 shows some the land use stations monitored by LA County that were used in the modeling for the Northern Sphere Area Development Project. The LA County data also is comprehensive in that it contains 30-60 samples per site and most samples are above detection (Table 6). This number of samples provides a robust statistical characterization of the storm water quality data.

Table 5: LA County Stations used for Land Use Water Quality Modeling

Station Name	Station	Land Use	Site Description	Years Monitoring Conducted
Project 620	S18	Single Family Residential	Located in the Los Angeles River watershed in City of Glendale. The monitoring station is at the intersection of Glenwood Road and Cleveland Ave. Land use is predominantly high-density single family residential. Catchment area is approximately 120 acres.	1996-2000
Santa Monica Pier	S08	Commercial	The monitoring site is located near intersection of Appian Way and Moss Ave. in Santa Monica. The storm drain discharges below the Santa Monica Pier. Catchment area is approximately 81 acres.	1997-2000
Project 404	S26	Multi-Family Residential	Located in Los Angeles River watershed in City of Arcadia. The monitoring station is located along Duarte Road, between Holly Ave and La Cadena Ave. Catchment area is approximately 214 acres.	1996-2000
Dominguez Channel	S23	Freeway	Located within the Dominguez Channel Los Angeles Harbor watershed in Lennox, near LAX. The monitoring station is near the intersection of 116th Street and Isis Ave. Land use is predominantly transportation and includes areas of LAX and Interstate 105.	1996-2000
Sawpit Creek	S11	Open Space/ Parks	Located in Los Angeles River watershed in City of Monrovia. The monitoring station is Sawpit Creek, downstream of Monrovia Creek. Sawpit Creek is a natural watercourse at this location.	1996-2000

Station Name	Station	Land Use	Site Description	Years Monitoring Conducted
			Catchment area is approximately 3300 acres.	
Project 474	S25	Education	Located in Los Angeles River watershed in the Northridge section of the City of Los Angeles. The monitoring station is located along Lindley Ave , one block south of Nordoff Street. The station monitors runoff from the California State University of Northridge. Catchment area is approximately 262 acres.	1997-2000

Source: Los Angeles County 1999-2000 Draft Stormwater Monitoring Report (Los Angeles County, 2000)

Table 6: Event Mean Concentration Data: Number of Samples & Percent Detects

Parameter	LA County Monitoring Data									
	Open Space		Education		S.F. Residential		M.F. Residential		Transportation	
	#	%	#	%	#	%	#	%	#	%
TSS	39	97	39	100	30	100	36	97	61	100
Total Phos	39	59	37	100	32	100	30	97	59	98
Dissolved Phos	37	43	37	97	32	100	30	97	59	95
TKN (Kjeldhal)	40	100	39	100	35	100	41	100	61	100
NO_3	40	98	39	69	32	66	37	68	61	75
NO_2	43	30	39	67	33	64	37	73	64	84
Total Copper	34	56	42	100	32	94	45	91	54	100
Total Lead	34	9	42	29	32	56	45	31	54	46
Total Zinc	45	27	42	88	38	66	45	89	65	100

Note - # = number of samples collected, % = percentage of samples with detectable levels of parameter;

Use of Available Monitoring Data for Existing Grazing and Nursery Land Uses

Monitoring data is available to estimate EMCs for the row crop and orchard land uses in the proposed development area, but comparable data for nurseries and grazing are not currently available. Therefore it is necessary to represent these existing land uses with data collected from monitoring areas that are believed to have similar stormwater pollutant concentrations.

Nurseries are believed to impact stormwater quality due to the use of fertilizers, associated farming machinery, and other chemicals such as pesticides and herbicides. Nurseries are represented in the water quality model with the EMC values from monitoring of row crops because of the similarity in topography, irrigation practices, and fertilization and other chemical application practices.

Grazing land uses have been represented in the water quality model with monitoring data collected for open space land uses, which does not reflect any increased pollutant loads due to this land use. This decision was based on limited scientific literature indicating well managed grazing has only minor impacts on sediment and nutrient loads. Owens et al. (1983) monitored a 26 hectare unimproved pasture in Ohio for two years prior to the introduction of a 17 cow herd for summer grazing. Monitoring conducted for three years with grazing found small increases in concentrations of nitrogen compounds and no appreciable change in total phosphorous concentrations. For example average annual concentrations of nitrate-as-nitrogen increased from 0.5 to 0.7 mg/L. Edwards et al. (2000) simulated the effects of grazing through application of cattle wastes and mowing of vegetation to 30 plots of a silt loam soil constructed at the University of Kentucky. Experimental results did not demonstrate considerable increases in sediment or nutrient loads due to the simulation of grazing effects. This is likely to be particularly true for the existing grazing because that grazing is highly managed, which minimizes erosion and sediment generation.

3.2 Comparison of Land Use Data Used in Model with Local In-stream Water Quality Data

A second indicator of model reliability is based on how well the water quality concentration data used in the model compare with local data. Ideally this comparison would be with local land-use-specific runoff data; however, the data collected by the County of Orange is mixed land use data collected within streams tributary to the coast. The in-stream data thus reflects runoff and pollutant contributions from the entire watershed including open space upland areas, transportation corridors, and in-stream sources. Table 7 compares water quality data taken from San Diego Creek and Peters Canyon Wash with agriculture and single-family residential land use data used in the model. In most cases the in-stream data are bracketed by the land use data. This is appropriate given that the in-stream data generally represents mixed land uses and agricultural and residential land use data generally bound the land use data. The only exception is the high levels of TSS in San Diego Creek. These numbers are relatively high because there is extensive down cutting in Serrano Creek, a tributary to San Diego Creek. This comparison, although by no means comprehensive, does provide some level of confidence that the land use data sets used in the model, although taken from sites outside of Orange County, appear to be reasonable surrogates for local conditions.

Table 7: Wet-weather Water Quality in Peters Canyon Wash and San Diego Creek (Reach 2) Compared to Land Use Data Used in Water Quality Model

Location	Units	TSS	NO_3-N	Total Cu	Total Pb	Total Zn
San Diego Creek at Harvard[1]	(mg/l)	1517	3.79	0.047	0.022	0.204
Peters Canyon Wash [2]	(mg/l)	800	6.05	0.048	0.023	0.137
Ventura County Row Crops	(mg/l)	1176	11.13	0.132	0.047	0.324

Location	Units	TSS	NO_3-N	Total Cu	Total Pb	Total Zn
LA County SFR	(mg/l)	95	0.39	0.015	0.010	0.079

n.a. – not available
1 – stormwater monitoring (03/94 to 03/00) average of 15-storm event EMCs
2 –stormwater monitoring (01/94 to 02/00) average of 18-storm event EMC

4.0 MODEL RESULTS

4.1 Project Design Feature

The project proponent proposes to include a PDF to improve the quality of storm water runoff from the development area. The PDF consists of two components. First, the existing Trabuco Retarding Basin will be modified to treat over a 24-hour period the volume of runoff produced by a 24-hour, 85th percentile storm event (runoff from a 0.75 inch, 24-hour storm) over the 1226 acre Planning Area 9, which constitutes approximately 40 percent of the development area. The release rate of this basin will be 24 hours, during which time pollutant removal will occur, primarily through settling of suspended solids and associated pollutants.

Second, for the remaining 60 percent of the development area (those area within Planning Areas 5B, 6 and 8A which are not tributary to the Trabuco Retarding Basin and which will be developed), BMPs (for example, BMPs that achieve similar performance per the National BMP Database ratings as catch basin inserts) will be designed to infiltrate, filter or treat the volume of runoff produced by either (a) a 24-hour, 85th percentile storm event (runoff from 0.75 inch, 24-hour storm), or (b) the maximum flow rate of runoff produced by a rainfall intensity of 0.2 inch of rainfall per hour. For the purposes of modeling, a network of catch basin inserts has been assumed.

The structural BMPs have been modeled as if the detention volume is sized to capture and treat the runoff from the 0.75-inch, 24-hour storm event. The water quality pool has been sized to account for discharge of treated stormwater from the detention basin during the storm event.

The overall treatment performance of a PDF is dependent on two factors: the volume of runoff that can be diverted into the PDF for treatment (or when expressed as a percent - capture efficiency), and the improvement in water quality (or treatment effectiveness). Table 8 summarizes the capture efficiencies for the detention basin and catch basin inserts based on a multi-year analysis of a long-term raingage (see Appendix B).

Table 8: Modeled Scenario, BMPs, and Capture Efficiencies

Basin WQ pool volume (AF)	Basis for sizing WQ pool	Draw down time (hrs)	% Capture efficiency	
			Detention Basin	Catch Basin Inserts
22.1	Volume to process runoff from area 9A for 0.75" event	24	59	60

4.2 Percent Capture of Structural BMPs

Percent capture is the ratio of water (expressed as a percent) that passes through the BMP to the total runoff volume. The water that is not treated in the BMP bypasses the BMP. The percent capture for the Trabuco Retarding Basin was estimated using a continuous modeling of the volume of water in the basin as it fills from storm runoff and empties based on the assumed drain time. The model was run with an input rainfall sequence taken from the Fullerton raingage (785 storm events), which took into account the size and actual sequencing of storms. The continuous analysis also took into account the capacity of the water quality pool (22.1 acres), and the drain time of 24 hours. The analysis was conducted two ways, initially using an Excel spreadsheet type model and results were then checked using EPA's Storm Water Management Model (SWMM). The resulting estimate of the "capture efficiency" for the Trabuco Retarding Basin was 59%.

Catch basin inserts are flow-based BMPs and the capture efficiency is normally based on the number of inserts per acre of catchment, which is not currently available. Capture efficiencies of catch basin inserts are typically around 60 to 70%. A percent capture of 60% was used for the catch basin inserts to provide a conservative estimate of pollutant removal. These estimates are consistent with the proposed PDF.

4.3 BMP Pollutant Removal Performance

The overall performance of a stormwater BMP is a function of the volume of water processed by the BMP (the percent capture as described above) and the treatment effectiveness. Anticipated treatment effectiveness for the Trabuco Basin was based effluent quality data obtained from a number of monitoring studies compiled in EPA's Nationwide BMP database (Table 5). Catch basin treatment effectiveness was characterized in the form of percent removal based on an evaluation of effectiveness data collected by Stenstrom et al (1998).

Table 9: Median Outflow Concentrations for Wet Ponds and % Removal for Catch Basin Inserts

Parameter	Water Quality Basin Outflow Conc.[1] (mg/L)	Catch Basin Insert % Removal[2]
TSS	16.0	21
Total Phos	0.13	14
TKN	1.13	14[3]
NO3-N	0.42	0[4]
Total Cu	0.0058	11
Total Pb	0.0050	15
Total Zn	0.029	5

1 – Estimated from National Stormwater Best Management Practices Database wet pond outflow concentration data. Median value of outflow data from all available studies.
2 - Performance estimate based on Mangarella et al. 2000
3 – TKN consists of organic nitrogen and ammonia. As organic nitrogen is predominantly associated with particulates, the removal of this constituent was estimated to be equivalent to the removal of phosphorous, which is also largely in particulate form.
4 – Because nitrate is water soluble, catch basin inserts (which rely primarily on filtering) were not considered to remove this pollutant.

Based on the information on treatment effectiveness and percent capture, estimates of the overall performance of the BMPs were made. These estimates were then applied to pre-development loads and concentrations to estimate reductions projected to be achieved with the BMPs. These estimates of the reduction in pollutant loads and concentrations are provided in Table 8 and Table 9 respectively.

Tables 10 and 11 present modeling results for pollutant loads and concentrations. Each table contains results for the existing and developed conditions (both with and without the PDF) and the percent changes in load or concentration compared to the pre-development conditions. The percent change results are calculated by dividing the difference between post-development and existing conditions by the existing conditions value (i.e. [post – existing]/existing × 100%).

The load and concentration estimates in the tables are based on runoff estimates and available water quality data that were determined to be the most representative of pre and post-development conditions. These load estimates were modeled for average annual rainfall and represent average annual conditions. During high or low rainfall years, pollutant loading to the receiving waters could vary depending upon the mobilization and dilution of pollutants by the rainfall.

Table 10: Pollutant Loads and % Changes

Development Condition	Units	Annual Q (ft^3)	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
Pre-Dev	Load (lbs/yr)	32,824,101	2,222,400	4,153	12,297	16,821	245.1	79.9	527
Post-Dev (w/o BMPs)	Load (lbs/yr)	78,350,588	445,283	1,757	13,710	3,708	107	55.2	614
% Change (pre vs. post w/o BMPs)		139%	-80%	-58%	11%	-78%	-56%	-31%	17%
Post-Dev (treatment)	Load (lbs/yr)	78,350,588	333,685	1,393	10,907	3,351	81.5	43.7	467
% Change (pre vs. treatment)		139%	-85%	-66%	-11%	-80%	-67%	-45%	-11%

Table 11: Pollutant Concentrations and % Changes

Development Condition	Units	Annual Q (ft^3)	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
Pre-Dev	Conc (mg/l)	32,824,101	1085	2.03	6.00	8.21	0.120	0.039	0.257
Post-Dev (w/o BMPs)	Conc (mg/l)	78,350,588	91.0	0.359	2.80	0.758	0.022	0.011	0.126
% Change (pre vs. post w/o BMPs)		139%	-92%	-82%	-53%	-91%	-82%	-71%	-51%
Post-Dev (treatment)	Conc (mg/l)	78,350,588	68.2	0.285	2.23	0.685	0.017	0.0089	0.095
% Change (pre vs. treatment)		139%	-94%	-86%	-63%	-92%	-86%	-77%	-63%

4.4 Comparison with California Toxic Rule Criteria

The project drains into receiving waters that are subject to the California Toxics Rules. Although the CTR criteria apply to receiving water quality and not to stormwater discharges, CTR provide criteria that can be used as a benchmark to evaluate the significance of potential impacts of stormwater runoff to receiving waters. Based on monitoring data collected by the County of Orange in the San Diego Creek watershed, typical hardness values tend to range between about 300- 400 mg/l (OC PFRD NPDES Annual Progress Report, 2000).

In order to evaluate the potential for dissolved metal concentrations to exceed CTR criteria, estimates of the dissolved metal concentrations were made based upon results from Sansalone at a highway site (1997) and LA County monitoring data (LACDPW 2000).

Table 12: Fraction of Metals in Dissolved Form

Metal	Estimated Fraction Dissolved[1]
Copper	57
Lead	27
Zinc	56

1 –Sources Sansalone (1997) and LA County (2000)

Table 13: Comparison of Predicted Dissolved Metals Concentrations (ug/l) to CTR Criteria

Metal	Pre-Development	Post Development without PDF	Post Development with PDF	California Toxics Rule Acute Criteria Dissolved Metal Concentration (ug/L) ***(Hardness as CaCO3 300 mg/L)***
Copper	68	13	9.7	38
Lead	11	3.0	2.4	208
Zinc	140	71	53	297

Table 13 shows the predicted dissolved concentrations for copper, lead and zinc compared to the CTR values based on a hardness of 300 mg/l. The hardness value is based on a review of hardness data collected in San Diego Creek by Orange County. Concentrations under post-development conditions are predicted to result in dissolved metal concentrations that are below the CTR acute criteria.

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Air Quality Assessment for the Northern Sphere Area (Protocol Area)

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Air Quality Analysis for the Northern Sphere Area (Protocol Area)

City of Irvine

1.0 EXISTING ENVIRONMENT

1.1 Introduction

The Northern Sphere Area comprises land within City of Irvine Planning Areas 2, 3, 5B, 6, 8A and 9. (For the purpose of this study, the Northern Sphere Area is also referred to as the Protocol Area.) The project is assessed in two phases: (interim) 2007 and (buildout) 2025. For the purpose of projecting vehicular traffic associated with this project, it is assumed that for the interim year (2007), the land uses will consist of a total of 1,343 single-family detached homes, 882 multi-family (condominium) units, 1,275 multi-family (apartment) units, 135,500 square feet of commercial, 13,500 square feet of restaurant, a gas station, and a 900-student elementary/middle school. For buildout year (2025), the land uses will consist of a total of 6,155 single-family detached homes, 4,070 multi-family (condominium) units, 2,125 multi-family (apartment) units, 6,566,000 square feet of office/research and development, 72,750 square feet of restaurant, 5 gas stations, 488,250 square feet of commercial, a 1,900-student elementary/middle school, a 900-student elementary/middle school, and a 1800-student elementary/middle school.

The project is located in the City of Irvine sphere of influence and proposed for annexation. The project is located adjacent to portions of Planning Areas 5 and 8, and is generally bounded by Trabuco Road and MCAS El Toro to the south, Jeffrey Road and existing residential development to the west, and the Santiago Hills to the north. The Foothill Transportation Corridor (SR-241) traverses the northern portion of the site.

The project is within the South Coast Air Basin (SCAB) and thus is subject to a review with respect to the South Coast Air Quality Management District's (SCAQMD) Air Quality Management Plan (AQMP). The SCAB comprises all of Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino Counties.

This report will analyze air quality impacts for four future scenarios. The four future scenarios are: *2007, 2025 Constrained Toll, 2025 Buildout Toll* and post *2040 Buildout Toll-Free*. The four future scenarios are summarized below:

- <u>Year 2007</u> – This analysis assumes that the project is partially built-out. The proposed project for this interim year includes 400 dwelling units in Planning Area (PA) 8A, 3,100 dwelling units in PA 9, and 135,500 square feet of retail use.

- <u>Year 2025 Constrained Toll</u> – The project is assumed to be fully built out in this scenario, including PA5B, PA6, PA8A and PA9 and the transfer of General Plan residential units from other planning areas. In this scenario, Jeffrey Road and Culver will not extend from Portola Parkway to SR-241.

- Year 2025 Buildout Toll – The project is assumed to be fully built out in this scenario, including PA5B, PA6, PA8A and PA9 and the transfer of General Plan residential units from other planning areas. In this scenario, Jeffrey Road and Culver Drive are assumed to be extended from Portola Parkway to SR-241 as four-lane primary and six-lane major arterials, respectively.

- Year Post-2040 Buildout Toll-Free – The project will be assumed to be fully built out in this scenario, including PA5B, PA6, PA8A and PA9 and the transfer of General Plan residential units from other planning areas. In this scenario, Jeffrey Road is assumed to be extended from Portola Parkway to SR-241 as a four-lane primary arterial and Culver Drive is assumed to be constructed north of Portola Parkway to SR-241 as a six-lane major arterial.

Additionally, in conjunction with the sensitivity analyses prepared for the project traffic study, the project has also been reviewed considering three other future potential land use/transportation scenarios. These scenarios are: *2025 with Oak Canyon, 2025 with El Toro Aviation Plan,* and *2025 with "Not Approved Probable Future" Project*. The three future scenarios are described below:

- Year 2025 with Oak Canyon Crossing – In this scenario, the 2025 with project scenario based on buildout of the circulation system will be modified to include the extension and I-5 over-crossing of Oak Canyon between Jeffrey Road and Trabuco Road.

- Year 2025 with "Not Approved Probable Future" Projects – In this scenario, the 2025 with project scenario based on buildout of the circulation system was modified to represent a setting which assumes "not approved probable future" projects that are proposed within the study area (e.g., Great Park, Culver Drive extension deletion and Spectrum Housing).

- Year 2025 with El Toro Aviation Plan – In this scenario, the 2025 with project scenario based on buildout of the circulation system will be modified to assume that the former MCAS El Toro site is developed as an airport serving 28.8 million annual passenger (MAP) rather than as the Millennium Plan II.

(For further project descriptions, refer to the Austin-Foust traffic study dated October 2001.)

1.1 Climate

The climate in and around the project area, as with all of Southern California, is controlled largely by the strength and position of the subtropical high pressure cell over the Pacific Ocean. It maintains moderate temperatures and comfortable humidities, and limits precipitation to a few storms during the winter "wet" season. Temperatures are normally mild, excepting the summer months, which commonly bring substantially higher temperatures. In all portions of the basin, temperatures well above 100 degrees F. have been recorded in recent years. The annual average temperature in the basin is approximately 62 degrees F.

Winds in the project area are usually driven by the dominant land/sea breeze circulation system. Regional wind patterns are dominated by daytime onshore sea breezes. At night the wind generally slows and reverses direction traveling towards the sea. Wind direction will be altered by local canyons, with wind tending to flow parallel to the canyons. During the transition period from one wind pattern to the other, the dominant wind direction rotates into the south and causes a minor wind direction maximum from the south. The frequency of calm winds (less than 2 miles per hour) is less than 10 percent. Therefore, there is little stagnation in the project vicinity, especially during busy daytime traffic hours.

Southern California frequently has temperature inversions which inhibit the dispersion of pollutants. Inversions may be either ground based or elevated. Ground based inversions, sometimes referred to as radiation inversions, are most severe during clear, cold, early winter mornings. Under conditions of a ground based inversion, very little mixing or turbulence occurs, and high concentrations of primary pollutants may occur local to major roadways. Elevated inversions can be generated by a variety of meteorological phenomena. Elevated inversions act as a lid or upper boundary and restrict vertical mixing. Below the elevated inversion dispersion is not restricted. Mixing heights for elevated inversions are lower in the summer and more persistent. This low summer inversion puts a lid over the SCAB and is responsible for the high levels of ozone observed during summer months in the air basin.

1.3 Air Quality Management

The Proposed Project is located in the South Coast Air Basin (SCAB), which is composed of Orange County, and the non-desert portions of and Los Angeles, San Bernardino and Riverside Counties. This topographically defined area is considered an airshed for pollution planning and control purposes.

Key Air Quality Mandates: Two key pieces of legislation govern air pollution control efforts within the SCAB:

- The Federal Clean Air Act, as amended in l990, sets national ambient air quality standards for six pollutants: ozone, carbon monoxide, nitrogen dioxide, microscopic particulates, sulfur dioxide and lead. The Clean Air Act also establishes deadlines for attaining the national standards based on the severity of pollution in each air basin. The United States Environmental Protection Agency (U.S. EPA) administers and enforces the Federal Clean Air Act. The Federal Clean Air Act requires polluted air basins to prepare attainment plans that specify control measures and schedules to expeditiously reduce pollution to meet federal standards and deadlines.

- The California Clean Air Act, adopted in l988, establishes separate, more stringent state standards for the same six pollutants as well as other compounds. The California Clean Air Act requires steady progress toward state standards, but does not specify deadlines. Instead, the Act requires attainment of the state standards at the earliest practicable date. The Act also requires the state to maintain a Clean Air Plan composed of control measures, emission reduction targets, and implementation strategies capable of meeting state standards expeditiously. The California Clean Air Act considers the cost-effectiveness of control measures

Lead Agencies on Air Quality. Four key agencies insure the South Coast Air Basin's compliance with air quality legislative mandates:

- The U.S. Environmental Protection Agency oversees state compliance with the Federal Clean Air Act. It also takes the lead in implementing control measures designed to reduce air pollution from locomotives, aircraft, trucks and other vehicles and fuels used in interstate commerce.

- The California Air Resources Board (CARB) is responsible for preparing and implementing California's air quality programs to comply with the Federal Clean Air Act and California Clean Air Act. CARB formulates state pollutant standards, prepares mandated state and federal pollution reduction plans, adopts emission control regulations, and coordinates the pollution control efforts of air basins throughout the state into a cohesive statewide pollution reduction effort. CARB oversees air quality planning for the SCAB, and integrates SCAB plans into statewide air plans. CARB is legislatively authorized to control stationary and mobile sources of pollution within California, and takes the lead on mobile source controls affecting vehicle engine and fuel usage.

- The South Coast Air Quality Management District (SCAQMD) was formed to manage air quality programs within the SCAB. SCAQMD develops and adopts rules and regulations to meet federal and state emission reduction requirements within the SCAB. SCAQMD powers include permit authority over stationary industrial sources. SCAQMD prepares the Air Quality Management Plan for the SCAB. The AQMP is designed to meet all federal and state Clean Air Act requirements in a coordinated, comprehensive program of control measures and incentives. The AQMP is updated every three years to insure timely compliance with state and federal requirements.

- The Southern California Association of Governments (SCAG) is the federally-designated Metropolitan Planning Organization for the six-county Southern California region. SCAG is mandated to prepare the region's long-range transportation plan and to insure that it conforms to emission budgets contained in the AQMP. SCAG also prepares the transportation control strategy contained in the AQMP.

The Air Quality Management Plan. The Air Quality Management Plan presents the SCAB's response to federal and state requirements to reduce air pollution below the applicable standards. The AQMP is updated every three years to incorporate new or improved control measures and advances in emission control technology.

The l997 AQMP, as amended in l999, is the most recent federally-approved AQMP. As such, the l997 AQMP is the appropriate basis for comparing the impacts of proposed projects. U.S. EPA approved the l997 AQMP in April, 2000. The l997 AQMP builds on and refines the previous l991 and l994 AQMPs, by eliminating unproductive control measures and adding new control measures based on the latest technology advances. The AQMP includes control measures aimed at stationary, areawide and mobile sources, that must be implemented by federal, state and local governments as well as the private sector. Short-term measures to be implemented by 2005 are based on available technology, while many long-term measures to be carried out by 2010 depend on technological breakthroughs or commercialization of emerging technologies.

SCAQMD is now preparing the 2001 AQMP update for SCAQMD Governing Board adoption in early 2002. The 2001 AQMP will be consistent with CARB's California Air Plan, a comprehensive long-term pollution control blueprint for the state which is now slated for adoption by CARB's Governing Board in December 2001. Building on the l997 AQMP, SCAQMD expects to replace control measures for which new technology has not yet become available or cost-effective, and add new stationary source controls. SCAG is preparing updated transportation control measures that reflect the recently adopted 2001 Regional Transportation Plan.

Attainment Status. Currently, the SCAB meets the federal nitrogen dioxide, sulfur dioxide, and lead standards. However, the SCAB is deemed an "extreme" nonattainment area for ozone, with a November 15, 2010, deadline for attaining the federal standard. The l997 AQMP sets forth the control strategy for meeting emission reduction milestones necessary to meet the 2010 deadline.

The SCAB fails to meet the standard for very fine particulates less than 10 microns in diameter (PM-10), which must be met by December 31, 2006. The l997 AQMP includes the SCAB's plan for attaining PM-10 standards.

The SCAB's l992 Carbon Monoxide Plan provided a federally approved strategy for attaining the federal CO standards by the Clean Air Act deadline of December 31, 2000. The l992 CO Plan was updated and incorporated into the l997 AQMP. The l997 AQMP predicted that the SCAB would achieve the federal CO standard by the December 2000 deadline, but the SCAB exceeded the federal carbon monoxide standard by a narrow margin. To date, the SCAB remains designated as a CO non-attainment area. U. S. EPA has not yet acted on the expired CO attainment. SCAQMD is working to reach the federal standard by the end of 2002 through revised CO control measures to be incorporated in the forthcoming 2001 AQMP.

1.4 HEALTH EFFECTS AND SENSITIVE RECEPTORS

Basic knowledge of air pollutants will aid the reader in understanding the technical nature of this report. This section provides general information concerning each of the major air pollutants: what they are, how they are generated and how they affect human health and activities.

Many pollutants are released directly into the atmosphere by motor vehicles and aircraft, among numerous other sources. This means that the pollutant is created and emitted immediately. Pollutants which are directly emitted by a source into the atmosphere are called primary pollutants. An example of a primary pollutant is carbon monoxide (CO). Other pollutants require additional chemical reactions subsequent to their release into the atmosphere. Pollutants which are formed via chemical reactions in the atmosphere are referred to as secondary pollutants. The most important secondary pollutant is ozone. This section discusses the major pollutants of concern in the study area and provides information regarding the health and well-being impacts of each pollutant.

1.4.1 Ozone

Ozone is not directly emitted by any pollutant source, and therefore, is considered a secondary pollutant. It is the product of a reaction in the atmosphere between hydrocarbons (HC) and nitrogen oxide (NOx). This reaction takes place only in the presence of ultraviolet light. Sunlight contains a lot of ultraviolet light. This is why ozone levels are the highest on bright, sunny days. As it takes several hours for the ozone levels to build, the pollutant is diffused over a wide area and concentrations are fairly constant over a regional area.

Ozone is a strong irritant to the respiratory system. It primarily affects children, people with respiratory ailments and the elderly, but has the potential to affect others as well. Exposure of humans to high concentrations of ozone may result in eye irritation, nausea, dizziness, headaches, coughs or a burning sensation in the chest, even in healthy people. Ozone aggravates heart disease, asthma, bronchitis and emphysema, and also acts to reduce lung capacity over long exposure periods. Research into the effects of this pollutant shows that ozone damages the alveoli, which are the small sacs in the lung where the exchange of gases between air and blood takes place.

1.4.2 Carbon Monoxide (CO)

The primary source of CO is the internal combustion engine in motor vehicles. CO is a primary pollutant. Generally, CO is a localized pollutant and high concentrations of CO generally occur only adjacent to very busy and congested roads. The highest concentrations occur when the atmosphere is very stable and there is very little or no wind. These conditions occur most commonly during early morning winter hours.

In the lung, particular gases are exchanged between the air and blood. The blood releases carbon dioxide (CO_2), which is a waste product of the body, into the alveoli, from which the CO_2 is then exhaled. Also in the alveoli, inhaled oxygen is absorbed by the blood and then carried to the parts of the body where it is needed. Because of the chemical nature of the substances, hemoglobin (the protein in the blood that carries oxygen) bonds more easily to CO than to oxygen. This means that the blood is more likely to absorb any CO that is present in the air that is inhaled than it is to absorb oxygen in the air. As a result, CO reduces the amount of oxygen that is absorbed by the blood and, in turn, reduces the amount of oxygen which reaches the heart, brain and other body tissues. The effects of this phenomenon, even at low doses, include headaches, fatigue and slow reflexes from lack of oxygen. Exposure to CO particularly endangers people with coronary artery disease, whose hearts already receive limited supplies of blood and oxygen. A consistent association between increasing ambient CO levels and excess admissions for heart diseases, such as congestive heart failure, is observed in many cities across the United States.

1.4.3 Respirable Particulate Matters (PM10)

In rural areas, wind and agricultural operations are primarily responsible for the particulate level. In urban areas, transportation sources can be a major source of particulate matter, especially PM10. Industrial activity and the burning of wood are other sources. Particulates can also be formed in the atmosphere via chemical reactions. Suspended water droplets (e.g., fog) can be a microscopic location where chemicals collect and chemically react. Then, as the water vaporizes, the remaining chemicals can form a particulate. PM10 is emitted directly from combustion sources, can form in the atmosphere, and is naturally occurring. Therefore, it is considered both a primary and secondary pollutant. The human body has the ability to prevent most large particles that might be inhaled from reaching the lungs. Larger particles are trapped in the nose, throat and upper respiratory system. Smaller particles (particles smaller than 10 microns in diameter, referred to as PM10), however, are able to bypass the body's protection mechanisms and can reach areas deep inside the lung. Such small particles can contain substances that can irritate the lung, constrict airways and aggravate chronic heart disease.

1.4.4 Nitrogen Oxides (NOx)

Most combustion processes, including motor vehicles, emit a combination of NO and NO_2. Much of the NO further reacts with oxygen in the atmosphere to form NO_2. The SCAB has not exceeded the federal standard for NO_2 since 1991. Although the health criteria for NO_2 have been met for almost a decade, NOx emissions are still of major concern because higher emissions of NOx result in higher concentrations of ozone.

Nitrogen oxides (NOx) consists primarily of nitrogen oxide (NO) and nitrogen dioxide (NO_2). The most significant impact of NOx emissions is its contribution to the formation of ozone, as discussed earlier. NO_2, by itself, however, damages the cells lining the respiratory tract and increases susceptibility to respiratory infection. It also constricts the airways of asthmatics.

1.4.5 Sulfur Dioxide (SO_2)

Since sulfur was removed from gasoline, motor vehicles have contributed very little to the sulfur dioxide (SO_2) emissions. SO_2 is a regional pollutant and concentrations in the SCAB are well below the ambient air quality standards (AAQS). The more stringent state 1-hour standard was last exceeded in 1990, due to a breakdown at a local refinery. This was the first exceedance since 1984. The presence of SO_2 in the atmosphere has been associated with a variety of respiratory diseases and constricts airway passages, thereby increasing airway resistance. Industrial sources, such as paper mills, power plants and smelters, are the major sources of this pollutant.

1.4.6 Lead (Pb)

Lead is introduced into the atmosphere in automobile emissions (although in far smaller concentrations than in the 1970's), in emissions from industries that smelt or process the metal, and other industrial and combustion processes. Lead is a regional pollutant. The last exceedance of the federal AAQS was in 1994. Exposure of lead to children one to five years old is extremely dangerous. Exposure can impair the formation of the nervous system and can damage kidneys and blood-forming systems. Lead exposure in other age groups is also considered hazardous.

1.4.7 Hydrocarbons (HC)

While there are no health effects linked directly with HC, it is important as a pollutant because it reacts with NOx in the presence of sunlight to form ozone. There are no state or federal standards for HC emissions. Hydrocarbons are also referred to as total organic gases (TOG). The methane portion of hydrocarbon gases does not contribute substantially to the formation of ozone and, therefore, references to non-methane hydrocarbons (NMHC), volatile organic compounds (VOC), reactive hydrocarbons (RHC) and reactive organic gases (ROG) are also found in the literature.

1.4.8 Sensitive Receptors

The SCAQMD "CEQA Air Quality Handbook" identifies the following as sensitive receptors; long-term health care facilities, rehabilitation centers, convalescent centers, retirement homes, residences, schools, playgrounds, child care centers, and athletic facilities. These locations represent areas that are most sensitive to air pollution. However, receptors sensitive to air pollution occur in all areas with a human presence. The US Environmental Protection Agency suggests that any areas with human occupancy should be considered as sensitive to air pollution. Therefore, people sensitive to air pollution also are located in office developments, industrial areas and all through developed areas.

Residential and other developed areas are spread throughout the study area. The western edge of the project is bounded by residential development. The southern edge of the project lies along the I-5 Freeway. The eastern side of the project is adjacent to the former El Toro military base. To the north of the project lies the Santiago Hills.

The project, once constructed, would contain sensitive receptors including residential areas, schools, parks, commercial and office areas.

1.5 Monitored Air Quality

Overview of Region

Air quality at any site is dependent on the regional air quality and local pollutant sources. Regional air quality is determined by the release of pollutants throughout the air basin. Estimates for the SCAB have been made for existing emissions ("1997 Air Quality Management Plan", April 2000). The data indicate that mobile sources are the major source of regional emissions. Motor vehicles (i.e., on-road mobile sources) account for approximately 51 percent of volatile organic compounds (VOC), 63 percent of nitrogen oxide (NOx) emissions, and approximately 78 percent of carbon monoxide (CO) emissions.

District Monitoring Stations

The SCAQMD has divided the air basin into Source Receptor Areas. The project site is in the District's Source Receptor Area 19 which is represented by the El Toro air monitoring station. The data collected at this station is considered to be representative of the air quality experienced in the vicinity of the project area. The air quality data at the El Toro station is available for ozone, CO, and PM10. Air quality data for NOx and sulfur oxides (SOx) is available at the next nearest station, which is Costa Mesa. The monitored air quality data are shown in Table 1 for the latest three years. The air monitoring data was obtained from the "California Air Quality Data" prepared by the California Air Resources Board.

Table 1
Air Quality Levels Measured at El Toro/Costa Mesa Ambient Air Monitoring Stations

Pollutant	California Standard	National Standard	Year	Maximum Level	Days State Std. Exceeded
Ozone	0.09 ppm for 1 hr.	0.12 ppm for 1 hr.	2000	0.13	3†
			1999	0.10	2
			1998	0.16	14
CO	20 ppm for 1-hour	35 ppm for 1-hour	2000	4.7	0
			1999	4.1	0
			1998	5.8	0
CO	9.0 ppm for 8-hour	9 ppm for 8-hour	2000	2.2	0
			1999	2.7	0
			1998	3.2	0
Particulates PM10**	50 ug/m3 for 24 hr.	150 ug/m3 for 24 hr.	2000	60	6(2%)†
			1999	111	36(10%)†
			1998	70*	36(10%)*
NO2	0.25 PPM for 1-hour	0.053 PPM AAM	2000	.11	0
			1999	.12	0
			1998	.12	0
SO2†	0.04 ppm for 24 hours	.014 ppm for 24 hours	2000	.01	0
			1999	.01	0
			1998	.01	0

† The number of days at least one measurement was greater than the level of the state hourly standard. The number of days above the standard is not necessarily the number of violations of the standard for the year.

** PM10 samples were collected every 6 days. Calculated days is the estimated number of days that a measurement would have been greater than the level of the standard had measurements been collected every day.

* Data presented are valid, but incomplete in that an insufficient number of valid data points were collected to meet EPA and/or ARB criteria for representativeness

The air quality data in Table 1 indicate that ozone is the air pollutant of primary concern in the project area. In the last three years, the state ozone standard was exceeded 3 days in 2000, 2 days in 1999, and 14 days in 1998. Ozone is a secondary pollutant; it is not directly emitted. Ozone is the result of the chemical reactions of other pollutants, most importantly hydrocarbons and nitrogen dioxide, in the presence of bright sunlight. Pollutants emitted from upwind cities react during transport downwind to produce the oxidant concentrations experienced in the project area. Many areas of the SCAB contribute to the ozone levels experienced at the monitoring station, with the more significant areas being those directly upwind.

PM10 is another air pollutant of primary concern in the project area. The state standard for particulate matter (PM10) has been consistently exceeded at the El Toro monitoring station. The state standard was exceeded for 2 percent of the days measured in 2000, 10 percent of the days measured in 1999 and 1998. The Federal PM10 standard, however, is not being exceeded. The data indicate that the trend for PM10 levels has slightly decreased. Particulate levels in the area are probably due to natural sources, grading operations, agricultural uses, and motor vehicles.

Carbon monoxide is another important pollutant that is due mainly to motor vehicles. As can be seen in Table 1, carbon monoxide levels in the area are currently within the State and Federal standards.

According to the monitoring data shown in Table 1, other than ozone and PM10 as mentioned above, no state or federal standards were exceeded for the remaining criteria pollutants.

1.6 Existing Emissions

At the present time, there is a minimum amount of emissions generated in the project area. The site is currently agricultural and open space. There is only a nominal amount of traffic and corresponding air emissions associated with the current land uses. Agricultural operations currently generate emissions from the operation of farm equipment, and particulate emissions are generated by cultivation and driving on unpaved roads. No statistics on these activities are kept, and therefore, the level of emissions generated by current agricultural operation can not be estimated. However, the current emissions are likely to be very small in comparison to the future emissions generated by the proposed project.

1.7 Local Air Quality

1.7.1 Background and Criteria

Local air quality is a major concern along roadways. Carbon monoxide is a primary pollutant. Unlike ozone, carbon monoxide is directly emitted from a variety of sources. The most notable source of carbon monoxide is motor vehicles. For this reason carbon monoxide concentrations are usually indicative of the local air quality generated by a roadway network, and are used as an indicator of its impacts on the local air quality. Comparisons of levels with state and federal carbon monoxide standards indicate the severity of the existing concentrations for receptors in the project area. The Federal and State standards for carbon monoxide are presented in Table 2.

Table 2
Federal and State Carbon Monoxide Standards

	Averaging Time	Standard
Federal	1 hour	35 ppm
	8 hours	9 ppm
State	1 hour	20 ppm
	8 hours	9 ppm

1.7.2 Caltrans Modeling "Protocol"

A CO hot-spot analysis for the proposed project was conducted according to the "Transportation Project-level Carbon Monoxide Protocol" (referred to as Protocol). Protocol was developed by the Institute of Transportation Studies at University of California, Davis (December 1997) for Caltrans. The Protocol has been approved by EPA to replace the procedures for determining localized CO concentrations (hot-spot analysis) in California that are set farther in 40 CFR 93.101. The Protocol has three sections. The first section provides a framework and roadmap for conducting a federal conformity determination at the project level as well as National Environmental Policy Act of 1969 (NEPA) and CEQA. The second section is intended to provide a procedure for conducting a "screening analysis" of local impacts of intersections. The third section provides guidance for conducting a more "detailed analysis" required when a project does not pass the screening analysis, and is for use in conjunction with programs such as CT-EMFAC or CALINE4. It is this third section of the Protocol that was followed for the CO hot spot analysis.

1.7.3 "CALINE4" Carbon Monoxide Modeling

Carbon monoxide levels in the project vicinity due to nearby roadways were assessed with the CALINE4 computer model. CALINE4 is a fourth generation line source air quality model developed by the California Department of Transportation ("CALINE4," Report No. FHWA/CA/TL-84/15, November 1984). The purpose of the model is to assess air quality impacts near transportation facilities in what is known as the microscale region. The microscale region encompasses the region of a few miles around the pollutant source. Given source strength, meteorology, site geometry, and site characteristics, the model can reliably predict pollutant concentrations. Additional details on the methodology used in the modeling is discussed in Section 2.4.1 (Local Air Quality Impacts.) The remainder of this section discusses the resulting existing carbon monoxide levels in comparison to the State and Federal carbon monoxide standards.

The existing traffic data were provided by Austin-Foust Associates, Inc. (October 2001). Peak p.m. traffic data were utilized in the CALINE4 CO modeling. The composite emission factors were derived from EMFAC2000 prepared by CARB.

The CALINE4 modeling was conducted for seven intersections in the vicinity of the project. The worst case intersections were selected based on traffic volume, congestion level and land use. Intersections with high traffic volumes and high demand to capacity ratios in the year 2025 were selected for analysis. Essentially, the traffic study was reviewed and all intersections with a future capacity with the project of Level of Service D or worse were flagged. Of these intersections, the intersections with the highest traffic volumes were further used to narrow down the intersections to be analyzed. From this short list, the worst case intersections in different parts of the City were selected so that the final intersections assessed provided a representation of sites throughout the study area. It should be noted that not all of these intersections are in the proposed project's traffic study area. Because the worst case intersections were selected (based on the highest traffic volumes and volume/capacity ratios), some of the intersections selected are outside the project's study area. The worst case intersections selected for analysis are: Jamboree Road/Barranca Parkway, Culver Drive/Walnut Avenue, Jeffrey Road/Irvine Boulevard, Jeffrey Road/Irvine Center Drive, Trabuco Road/Sand Canyon Avenue, Bake Parkway/Millennium, and Oak Canyon/Sand Canyon Avenue. Seven receptor locations were chosen for analysis. These receptors are situated approximately 25 feet from the intersections and represent the nearest sensitive land uses. The locations of these receptors are shown in Exhibit 1.

The existing (2001) background CO concentrations were estimated using the highest of the CO monitoring data for the last three years. The nearest available CO background data for the project area is the El Toro monitoring station. The highest CO background data at the El Toro monitoring station in the last three years are 5.8 ppm for 1-hour and 3.2 ppm for 8-hour. Therefore, 5.8 ppm is added to the worst case meteorological 1-hour projections, and 3.2 ppm to the 8-hour projections, to account for the existing background carbon monoxide levels. The 8-hour CO concentration is estimated utilizing a persistence factor of 0.7. The modeling results of the existing CO levels are presented in Table 3.

Table 3
Carbon Monoxide Concentrations for Existing (2001)

	Receptor	Carbon Monoxide Concentrations(ppm) 1 Hour	8 Hour
1	Jamboree Rd./Barranca Pkwy. – Residential/Ind.	10.6	6.6
2	Culver Dr./Walnut Av. – Residential	10.5	6.5
3	Jeffrey Rd./Irvine Blvd. – Residential	7.7	4.5
4	Jeffrey Rd/ Irvine Center Dr. – Residential	8.5	5.1
5	Trabuco Rd./Sand Canyon Av. – Commercial	6.8	3.9
6	Bake Pkwy./Millenium – Commercial	--	--
7	Oak Canyon/Sand Canyon Av. – Commercial	8.7	5.2
	Summary of Carbon Monoxide State Standards Exceedance	**No. of Sites exceeding 20 ppm** **0**	**No. of Sites exceeding 9 ppm** **0**

NOTE: Concentrations include existing background CO concentrations of 5.8 ppm for 1-hour and 3.2 ppm for 8-hour.

-- Future intersection; does not currently exist.

Table 3 presents the existing CO modeling results at the receptor locations. The existing CO concentration levels range between 6.8 and 10.6 ppm for 1-hour and between 3.9 and 6.6 ppm for 8-hour. The results indicate that the existing CO concentrations at these receptor locations are currently in compliance with both State and Federal CO standards.

1.7.4 PM10 Hot-Spot Analysis

As CO levels have consistently improved over the years, PM10 has shown little change. Therefore, PM10 is becoming more of a concern along busy roadways. Areas of most concern are where high levels of traffic operate under heavily congested conditions, or where unusually large numbers of diesel-powered vehicles can be expected to occur. Currently, the project is located in a serious nonattainment area for PM10.

There are no protocol guidelines at this time for modeling PM10. The CALINE4 computer modeling was used to determine the potential for PM10 hot spots for the proposed project. The precise methodology utilized with the CALINE4 modeling is further discussed Section 2.4.1.

1.7.5 "CALINE4" PM10 MODELING

The CALINE4 computer modeling was conducted for PM10 at the same seven intersections and receptor locations as in the CO modeling. These receptor locations were shown previously in Exhibit 1.

The existing (2001) background PM10 concentrations were estimated using the highest of the PM10 monitoring data for the last three years. The nearest available PM10 background data for the project area is the El Toro monitoring station. The highest existing background concentration for 24-hour PM10 is 111 micrograms per cubic meter (ug/m3), and this was added to the CALINE4 PM10 projections to determine PM10 levels. The CALINE4 model can only project 1-hour concentrations. Therefore, the 1-hour PM10 concentrations due to local roadways were multiplied by a persistence factor of 0.6 to get a 24-hour concentration. (The persistence factor of 0.6 is recommended in the U.S. EPA's "Workbook of Atmospheric Dispersion Estimates".) The modeling results of the existing PM10 concentration levels are presented in Table 4.

Table 4
PM10 Concentrations for Existing (2001)

	Receptor	PM10 Concentrations(ug/m^3) 24 Hour
1	Jamboree Rd./Barranca Pkwy. – Residential	123
2	Culver Dr./Walnut Av. – Residential	121
3	Jeffrey Rd./Irvine Blvd. – Residential	116
4	Jeffrey Rd/ Irvine Center Dr. - Residential	117
5	Trabuco Rd./Sand Canyon Av. - Commercial	113
6	Bake Pkwy./Millenium - Commercial	--
7	Oak Canyon/Sand Canyon Av. – Animal shelter	115
Number of Sites Exceeding State Standard of 50 ug/m^3:		**6**
Number of Sites Exceeding Federal Standard of 150 ug/m^3:		**0**

NOTE: Concentrations include existing background PM10 concentrations of 111 ug/m^3 for 24-hour.

-- Future intersection; does not currently exist.

Table 4 presents the existing PM10 modeling results at the seven receptor locations. The existing PM10 concentrations range between 113 and 123 ug/m^3 for 24-hour. The results indicate that the existing PM10 concentrations currently comply with the Federal standard of 150 ug/m^3; however, the PM10 concentration levels exceed the State PM10 standard of 50 ug/m^3 at all receptor locations.

Note that the bulk of the PM10 concentrations are due to the background concentration. The local roadways added 2 to 12 ug/m^3 to the ambient level of 111 ug/m^3 (1.8% to 10.8%).

2.0 POTENTIAL AIR IMPACTS

Air quality impacts are usually divided into short-term and long-term. Short-term impacts are usually the result of construction of grading operations. Long-term impacts are associated with the built out condition. Long term impacts are further divided into local and regional impacts.

Regional air quality generally refers to the typical air quality over a large area, such as the traffic study area, or even the entire air basin. For this study, traffic study area was defined as the region. Emissions are released, travel downwind, chemically react with other air constituents, disperse and finally result in the air quality that we breathe. Ozone, for example, is not released directly and is a result of chemical reactions of other pollutants, most notably hydrocarbons and nitrogen dioxide. Ozone may take several hours to form. In fact, emissions released in the late afternoon often do not react to form ozone until the next day when sunlight is available to drive the chemical reactions. The relationship between emissions released and the final pollutant levels is a very complex process for regional air quality. Therefore, for the regional analysis, emissions, rather than pollutants concentrations, are usually evaluated. If the emission levels increase, then it is generally assumed that the levels of pollutants will also go up.

Local air quality refers to the resulting pollution levels within a few hundred feet of the pollutant source or within a few thousand feet for major pollutant sources such as power plants. For most projects the major concern will be pollutant concentrations near roads or intersections potentially affected by the project. For local air quality impacts, the concern is for pollutants that are emitted along the road or roads of concern. The amount of dispersion and chemical reactions that occur are minimal compared to the regional setting. Therefore, computer models are used to evaluate the concentration of air pollutants that will be generated near these roads. The pollutant levels or concentrations are compared to the Ambient Air Quality Standards (AAQS) to determine if an exceedance of the AAQS will occur.

2.1 Significance Thresholds

The SCAQMD (CEQA Air Quality Handbook, November 1993) has established two types of air pollutant thresholds, short-term construction and long-term daily operation, to assist lead agencies in determining whether or not each phase of a project is significant. The significant thresholds established by the SCAQMD for short-term construction operation are: 75 pounds a day for ROC, 100 pounds a day for NOx, 550 pounds a day for CO, 150 pounds a day for PM10, and 150 pounds a day for SOx. For long-term daily operation, both direct and indirect emissions should be included when determining whether the project exceeds these thresholds. The significant thresholds for long-term daily operation are: 55 pounds per day for ROC, 55 pound per day for NOx, 550 pounds per day for CO, 150 pounds per day for PM10, and 150 pounds per day for SOx. The SCAQMD recommends that these thresholds be used by lead agencies in making a determination of significance. However, the final determination of whether or not a project is significant is within the purview of the lead agency pursuant to Section 15064 (b) of the CEQA Guidelines. In addition, the local air quality thresholds include the State standards of 20 ppm for 1-hour CO concentration levels, and 9 ppm for 8-hour CO concentration levels.

2.2 Short Term Impacts

The project site comprises a total of approximately 3,145 acres. As a worst case scenario, it is assumed that all 3,145 acres will be graded. At this time, specific construction information in terms of phasing, duration of grading, and amount of construction equipment for the proposed project is not known. According to the developer, it is anticipated that approximately two thirds of the project site or 2,097 acres may be graded in the first five years of construction, and the last third or 1,048 acres may be graded in the second five years of construction. This corresponds roughly to the Phase 1 and Phase 2 development in the project description. That is, grading is assumed to be initiated in year 2002 and then, five years later in the year 2007, two thirds of the project area is assumed to be graded. The construction of the proposed project is expected to be completed in a 15 year duration. Due to the size of the project, the grading cycles of the project are assumed to be six months.

Temporary impacts will result from the project's construction activities. Air pollutants will be emitted by construction equipment and fugitive dust will be generated during grading and site preparation. Construction emission rates for large development projects have been estimated by the U.S. Environmental Protection Agency. According to the SCAQMD's 1993 CEQA Air Quality Handbook, the emission factor for disturbed soil is 0.40 tons of PM10 per month per acre. If water or other soil stabilizers are used to control dust as required by SCAQMD Rule 403, the emissions can be reduced by 50 percent.

For the first phase, applying the above factors to 2,097 acres of gradable area and six month grading cycles result in an estimate of 498 tons per year and an average 2,730 pounds of PM10 per day. This estimate represents a worst case estimate of the PM10 emissions generated.
Heavy-duty equipment emissions are difficult to quantify because of day to day variability in construction activities and equipment used. Typical emission rates for construction equipment were obtained from the SCAQMD Air Quality Handbook. For the grading of a site of this size (2,097 acres), it is anticipated that approximately 140 pieces of heavy equipment may be expected to operate at one time. The number of pieces of equipment assumed included 20 scrapers, 20 loaders, 20 graders, 40 dozers, 20 water trucks and 20 miscellaneous trucks. If all of the equipment operated for 8 hours per day the following emissions would result; approximately 712 pounds per day of carbon monoxide, 119 pounds per day of ROG, 1,866 pounds per day of nitrogen oxides, 235 pounds per day of PM10, and 283 pounds per day of sulfur oxides.

For the second phase, applying the above factors to 1,048 acres of gradable area and 6 month grading cycles result in an estimate of 249 tons per year and an average 1,365 pounds of PM10 per day. Again this estimate represents a worst case estimate of the PM10 emissions generated.

For the grading of a site of this size (1,048 acres), it is anticipated that approximately 70 pieces of heavy equipment may be expected to operate at one time. The number of pieces of equipment assumed included 10 scrapers, 10 loaders, 10 graders, 20 dozers, 10 water trucks and 10 miscellaneous trucks. If all of the equipment operated for 8 hours per day the following emissions would result; approximately 356 pounds per day of carbon monoxide, 60 pounds per day of ROG, 933 pounds per day of nitrogen oxides, 118 pounds per day of PM10, and 142 pounds per day of sulfur oxides.

There will also be some emissions generated by construction workers traveling to and from the job site. However, specific information for the project is not available to project these emissions. Assumptions were made to determine the air emissions and they are usually small in comparison to the other construction emissions. The data used in the assumptions to determine emissions generated from construction workers are provided in the appendix.

The construction emission data is summarized in Table 5. Note that all of the pollutant emissions are greater than the significance thresholds established by the SCAQMD in the CEQA Air Quality Handbook for the first phase. Only NOx and PM10 are greater than the thresholds for the second phase. Since the project's construction emissions are greater than the significance thresholds, the construction emissions are considered to be significant. Mitigation measures are recommended for the construction activities of the project to minimize emissions. The mitigation measures are provided in Section 3.0. The data used to calculate the construction emissions are shown in the appendix.

Table 5
Worst Case Construction Emissions

	- - - - - - - - - - - - - -Peak Emissions (Pounds/Day) - - - - - - - - - - - - - -			
Pollutant	Employee Travel	Grading Activities (PM10* only)	Equipment Emissions	Total Emissions	SCAQMD Thresholds
<u>First Phase</u>					
Carbon Monoxide	69.51	- -	712	<u>781</u>	*550*
ROG	5.93	- -	119	<u>125</u>	*75*
Nitrogen Oxides	18.15	- -	1,866	<u>1,884</u>	*100*
PM10*	0.62	2,730	135	<u>2,966</u>	*150*
Sulfur Oxides	0.74	- -	283	<u>284</u>	*150*
<u>Second Phase</u>					
Carbon Monoxide	34.75	- -	356	391	*550*
ROG	2.96	- -	60	62	*75*
Nitrogen Oxides	9.07	- -	933	<u>942</u>	*100*
PM10*	0.31	1,365	118	<u>1,483</u>	*150*
Sulfur Oxides	0.37	- -	142	142	*150*

NOTE: The underlined data indicate exceedance of the significance thresholds.
* Includes a 50% reduction from watering.

PM10 emissions exceed the threshold more than any of the other pollutants. For the proposed project, the average emissions of 2,966 pounds per day of PM10 generated in the first phase, and 1,483 pounds per day of PM10 generated in the second phase are minor when compared with the total average annual of 416 tons per day (832,000 pounds per day) of particulate matter currently released in the whole South Coast Air Basin (SCAB). However, according to the SCAQMD's CEQA Handbook, PM10 emissions greater than 150 pounds per day for a proposed project should be considered significant. The PM10 emissions generated by the proposed project for both phases are projected to exceed this threshold, and therefore, are considered to be significant.

The construction emissions above are the best estimate for the proposed project. More precise construction emissions for the project can be determined when more specific construction data is available. Specific construction data needed to calculate emissions would include the duration of the construction, the number of equipment and employees involved on a daily basis, phasing and the total area graded.

2.3 FUTURE EMISSIONS

2.3.1 Regional Emissions – Long Term

The long-term daily emissions were assessed for the proposed project. The long-term daily emissions at the project build out will be primarily due to vehicular emissions, and emissions due to on-site combustion of natural gas for space heating and water heating. Also, the generation of electrical energy by the combustion of fossil fuels results in additional emissions off-site.

The proposed project is projected to be developed in two phases: (interim) 2007 and (buildout) 2025. For 2007, the proposed land uses consist of a total of 1,343 single-family detached homes, 882 multi-family (condominium) units, 1,275 multi-family (apartment) units, 135,500 square feet of commercial, 13,500 square feet of restaurant, a gas station, and a 900-student elementary/middle school. For project buildout year (2025), the proposed land uses consist of a total of 6,155 single-family detached homes, 4,070 multi-family (condominium) units, 2,125 multi-family (apartment) units, 6,566,000 square feet of office/research and development, 72,750 square feet of restaurant, 5 gas stations, 488,250 square feet of commercial, a 1,900-student elementary/middle school, a 900-student elementary/middle school, and a 1800-student elementary/middle school.

The future traffic data for the proposed project were provided by Austin-Foust Associates, Inc. (October 2001). The traffic study analyzed four future scenarios: *2007, 2025 Constrained Toll, 2025 Buildout Toll*, and post *2040 Buildout Toll-Free.* As noted previously, the 2040 Buildout Toll-Free analysis is the cumulative impact analysis as it assumed the air quality impacts of the proposed project considered together with build-out of the City's General Plan.

Vehicular emissions will be the main sources of the project's daily emissions. Estimates were made of the vehicular emissions that would be generated by the proposed project. The project's average daily trip generation (ADT), as well as vehicle miles traveled (VMT) for all future scenarios were provided by the traffic engineer. The proposed project is expected to generate approximately 46,051 ADT by year 2007, and a total of 254,873 ADT by buildout year 2025. The project's VMT are estimated to be 46,127 for year *2007*, 628,989 for *2025 Constrained Toll*, 622,245 for *2025*

Buildout Toll and 567,379 for post *2040 Buildout Toll-Free*. The project's VMT contribution was determined by taking the regional VMT forecast with the project and subtracting the regional VMT forecast without the project.

The emission factors were derived from EMFAC2000 prepared by the Air Resources Board (ARB). The EMFAC2000 emission factors, at an average speed of 25 miles per hour, were utilized in the estimates.

Other emission sources that will be generated by the proposed project are on-site combustion of natural gas for space heating and water heating, and off-site electrical usage. The data used to estimate the on-site combustion of natural gas, and off-site electrical usage were based on the project's land uses in terms of dwelling units and square footages, and emission factors taken from EMFAC2000. These data are provided as technical data in the appendix. The total daily emissions for all future scenarios are presented in Table 6.

Table 6
TOTAL DAILY EMISSIONS – DUE TO PROJECT

Pollutant	Vehicular Emissions (pounds/day)	On-Site Emis. from Natural Gas Combustion (pounds/day)	Off-Site Emis. from Electrical Generation (pounds/day)	Total Daily Emissions (pounds/day)
	- - - SOURCE - - -			
Year 2007				
CO	1,089	11.85	13.01	1,114
TOG/ROG	53	3.14	0.65	57
NOx	197	48.06	74.82	320
PM10	7	0.12	2.60	10
SOx	37	0.00	7.81	44
2025 Constrained Toll				
CO	3,474	57.46	78.49	3,610
TOG/ROG	128	15.23	3.92	147
NOx	592	258.13	451.31	1,302
PM10	50	0.57	15.70	66
SOx	441	0.00	47.09	489
2025 Buildout Toll				
CO	3,447	57.46	78.49	3,583
TOG/ROG	127	15.23	3.92	146
NOx	587	258.13	451.31	1,296
PM10	50	0.57	15.70	66
SOx	437	0.00	47.09	484
Post-2040 Buildout Toll-Free				
CO	1,974	57.46	78.49	2,110
TOG/ROG	49	15.23	3.92	68
NOx	494	258.13	451.31	1,203
PM10	42	0.57	15.70	58
SOx	402	0.00	47.09	449

The data in Table 6 show that the greatest emissions will be generated by the project around the year 2025. By this year the project will be completely built out. In years after 2025, emission rates for motor vehicles will continue to decline. Therefore, the highest emissions for the project will occur around the year of buildout. Two cases were considered for the year 2025: *Constrained Toll* and *Buildout Toll*. The emissions projected for these two cases are nearly identical indicating that the traffic conditions for these two scenarios only have minor differences from an air quality perspective.

The year post 2040 emissions are lower than year 2025 emissions for two reasons. First, the motor vehicle emission rates will continue to decline as cleaner vehicle engines and fuels are integrated into the fleet. (Vehicle emission rates based on cleaner engine and fuel technologies are provided in the “On-Road Motor Vehicle Emissions Inventory Technical Support Document” prepared by CARB, May 2000). Second, the VMT for the project is also lower in comparison to the project 2025 VMT. The VMT reduction is due to a combination of factors, including a more developed roadway network (i.e., toll-free corridor network) which results in shorter trip lengths.

2.3.1 Project Emissions Compared to Thresholds and Regional Levels

The main source of emissions generated by the proposed project will be motor vehicles. Other sources of emissions will be natural gas combustion for space heating and electrical generation. Emissions for the proposed project were calculated using methods recommended by the SCAQMD’s CEQA Air Quality Handbook.

The SCAB regional emissions data are for year 2010 and are from the 1997 AQMP. The SCAB regional emissions are compared with the project’s total emissions. The total daily emissions generated by the future scenarios are presented in the first through fourth lines of Table 7.

Table 7
Comparison of Project Impact Emissions

Contaminant	CO	ROG	NOx	PM10	SOx
Total Project Emissions Per Day					
2007 Emissions (Pounds/Day)	1,114	57	320	10	44
2025 Constrained Toll Emissions (Pounds/Day)	3,610	147	1,302	66	489
2025 Buildout Toll Emissions (Pounds/Day)	3,583	146	1,296	66	484
Post 2040 Buildout Toll-Free Emissions (Pounds/Day)	2,110	68	1,203	58	449
SCAQMD Thresholds of Significance (Pounds/Day)	*550*	*55*	*55*	*150*	*150*
SCAB (Pounds/Day)	6,682,000	1,538,000	1,394,000	914,000	140,000
Project Emissions as a Percent of Regional (SCAB) Emissions					
2007	.017%	.004%	.023%	.001%	.032%
2025 Constrained Toll	.054%	.010%	.093%	.007%	.349%
2025 Buildout Toll	.054%	.010%	.093%	.007%	.346%
Post 2040 Buildout Toll-Free	.032%	.004%	.086%	.006%	.321%

NOTE: Underlined data indicate exceedance of the significance thresholds.

As can be seen in Table 7, on the regional basis (when compared with the SCAB emissions), the future scenarios will contribute less than 0.04 percent for *2007*, and less than 0.4 percent *for 2025 Constrained Toll*, *2025 Buildout Toll*, and *post 2040 Buildout Toll-Free*. The primary source of the proposed project emissions will be from motor vehicles.

Note that the project's emissions are projected to exceed the SCAQMD thresholds of significance for all scenarios, specifically for CO, ROG (except 2007), NOx and SOx (except 2007). Note also that these thresholds are not necessarily an appropriate reference to determine the significance of project emissions. These thresholds are taken from the "1993 CEQA Air Quality Handbook", which states that the criteria "are consistent with the federal Clean Air Act definition of a significant source in an area classified as extreme for ozone." While it is correct that the thresholds are consistent as such, the Handbook does not acknowledge such criteria were developed initially by the U.S. EPA to be applied to point source emissions, such as an industrial smokestack. Comparisons between emissions from an extreme point source and emissions from the proposed project are clearly inappropriate in this context. Emissions from the proposed project are primarily from motor vehicles traveling in the area. Emissions from the proposed project bear no resemblance to emissions from industrial sources.

In spite of the original intent and application of SCAQMD's thresholds, SCAQMD has recommended their application to emissions generated by a proposed project, including vehicle emissions, and therefore, the proposed project is compared with them per the SCAQMD's CEQA Air Quality Handbook. Since the project daily emissions will exceed the above significance thresholds for all future scenarios according to the SCAQMD CEQA Handbook, the project is considered to be significant. Significant long-term impacts on regional air quality are projected for all future scenarios. As a result, mitigation measures are recommended for long-term impacts. Mitigation measures are discussed in Section 3.0.

2.4 Local Air Quality Impacts

Because the project will introduce an increase in traffic upon the roadways serving the project, a detailed analysis of carbon monoxide concentrations at sensitive areas in the project vicinity is warranted.

2.4.1 Methodology

Carbon monoxide (CO) is the pollutant of major concern along roadways since the most notable source of carbon monoxide is motor vehicles. For this reason carbon monoxide concentrations are usually indicative of the local air quality generated by a roadway network, and are used as an indicator of its impacts on local air quality.

PM10 is also a pollutant of concern. At this time, there is no formal protocol guidance established by EPA or Caltrans for PM10 analysis. The CALINE4 model was used for the PM10 hot spot analysis.

Local air quality impacts can be assessed by comparing future CO and PM10 levels with state and federal standards, and also by comparing future concentrations with and without the project. The federal and state standards for PM10 and CO were presented previously in Tables 1 and 2, respectively.

Future CO and PM10 concentrations were forecasted with the CALINE4 computer model. CALINE4 is a fourth generation line source air quality model developed by the California Department of Transportation ("CALINE4," Report No. FHWA/CA/TL-84/15, June 1989). The purpose of the model is to forecast air quality impacts near transportation facilities in what is known as the microscale region. The microscale region encompasses the region of a few thousand feet around the pollutant source. Given source strength, meteorology, site geometry, and site characteristics, the model can reliably predict pollutant concentrations.

Worst case meteorology was assessed. Specifically, a late afternoon winter period with a ground based inversion was considered. For worst case meteorological conditions, a wind speed of 0.5 meter per second (1 mph) and stability class G was utilized for a 1-hour averaging time. Stability class G is the worst case scenario in terms of the most turbulent atmospheric conditions. A worst case wind direction for each site was determined by the CALINE4 Model. A sigma theta of 10 degrees was also used and represents the fluctuation of wind direction. A high sigma theta number would represent a very changeable wind direction. The temperature used for worst case was 45 degrees Fahrenheit (7.2 degrees Celsius). The temperature affects the dispersion pattern and emission rates of the motor vehicles. The temperature represents the January mean minimum temperature as reported by Caltrans. The wind speed, stability class, sigma theta, and temperature data used for the modeling are those recommended in the "Development of Worst Case Meteorology Criteria," (California Department of Transportation, June 1989). A mixing height of 1,000 meters was used as recommended in the CALINE4 Manual. A surface roughness of the ground in the area, 100 centimeters, was utilized and is based on the CALINE4 Manual. It should be noted that the results are also determined based on the level-of-service of the roadways. These worst case meteorology assumptions are also consistent with the Caltrans Carbon Monoxide Protocol.

Composite emission factors utilized with the CALINE4 computer model were obtained from EMFAC2000 prepared by CARB. The traffic data used in the CALINE4 CO and PM10 computer modeling were provided by Austin-Foust Associates, Inc. (October 2001). The traffic volumes and capacity levels are unmitigated and therefore, the intersections modeled represent congested intersections prior to any mitigation that might be required by the traffic study. Therefore, the traffic scenario modeled for these intersections represent a worst case.

The CALINE4 computer modeling was based on the peak hour traffic data. For this analysis, peak p.m. hour traffic data were used as the worst case scenario. The levels-of-service at the intersections were also used in the CALINE4 computer modeling. The levels-of-service determine the congestion levels at the intersections, and therefore, are important in the CALINE4 modeling. The levels-of-service determine the average speeds used at these intersections. In general, the slower the speeds, the higher the vehicular emissions factors. As a result, the higher the pollutant levels that will result.

Eight hour carbon monoxide levels were projected using Caltrans methodology described in the "Transportation Project-Level Carbon Monoxide Protocol". The method essentially uses a persistence factor which is multiplied times the 1-hour emission projections. The projected 8-hour ambient concentration is then added to the product. The persistence factor can be estimated using the highest ratio of 8-hour to 1-hour second annual maximum carbon monoxide concentrations from the most recent three years that data is available. For the project, a persistence factor of 0.7 was utilized to determine 8-hour CO concentration. For PM10 analysis, a persistent factor of 0.6 was utilized to estimate 24-hour PM10 concentration levels. The data and results of the CALINE4 modeling for CO and PM10 are provided in the appendix. (The CALINE4 modeling results shown in the appendix do not include the ambient background levels.)

The CALINE4 computer modeling was conducted for the worst case future scenarios. The worst case future scenarios are considered to be those with the highest traffic volumes and heavy congestion levels. Six worst case scenarios were selected for the CO and PM10 computer modeling and these scenarios are: *2007 with and without project*, *2025 Buildout Toll with and without project*, *2025 with El Toro Aviation Plan,* and *2025 with "Not Approved Probable Future" projects*. Additionally, *2025 (with project) with and without the Oak Canyon Crossing* were assessed at one intersection. (An intersection with a level-of-service of "D" or worse was selected to assess the changes in the emissions caused by the Oak Canyon Crossing). If these future scenarios comply with the state and federal standards, then all other future scenarios (*2025 Constrained Toll*, and post *2040 with and without project*) will also comply with the state and federal standards.

The CALINE4 modeling was performed for seven intersections in the vicinity of the project. These worst case intersections were selected based on traffic volume, congestion level and land use. In general, intersections with high traffic volumes and high demand to capacity ratios in the year 2025 were selected for analysis. These intersections are Jamboree Road/Barranca Parkway, Culver Drive/Walnut Avenue, Jeffrey Road/Irvine Boulevard, Jeffrey Road/Irvine Center Drive, Trabuco Road/Sand Canyon Avenue, Bake Parkway/Millennium, and Sand Canyon Avenue/Oak Canyon. In addition, the CALINE4 modeling was conducted for 2025 at the Oak Canyon/Sand Canyon Avenue intersection. This intersection currently experiences a level-of-service "D", but this congestion level will be improved to "C" for year 2025. Seven receptor locations were chosen for analysis. These receptors are set back approximately 25 feet from the intersections, and represent the nearest sensitive land uses in the vicinity of the project. The locations of the receptor locations are shown in Exhibit 1. The receptor locations utilized for the future CO and PM10 modeling are essentially the same receptor locations as the existing CALINE4 modeling (Exhibit 1) in Section 1.7.

The future ambient (background) concentration levels for CO and PM10 are not available. For the purpose of the analysis, it is assumed that the background levels for the future years are the same as existing year 2001. This can be considered as the worst case situation since the background levels are anticipated to decrease in future years due to cleaner vehicles and fuels.

2.4.2 CO Analysis Results

The results of the CO analysis are summarized in Table 8 for 1 hour concentrations, and Table 9 for 8 hour concentrations. The pollutant levels, expressed in parts per million (ppm) for each receptor are reported. The carbon monoxide levels reported in Tables 8 and 9 are composites of the background levels of carbon monoxide coming into the area plus those generated by the local roadways.

Table 8
Future Projections of 1-Hour Carbon Monoxide Concentrations

Receptor	Year 2007 No Proj. 1 Hour	Year 2007 With Proj 1 Hour	2025 Build-out Toll No Proj. 1 Hour	2025 Build-out Toll With Proj 1 Hour	2025 w/El Toro Aviation Plan 1 Hour	2025 Not Apprv. Prob. Future 1 Hour	2025 Oak Canyon No Crossing 1 Hour	2025 Oak Canyon W/Crossing 1 Hour
1	7.8	7.8	6.4	6.7	6.4	6.4	--	--
2	8.5	8.5	6.7	6.9	6.7	6.7	--	--
3	7.2	7.2	6.3	6.4	6.5	6.5	--	--
4	8.0	8.0	6.6	6.7	6.7	6.7	--	--
5	7.2	7.3	6.4	6.5	6.5	6.4	--	--
6	8.5	8.5	6.7	7.0	--	--	--	-
7	--	--	--	--	--	--	6.4	6.4
Number of Sites exceeding 1-Hour CO State standard of 20 ppm								
Exceedances	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

NOTE: Concentrations include background CO concentrations of 5.8 ppm for 1-hour.

-- Not applicable

Table 9
Future Projections of 8-Hour Carbon Monoxide Concentrations

Receptor	Year 2007 No Proj. 8 Hour	Year 2007 With Proj 8 Hour	2025 Build-out Toll No Proj. 8 Hour	2025 Build-out Toll With Proj 8 Hour	2025 w/El Toro Aviation Plan 8 Hour	2025 Not Apprv. Prob. Future 8 Hour	2025 Oak Canyon No Crossing 8 Hour	2025 Oak Canyon W/Crossing 8 Hour
1	4.6	4.6	3.6	3.8	3.6	3.6	--	--
2	5.1	5.1	3.8	4.0	3.8	3.8	--	--
3	4.2	4.2	3.6	3.6	3.7	3.7	--	--
4	4.7	4.7	3.8	3.8	3.8	3.8	--	--
5	4.2	4.3	3.6	3.7	3.7	3.6	--	--
6	5.1	5.1	3.9	4.0	--	--	--	--
7	--	--	--	--	--	--	3.6	3.6
Number of Sites exceeding 8-Hour CO State standard of 9 ppm								
Exceedances	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

NOTE: Concentrations include background CO concentrations of 3.2 ppm for 8-hour.

-- Not applicable

The CO modeling results in Tables 8 and 9 show that the future CO concentration levels for all future scenarios will comply with the State and Federal CO standards for both 1-hour and 8-hour, at all receptor locations. The future CO concentration levels for the *2007 with and without project* scenarios will range between 7.2 and 8.5 ppm for 1 hour, and 4.3 and 5.1 ppm for 8 hour at the six receptor locations. The CO levels are similar with only a small increase at Receptor 5. The future CO concentration levels for the *2025 Buildout Toll no project* scenario will range between 6.3 and 6.7 ppm for 1 hour, and 3.6 and 3.9 ppm for 8 hour. For the *2025 Buildout Toll with project* scenario, the future CO levels will be in the range of 6.4 and 7.0 ppm for 1 hour, and 3.6 and 4.0 ppm for 8 hour. The change in PM10 levels between these scenarios is minor. For the next two scenarios, *2025 El Toro Aviation Plan* and *2025 with "Not Approved Probable Future" Projects* scenarios, the future CO concentrations will be the same (with the exception of Receptor 5.) The future CO concentrations for these two scenarios will be between 6.4 and 6.7 ppm for 1 hour, and 3.6 and 3.8 ppm for 8 hour. For both *2025 with and without the Oak Canyon Crossing* scenarios, the future CO levels will be the same at Receptor 7; the CO concentration levels for these scenarios will be approximately 6.4 ppm for 1 hour and 3.6 ppm for 8 hour.

As can be seen in Tables 8 and 9, the *2007 with and without project* CO concentration levels will be the same for all receptors, with the exception of Receptor 5. The *2007 with project* will increase over *no project* by 0.1 ppm for both 1 hour and 8 hour CO concentration levels. The *2025 Buildout Toll with project* CO concentration levels will be higher than *2025 no project* at all receptor locations. The *2025 with project* will increase over *no project* by 0.1 to 0.3 ppm for 1 hour, and 0.1

to 2 ppm for 8 hour CO concentration levels, with the maximum increase at Receptor 1. The *2025 with El Toro Aviation Plan* and *2025 with "Not Approved Probable Future" Projects* CO concentration levels will be the same for most receptors; only Receptor 5 shows a slight increase of 0.1 ppm for both 1 hour and 8 hour CO concentration levels. The *2025 with and without the Oak Canyon Crossing* CO concentration levels will be the same at the Sand Canyon Avenue/Oak Canyon intersection. The congestion level at this intersection will be improved from an existing level-of-service "D" to "C" for year 2025. In terms of CO concentration levels, the change is not measurable.

The future CO concentration levels in Tables 8 and 9 can also be compared with the existing CO levels shown in Table 3. The future CO concentration levels will essentially be lower than the existing CO levels for all future scenarios, with the exception of 2007 at Receptor 5. In fact, the future CO concentration levels will be reduced on average 0.9 ppm for 1-hour and 0.5 ppm for 8-hour CO. This is mainly due to the anticipated decrease in the future emission factors (EMFAC2000) due to cleaner vehicles and fuels. In general, the background CO concentration and the vehicular emission factors are projected to decrease steadily in the future years. The future contribution of the local traffic actually increase due to increases in traffic, but this is more than offset by declining vehicular emission rates.

2.4.3 PM10 Hot Spot Analysis Results

The results of the CALINE4 modeling are summarized in Table 10 for 24-hour PM10 concentrations. The pollutant levels, expressed in ug/m3 for each receptor are reported. The PM10 concentration levels reported in Table 10 are composites of the background levels of PM10 coming into the area plus those generated by the local roadways.

Table 9
Future Projections of 24-Hour PM10 Concentrations (ug/m^3)

Receptor	Year 2007 No Proj. 24 Hour	Year 2007 With Proj 24 Hour	2025 Build-out Toll No Proj. 24 Hour	2025 Build-out Toll With Proj 24 Hour	2025 w/El Toro Aviation Plan 24 Hour	2025 Not Apprv. Prob. Future 24 Hour	2025 Oak Canyon No Crossing 24 Hour	2025 Oak Canyon w/Crossing 24 Hour
1	120	120	117	118	120	120	--	--
2	121	121	122	123	124	124	--	--
3	118	118	119	120	123	123	--	--
4	120	120	123	126	127	127	--	--
5	117	118	121	121	124	124	--	--
6	123	123	128	128	--	--	--	--
7	--	--	--	--	--	--	119	119
Summary:	**No. of Sites exceeding PM10 State standards of 50 ug/m3**							
Exceedances	**6**	**6**	**6**	**6**	**5**	**5**	**1**	**1**
Summary:	**No. of Sites exceeding PM10 Federal standards of 150 ug/m3**							
Exceedances	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

NOTE: Concentrations include background PM10 concentrations of 111 ug/m^3 for 24 hour. The 24 hour PM10 concentrations were determined based on a persistent factor of 0.6.

-- Not applicable

According to Table 10, the future 24 hour PM10 concentration levels for *2007 no project* will be in the range of 117 to 123 ug/m^3. The future PM10 concentration levels for *2007 with project* will be in the range of 118 to 123 ug/m^3. For *2025 Buildout Toll with and without project*, the future PM10 levels will be between 117 and 128 ug/m^3, and 118 and 128 ug/m^3, respectively. As can be seen, the increase in the PM10 levels with the project will be very minor when compared to no project. For the next two scenarios, *2025 with El Toro Aviation Plan* and *2025 with "Not Approved Probable Future" Projects*, the future PM10 levels for both scenarios will be in the range of 120 to 127 ug/m3. The future PM10 concentration levels for *2025 with and without the Oak Canyon Crossing* scenarios will be approximately 119 ug/m^3. The PM10 modeling results in Table 10 show that the future PM10 concentration levels for all future scenarios will comply with the Federal PM10 standard of 150 ug/m^3. However, the future PM10 concentrations will exceed the State PM10 standard of 50 ug/m^3 for all cases due to the high background concentrations which already exceed the state standard.

As can be seen in Table 10, the *2007 with and without project* PM10 concentration levels will be essentially the same for most of the receptor locations. The future PM10 concentration for *2007 with project* will increase over *no project* by 1 ug/ m^{3}only at Receptor 5. The *2025 Buildout Toll* *with project* PM10 concentration levels will be slightly higher than *no project* at Receptors 1 through 4; the future PM10 emissions will be the same at the other two receptor locations. The *2025 Buildout Toll with project* PM10 concentration levels will increase over *no project* by 1 to 3 ug/ m^3, with the maximum increase at Receptor 4. The increases in PM10 with the project are very small and are not considered to be significant. The future PM10 concentration levels for *2025 with El Toro Aviation Plan* and *2025 with "Not Approved Probable Future" Project* will be the same for all receptor locations. The PM10 concentration levels for *2025 with and without the Oak Canyon Crossing* will be the same at the Sand Canyon Avenue/Oak Canyon intersection (Receptor 7). The congestion level at this intersection will be improved from an existing level-of-service "D" to "C". In terms of PM10, the concentration levels for 2025 with and without the Oak Canyon Crossing will not change.

In summary, the project will generate little or no increase in pollutant concentrations along the roadways assessed. No violations of the state or federal CO standards are projected with the project. The project will not increase significantly the levels of PM10 adjacent to roadways serving the project. No local air quality impacts are anticipated for the project.

2.5 Consistency with Air Quality Plans and Policies

Assess Consistency against the most recent federally-approved air plan.

The l997 AQMP, as amended in l999, is the current applicable air plan for the South Coast Air Basin (SCAB). As detailed in Section 1.3, this AQMP provides an overall control strategy for meeting federal and state standards as expeditiously as possible. Control measures to be implemented by stationary, areawide and mobile sources of pollution are contained in the AQMP.

The California Environmental Quality Act (CEQA) requires projects to be consistent with the Air Quality Management Plan and other applicable regional plans. The primary purpose of a consistency analysis is to establish if the Proposed Project is inconsistent with assumptions and objectives of the approved Air Plan, and therefore its ability to interfere with attainment of federal and state air quality standards. Section15125 of the CEQA Guidelines require that EIRs analyze and discuss any inconsistencies between the proposed project and regional plans such as the AQMP:

The South Coast Air Quality Management District (SCAQMD) l993 CEQA Air Quality Handbook provides advisory guidance on determining consistency of proposed projects in the South Coast Air Basin with the AQMP. SCAQMD's CEQA Handbook is widely referenced by lead agencies and project sponsors throughout the SCAB. Consistency review is recommended for new or amended General Plans, Specific Plans and significant projects that are not reflected in current General Plans or the AQMP. A consistency review for the Proposed Project is appropriate since it involves a General Plan amendment.

SCAQMD's CEQA Air Quality Handbook recommends two key determinants of consistency with the AQMP:

1) Whether the project will not result in an increase in the frequency or severity of existing air quality violations or cause or contribute to new violations, or delay timely attainment of air quality standards or the interim emission reductions specified in the AQMP (except as provided for in Section 9.4 for relocating CO hot spots).

2) Whether the project will exceed the assumptions in the AQMP in 2010 or increments based on the year of project build-out and phase."

Source: SCAQMD CEQA Air Quality Handbook,l993, page 12-3.

The following discussion examines the Proposed Project's consistency with each criterion with the AQMP.

Consistency with Federal and State Standards

The Proposed Project will not result in an increase in the frequency or severity of existing air quality violations, will not cause or substantially contribute to new violations, nor will it delay timely attainment of any ambient air quality standards.

Specifically, both the Proposed Project and all of the alternatives considered will comply with State and Federal 1-hour and 8-hour CO standards at all receptor locations. At all but one receptor location, future CO levels are expected to be lower than existing concentrations. Future increases in traffic are more than offset by decreasing background levels and cleaner engines and fuels in the vehicle fleet. (Tables 8 and 9 present summary information on CO concentrations.)

With regard to PM-10, all receptor sites under all scenarios meet the Federal PM-10 standard. However, all of the receptor sites currently exceed the State PM-10 standard. Neither the Proposed Project nor any of the future scenarios studied would significantly increase the frequency or severity of this exceedance.

Consistency with Key Assumptions in the AQMP

SCAQMD's CEQA Handbook guidance calls for consistency with the forecast used in the federally-approved AQMP. A key principle in the CEQA Air Quality Handbook is that a project is accommodated by and consistent with the AQMP to the extent that it fits within the regional socio-economic and transportation forecasts assumed in the Plan. The AQMP is based on projections from Local General Plans, which are incorporated into the SCAG regional growth forecasts that form the foundation for the adopted Regional Transportation Plan.

The l997 AQMP, as amended in l999, is the applicable federally-approved air plan against which consistency is determined. The l997 AQMP is based on SCAG's l994 growth forecast for the South Coast Air Basin, which includes Orange County and the Proposed Project. The l997 AQMP accommodates the level of growth assumed in SCAG's l994 forecast.

Technical obstacles interfere with a direct comparison of the Proposed Project with the forecasts assumed in the l997 AQMP.

The horizon year for the l994 forecast assumed in the l997 AQMP is 2015. The full impact of the Proposed Project will not be realized until build-out in 2025. Thus, the Proposed Project can be compared with the AQMP forecast, but no conclusions can be reached.

The following Table 11 compares the l994 forecast in the l997 AQMP with the Proposed Project. Since the horizon year for the l994 forecast is 2015, it is not possible to compare the AQMP forecast with the Project for 2025.

Table 11
Comparison of 1994 Regional Growth Forecast Assumed in l997 AQMP

	2000	2005	2010	2015	2020	2025
	Orange County Population					
97 AQMP	2,868,000	--	3,108,000	3,182,000	--	--
Prop Project	0	--	--	--	--	34,388
	Orange County Households					
97 AQMP	1,005,000	--	1,092,000	1,130,000	--	--
Prop Project	0	--	--	--	--	12,350
	Orange County Employment					
97 AQMP	1,558,000	--	1,886,000	2,006,123	--	--
Prop Project	1,694	--	--	--	--	17,841

Source: l997 AQMP andSCAG l994 Regional Growth Projection in RCGP, 1995

A direct project-level comparison is not possible for technical reasons, and therefore it is not possible to determine quantitatively if proposed project is inconsistent with the demographic assumptions in the l997 AQMP. Efforts are underway to extend the AQMP growth assumptions through 2025 in the 2001 AQMP update now in progress. SCAG's l994 Regional Growth Forecast has been replaced by updated forecasts twice during the intervening years, first in l998 and most recently in 2001. The l994 forecast underpinning the l997 AQMP was based on local general plans at the time it was adopted. Therefore, the AQMP may no longer reflect current General Plans in the vicinity of the Proposed Project.

Consistency with Recommended Land Use/Air Quality Strategies to Reduce Emissions

While it is not technically feasible to compare the Proposed Project to the l997 AQMP forecast assumptions, it is possible to determine the consistency of the proposed project with AQMP control measures and emission reduction strategies.

One of the AQMP's major challenges is to insure attainment of federal and state ambient air quality standards despite continued growth within the South Coast Air Basin. As the Basin has evolved from scattered settlements into a four-county metropolitan area, industrial sources of pollution and emissions from cars, trucks, buses and other vehicles have increased to levels that exceed the federal and state health-based standards.

All new development within the SCAB occurs within a nonattainment area. Although the AQMP accommodates and mitigates growth anticipated in the regional growth forecast, SCAQMD encourages all projects to minimize their emissions to the extent feasible. The Proposed Project incorporates a coordinated package of emission reduction strategies recommended in SCAQMD's CEQA Air Quality Handbook, CARB's "Transportation-Related Land Use Strategies to Minimize Motor Vehicle Emissions " (1995), and U.S. EPA's guidance on "Improving Air Quality Through Land Use Activities"(2000). CARB's l997 "Land Use-Air Quality Linkage" guidance identifies the following "optimum land use strategies for air quality to reduce project Vehicle Miles Traveled and associated emissions or to enhance emission mitigation measure effectiveness:

- Concentrated development design to make use of HOV lanes, carpools, vanpools, bicycle trips and pedestrian trips more viable;
- Enhanced activity centers with proximity to transportation corridors and transit centers to encourage efficient use of the transportation system;
- Mixed land uses incorporating housing, shopping and employment, to encourage pedestrian, bicycle and transit trips.

The proposed project mixes housing and job growth in a manner conducive to walking, biking and transit alternatives to automobile travel. The Project would interface with commercial, residential and mixed-use areas including the existing Irvine Spectrum activity center and future development within Planning Area 51. The Proposed Project is adjacent to High Occupancy Vehicle lanes on I-5, and the Eastern Transportation Corridor toll lanes (which are priced to insure free flow).

Using these techniques, CARB's report finds that "reductions in the range of 10 to 30 percent in per-household vehicle travel and related emissions are possible at the neighborhood or community level…in comparison with typical low density, single-use development." Irvine Spectrum, which is adjacent to the Proposed Project, provides an example within the City of Irvine of the effectiveness of these strategies under local conditions. Employment is concentrated in Irvine Spectrum near major transportation corridors and transit nodes. The resulting concentration of employees creates opportunities for more effective transportation demand management programs to reduce Vehicle Miles Traveled and associated congestion and emissions. Spectrumotion is the comprehensive Transportation Demand Management Program serving Spectrum. Participation in Spectrumotion is mandatory for all property owners within Spectrum, except Spectrum 2.

Documentation presented to the Institute of Transportation Engineers (ITE) finds that the proportion of drive-alone commute trips within Spectrum is well below comparable rates in Los Angeles and Orange Counties. This in turn results in less congestion and lower emissions (J. Boslet and S. McCaughey, Irvine Spectrum Trip Reduction Program, 2000). These quantified reductions resulting from Spectrum's design and complementary transportation demand management programs fall well within range identified by CARB.

The Proposed Project's mixed use design and concentration of jobs and housing also improve jobs/housing balance. Jobs/housing balance is a measure of the proximity between job and housing opportunities. Jobs/housing balance holds implications for local and regional air quality: the shorter the distance between job opportunities and housing opportunities, the less Vehicle Miles Traveled and the greater the opportunity that residents and employees will rideshare, walk, or use transit rather than a single-occupant automobile.

The Proposed Project achieves a 1.44 jobs/housing ratio within a County and City that are imbalanced in favor of jobs. The Proposed Project would benefit the City of Irvine's overall jobs/housing ratio, as well as the subregion's balance of jobs and housing (Regional Statistical Area E-44). The City's jobs/housing ratio was 3.29 (per OCP-2000) in 2000. With the Proposed Project, this ratio improves to 2.96. RSA E-44's jobs/housing ratio in 2000 was 2.78. With the Proposed Project, this ratio improves to 2.57. Although both the City of Irvine and the Project's Regional Statistical Area E-44 are projected to grow more jobs-rich by 2025, they would be even more jobs-rich without the Proposed Project.

Further, the project will not interfere with provision of any regionally significant projects assumed in the 1997 AQMP.

Local and Regional Mitigation Measures Supportive of the AQMP

CEQA allows lead agencies to approve projects that are found to be inconsistent with the AQMP. However, a primary intention of SCAQMD's consistency guidance is to identify ways in which all projects can be modified or strengthened to support the AQMP, as well as ways in which projects inconsistent with the AQMP can mitigate their impacts.

The Proposed Project includes measures designed to reduce emissions to the degree feasible. While not required by SCAQMD, these measures are intended to support AQMP objectives:

- The Project will implement all applicable City and SCAQMD rules and regulations which will reduce emissions (e.g. Rule 403, Fugitive Dust.)

- The Proposed Project will include all feasible mitigation measures for construction and operation emissions applied to adjacent parcels or projects with similar characteristics within the City of Irvine.

Section 3.1 of this report details 22 mitigation measures aimed at reducing short-term construction emissions. The measures range from dust abatement controls to traffic congestion mitigations, consistent with SCAQMD and City of Irvine dust control requirements.

In addition, Section 3.2 of this report identifies a number of Transportation Demand Management (TDM) and Energy Efficiency measures that would minimize emissions within the South Coast Air Basin. In particular, the TDM measures would require programs patterned after successful techniques developed by Spectrumotion, the Transportation Demand Management program that has significantly reduced trips and congestion in the Spectrum development adjacent to the Proposed Project.

2.6 Sensitivity Analysis

The project has also considered three other future potential land use/transportation scenarios. These scenarios are: *2025 with Oak Canyon, 2025 with El Toro Aviation Plan,* and *2025 with "Not Approved Probable Future" Project*. All of these alternative land use or circulation scenarios include the proposed project. The proposed project is not changed, rather the surrounding land use or roadway network has been altered. This analysis shows the difference in vehicular emissions with alternative land use and/or roadway network scenarios around the project. Therefore, changes in vehicular emissions are primarily due to the increases or decreases in traffic generation and distribution for the alternative scenarios. The emissions for the project will remain essentially unchanged for all of the alternative scenarios considered.

The emission factors were derived from EMFAC2000 prepared by the Air Resources Board (ARB). The EMFAC2000 emission factors, at an average speed of 25 miles per hour, were utilized in the estimates. These data are provided as technical data in the appendix.

2.6.1 Oak Canyon Crossing

The Oak Canyon Crossing represents a potential circulation improvement. The traffic data for the alternatives were provided by Austin-Foust Associates, Inc. (October 2001). The VMT for the 2025 Buildout Toll represents the difference between the regional VMT for the 2025 Buildout Toll No Project subtracted from the 2025 Buildout Toll With Project. Similarly, the 2025 Buildout Toll No Project was subtracted from the 2025 with Oak Canyon. Since the land uses for this alternative do not change, the change in VMT and emissions is due strictly to changes in travel patterns with the Oak Canyon overcrossing. Therefore, the emissions presented below represent the emissions due to the project plus the increase or decrease in emissions caused by the Oak Canyon Crossing. The results of the vehicular emissions for the Oak Canyon Crossing are presented in Table 12, and are compared to the proposed project (*Buildout Toll*) shown previously in Table 6. As can be seen from the data in Table 12, the emissions decrease slightly with the Oak Canyon Crossing and the cumulative impacts of the crossing and the project are a very slight improvement in air emissions. The decrease in emissions is due to the shorter travel distances that would be made available by the Oak Canyon Crossing.

Table 12
VEHICULAR EMISSIONS - OAK CANYON CROSSING

Pollutant	2025 Buildout Toll (pounds/day)	2025 w/Oak Canyon (pounds/day)
CO	3,447	3,435
TOG/ROG	127	127
NOx	587	585
PM10	50	50
SOx	437	435

2.6.2 El Toro Aviation Plan

The El Toro Aviation Plan represents the County of Orange's adopted proposed land use for the former El Toro military base. The regional VMT for the Buildout Toll No Project was subtracted from the regional VMT for the 2025 El Toro Aviation Plan (With Project). Therefore, the emissions presented below represent the emissions due to the project emissions generated by the El Toro Aviation Plan. The results of the vehicular emissions for the El Toro Aviation Plan are presented in Table 13. As can be seen from the data in Table 13, the emissions decrease with the El Toro Aviation Plan and the cumulative impacts of the aviation plan and the project are an improvement in air emissions. The decrease in emissions is because the El Toro Aviation Plan would generate less vehicular miles traveled than the land uses for the El Toro base that are currently adopted by the City of Irvine.

Table 13
VEHICULAR EMISSIONS - EL TORO AVIATION PLAN

Pollutant	2025 Buildout Toll (pounds/day)	2025 w/El Toro Aviation (pounds/day)
CO	3,447	2,716
TOG/ROG	127	103
NOx	587	445
PM10	50	42
SOx	437	319

2.6.3 Not Approved Probable Future Projects

The "Not Approved Probable Future Projects" scenario includes the project with other land use and roadway network unapproved proposals (see Austin-Foust traffic study for more detailed description). This includes the Great Park Plan for the former El Toro military base. The emissions presented below represent the emissions due to the project plus the increase or decrease in emissions caused by the Not Approved Probable Future land uses. The results of the vehicular emissions for the Not Approved Probable Future case are presented in Table 14. As can be seen from the data in Table 14, the emissions decrease significantly with the Not Approved Probable Future land uses and the cumulative impacts of these land uses and the project are an improvement in air emissions. The decrease in emissions is because the land uses and roadway network for this scenario would generate less vehicular miles traveled than currently approved. In fact, this alternative scenario results in the lowest emissions of all the alternative scenarios considered.

This scenario presents a sensitivity run under 2025 build-out toll network conditions assuming the build-out of the Northern Sphere Area and the inclusion of "not approved probable future project" developments. These "not approved probable future projects" have either filed applications, are expected to be included in the March 2002 ballot measure or have been announced by The Irvine Company with the intent to modify existing approved plans. This sensitivity scenario is compared to the baseline 2025 build-out toll with project forecasts, which were presented in Chapter 5.0. These "not approved probable future projects" include Lower Peters Canyon Intensity Transfer (including Planning Area 4), Irvine Spectrum Housing (Planning Areas 17, 31, 33 and 34) and the Woodbridge General Plan Amendment (Irvine Planning Area 15). The City of Irvine's proposed Great Park Plan for the former Marine Corps (MCAS) El Toro is included. The City of Irvine's proposed Master Plan of Arterial Highways (MPAH) Amendment to delete Culver Drive between Portola Parkway and SR-241 is included. Lastly, development reductions have been assumed in the East Orange area reflecting The Irvine Company's intention to expand permanent open space within this area. Detailed land use data for these "Not Approved Probable Future Projects" is included in Appendix A.

Table 14
VEHICULAR EMISSIONS - NOT APPROVED PROBABLE FUTURE (NAPF)

Pollutant	**2025 Buildout Toll** (pounds/day)	**2025 w/NAPF** (pounds/day)
CO	3,447	1,284
TOG/ROG	127	55
NOx	587	166
PM10	50	26
SOx	437	59

2.7 Cumulative Impact Analysis - Post 2040 Long Term Impacts

The traffic data for a post 2040 scenario was provided by Austin-Foust Associates, Inc. (October 2001). The cumulative scenario represents the buildout of the proposed project plus the buildout of the City's General Plan and assumes toll-free corridors. The VMT is estimated for the project to be 567,379 for post *2040 Buildout Toll-Free.* Again, the project's VMT were determined by subtracting the regional VMT without the project from the regional VMT with the project.

The emission factors were derived from EMFAC2000 prepared by the Air Resources Board (ARB). The EMFAC2000 emission factors, at an average speed of 25 miles per hour, were utilized in the estimates. These data are provided as technical data in the appendix. The results of the vehicular emissions for the cumulative scenario are presented in Table 15.

Table 15
VEHICULAR PROJECT EMISSIONS POST 2040

Pollutant	Post 2040 Buildout Toll-Free (pounds/day)
CO	1,974
TOG/ROG	49
NOx	494
PM10	42
SOx	402

The emissions for the Post 2040 Buildout are reduced in comparison to the 2025 Buildout emissions. Even though the Post 2040 case represents additional development in the City of Irvine, the continued reduction in vehicular emissions more than offsets the additional development. The emissions for the cumulative scenario will be significant, when compared to the daily significance thresholds. As a result, the project related emissions in the Post 2040 scenario would still result in a significant regional air quality impact.

3.0 MITIGATION MEASURES

3.1 Construction Impacts (Short Term) Mitigation

Particulate Emission (PM-10) Control

AQ-1: Apply measures contained in Table 1 and Table 2 of SCAQMD Rule 403. Control of particulate emissions from construction activities is best controlled through the requirements contained in SCAQMD's Rule 403, Tables 1 and 2. Tables 1 and 2 are reproduced here as Exhibits 2 and 3. The measures contained in these tables are presented as an option to air quality monitoring in Rule 403. Exhibit 3 contains measures such as maintaining an adequate moisture content in the soil, watering grading areas, establishing ground cover inactive areas and watering unpaved roads. Exhibit 2 identifies additional measures which are applied during high wind conditions. The mitigation measure, therefore, is to require that the measures contained in Table 1 and 2 of Rule 403 be utilized. This potentially results in a much higher reduction of particulate emissions than if the air monitoring option contained in Rule 403 was employed. The measure would be triggered prior to the granting of the first grading permit. The project applicant or his grading contractors would be required to get the appropriate permits from the SCAQMD and submit them to the City. This measure would be required for each grading permit issued by the City.

Construction Equipment Emission Control

While Measure AQ-1 above addresses particulate emissions from construction activities, other pollutants generated by construction equipment will also exceed SCAQMD thresholds. The generation of these emissions is almost entirely due to engine combustion in construction equipment and employee commuting. The measure below addresses these emissions.

AQ-2: Reduce construction equipment emissions by implementing the following measures. The following measures should be implemented when feasible. They should be included in grading and improvement plans specifications for implementation by contractors. Some additional gains in particulate emission control will also be realized from the implementation of these measures.

- Use low emission mobile construction equipment.

- Maintain construction equipment engines by keeping them tuned.

- Use low sulfur fuel for stationary construction equipment. This is required by SCAQMD Rules 431.1 and 431.2.

- Utilize existing power sources (i.e., power poles) when feasible. This measure would minimize the use of higher polluting gas or diesel generators.

- Configure construction parking to minimize traffic interference.

- Minimize obstruction of through-traffic lanes. When feasible, construction should be planned to that lane closures on existing streets are kept to a minimum.

- Schedule construction operations affecting traffic for off-peak hours.

- Develop a traffic plan to minimize traffic flow interference from construction activities (the plan may include advance public notice of routing, use of public transportation and satellite parking areas with a shuttle service.

3.2 Regional Air Quality (Long Term) Mitigation

The most significant reductions in regional and local air pollutant emissions are attainable through programs which reduce the vehicular travel associated with the project. Support and compliance with the AQMP for the basin is the most important measure to achieve this goal. The AQMP includes improvement of mass transit facilities and implementation of vehicular usage reduction programs. Additionally, energy conservation measures are included. None of these recommended mitigation measures are strictly required by SCAQMD. However, SCAQMD wants to see all relevant measures applied.

TDM Measures

AQ-3: Annexation to the Irvine Spectrum TMA. Prior to recordation of each final map for the project, the Applicant shall apply for annexation of any non-residential land use (except institutional areas within the project and except community commercial in PA6) within such final map area to the Irvine Spectrum Transportation Management Association (Spectrumotion) in accordance with Article X of the recorded Declaration of Covenants, Conditions and Restrictions (CC & R's) for Spectrumotion including any supplementary and amended CC & R's. Should annexation into Spectrumontion not be approved, the Applicant shall develop a similar transportation management plan to the satisfaction of the City.

AQ-4: Schedule truck deliveries and pickups for commercial uses during off-peak hours when feasible. This will alleviate traffic congestion, therefore, emissions during the peak hour.

AQ-5: Provide adequate ingress and egress at all entrances to public facilities to minimize vehicle idling at curbsides. Presumably, this measure would improve traffic flow into and out of the parking lot. The air quality benefits are incalculable because more specific data is required.

AQ-5: Provide dedicated turn lanes as appropriate and provide roadway improvements at heavily congested roadways. Again, the areas where this measure would be applicable are the intersections in and near the project area. Presumably, these measures would improve traffic flow. Emissions would drop as a result of the higher traffic speeds, but to an unknown extent.

AQ-7: Provide on-site services. Provide incentives such as on-site ATMs and other similar measures that address lifestyle needs. These measures reduce the VMT, but the air quality benefit can not be quantified because more specific data is required.

Energy Efficiency Measures and Additional Measures

AQ-8: Compliance with Title 24, Part 6, California's Energy Efficiency Standards for Residential and Nonresidential Buildings. All buildings must comply with Title 24, Part 6. Reducing the need to heat or cool structures by improving thermal integrity will result in a reduced expenditure of energy and a reduction in pollutant emissions.

AQ-9: Develop operational emissions mitigation plan. Prior to approval of each building permit for a medical and science zoned use, the Applicant shall submit to the Director of Community Development for approval, an operational emissions mitigation plan. The plan shall identify implementation procedures for each of the following emissions reduction measures. If certain measures are determined infeasible, an explanation thereof shall be provided in the operational emissions mitigation plan.

- Utilize built-in energy-efficient appliances to reduce energy consumption and emissions.

- Utilize energy-efficient and automated controls for air conditioners and lighting to reduce electricity consumption and associated emissions.

AQ-10: Develop plans to facilitate walking and use of bicycles. Prior to approval of each tentative tract map, the Applicant shall submit to the Director of Community Development for approval, a plan showing pedestrian/bicycle trails that facilitate connections to public facilities such as schools, parks, and regional trails, as well as between residential neighborhoods.

- Where possible, connect residential areas to public facilities, parks, regional trails and other residential neighborhoods with pedestrian/bicycle trails.

- Where possible, connect commercial areas to adjacent residential areas via bike/walking paths.

- Coordinate with OCTA and the City regarding the location of bus turnouts and bus routes within the project area.

3.2.1 Regional Impact Mitigation Measures Considered But Rejected

The following non-construction measures are recommended for consideration by the SCAQMD, but have been rejected because of inapplicability to this project or because they will have an improbable or negative impact upon non-construction emissions. The measures are underlined in the following paragraphs and the reason or reasons for rejection follow each measure.

Provide incentives for solid waste recycling. The connection between solid waste recycling and air quality is a tenuous one at best. There will be no air quality benefit resulting from the encouragement or coercion to recycle solid waste. Provisions of AB 939 are still relative as a required waste reduction measure.

<u>Implement energy conservation measures beyond state and local requirements.</u> This measure is simply too vague to be implemented.

4.0 LEVELS OF SIGNIFICANCE AFTER MITIGATION

4.1 Construction Emissions

In conclusion, the short-term construction emissions due to the proposed project will be reduced by mitigation measures to an extent, but can not be quantified. However, the emissions would still be significant for all air pollutants in the first construction phase, and for NOx and PM10 in the second construction phase, and will be considered unavoidable and adverse.

4.2 Regional Impacts

The long term regional air quality impact due to the proposed project and all alternatives with mitigation measures will be reduced to an extent but can not be quantified. However, the emissions would still be significant after mitigation, specifically for CO, ROG, NOx and PM10 and wil be considered unavoidable and adverse.

Although the project will result in significant regional air quality impacts, the proposed project is consistent with AQMP and other regional plan strategies to reduce the number of trips and the length of trips in the region, and to improve the balance between jobs and housing at the subregional level. The AQMP recognizes that emissions due to trips and mode choices are not only a function of the transportation system, but also relate to the proximity of housing and job-generating land uses, and proximity of jobs to transportation infrastructure and transit.

4.3 Local Air Quality Impacts

The future CO emissions are projected to be in compliance with the 1-hour and 8-hour state and federal standards, and therefore, the local CO impacts due to all future scenarios are not considered to be significant.

The future PM10 concentrations are projected to be in compliance with the Federal 24 hour PM10 standard. However, the PM10 concentrations are projected to exceed the State standard. This is because the background PM10 emissions are projected to be over the State standard. The increase in PM10 levels due to the project is very small, and its incremental contribution is not considered to be a significant impact.

4.4 Cumulative Impacts

The cumulative impacts of the project and the buildout of the General Plan, as well as the buildout of alternative land use scenarios, were investigated. No cumulative impacts are identified. This is consistent with the AQMP.

APPENDIX

PROJECT EMISSIONS
DATA SHEETS

CALINE4

Data Utilized for Modeling

1.0 INTRODUCTION

This report summarizes the results of biological surveys conducted in 2001 in the northeastern sphere of influence of The City of Irvine (the "Protocol Area"). The surveys were conducted in anticipation of the City of Irvine processing land use approvals preparatory to annexation of this sphere area. The surveys involved:

- Vegetation mapping throughout the Protocol Area,
- Rare plant surveys throughout the Protocol Area, except in Planning Area 3, which is not being developed,
- General wildlife inventories and habitat assessments throughout the Protocol Area, except in Planning Area 3, which is not being developed,
- Focused California gnatcatcher (*Polioptila californica californica*) and cactus wren (*Campylorhynchus brunneicapillus*) surveys within those parts of the Protocol Area proposed for development,
- Focused least Bell's vireo (*Vireo bellii pusillus*) and southwestern willow flycatcher (*Empidonax trailli extimus*) surveys in that part of the Protocol Area containing potential habitat for those specialized species.

Given the absence of habitat in the Protocol Area suitable for the Pacific pocket mouse (*Perognathus longimembris pacificus*), southwestern arroyo toad (*Bufo microscaphus californicus*), Quino checkerspot butterfly (*Euphydryas editha quino*), Riverside and San Diego fairy shrimps (*Streptocephalus woottoni* and *Branchinecta sandiegonesis*), golden eagle (*Aquila chrysaetos*), and prairie falcon (*Falco mexicanus*), focused surveys were not conducted for these species. Nonetheless, those species were considered in the general wildlife inventory survey efforts.

2.0 LOCAL SETTING AND SITE DESCRIPTION

The Protocol Area consists of five Planning Areas ("PA") as designated in the City of Irvine General Plan: PA 3, 5b, PA 6, PA 8a and PA 9. The Protocol Area is located southeast of Lomas de Santiago, in the northeastern sphere of influence of the City of Irvine, Orange County, California (Exhibit 1). As shown on Exhibit 1, the Protocol Area generally lies west and north of the former El Toro Marine ACOE Air Station. It is within the unincorporated area of Orange County. For purposes of the focused California gnatcatcher and cactus wren surveys, the Protocol Area was divided into those areas proposed for some form of development or disturbance (the "Development Area"), those areas proposed for inclusion in the NCCP Reserve[1] (the "Reserve Open Space") and those areas that would be outside both the development area and the NCCP Reserve ("Non Reserve Open Space") (Exhibit 2). The Development Area consists mostly of agricultural land, but does include some undisturbed areas, primarily in PA 6. (Exhibit 3).

The entire Protocol Area consists of approximately 8,708 acres of mostly undeveloped and agricultural land. Planning Areas 5b (310.6 acres), 8a (73.1 acres) and 9 (1,326.2 acres) consists mostly of actively farmed agricultural land or nursery lands, generally in the flat, lower elevation portions of the Protocol Area. Planning Areas 3 and 6, (3,739.6 and 3,258.2 acres, respectively), comprises the most varied topography and contains the more diverse habitat types. The majority of PA 6 southeast of the Foothill/Eastern Transportation Corridor is comprised of agricultural and ornamental nursery lands with occasional developed and disturbed/graded parcels. Isolated natural habitat fragments occur throughout this area, generally located on hilltops, steeper slopes and on the edges/interface with bordering properties. The most extensive stands of native vegetation occur in Reserve Open Space (in PAs 3 and 6) north and east of the Foothill/Eastern Transportation Corridor near the Frank Bowerman Landfill, Agua Chinon, and Round Canyons and in the vicinity of Siphon Reservoir. However, several developed and agricultural lands occur in Pas 3 and 6, including a nursery, gravel mining operation and office trailers west of Bee Canyon Road, and an occasional orchard of avocado groves in the shallow valleys north of the Foothill/Eastern Transportation Corridor.

The County of Orange's Frank Bowerman Landfill is located within Planning Area 3. The landfill is specifically addressed under the NCCP/HCP plan. A 173-acre Special Linkage is located within the north-central portion of the existing landfill. The NCCP/HCP allows for the Special Linkage portion to be developed as a golf course after landfill operations are terminated and landfill closure actions have been completed. Per the NCCP/HCP the County will confer with USFWS and CDFG in the design and construction of any golf course to minimize impacts to adjacent Reserve. Under the NCCP/HCP upon completion of construction and landscaping for the golf course, the remaining 500 acres of the landfill that surrounds the Special Linkage shall become part of the Reserve System and managed in accordance with the provisions of the Implementation Agreement and then applicable landfill closure requirements.

A significant portion of the coastal sage scrub habitat at Siphon Reservoir (within Reserve Open Space of PA 6) consists of revegetation associated with mitigation for the Foothill/Eastern Transportation Corridor and was installed in 1994/1995 and 1995/1996. A wildfire in 1998 burned approximately 70 percent of the natural habitat northeast of the

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[1] In July 1996, a Natural Communities Conservation Plan/Habitat Conservation Plan (NCCP/HCP) was approved, and an Implementing Agreement (IA) was executed, between U.S. Fish and Wildlife Service (USFWS) and the California Depatrment of Fish and Game (CDFG), and participating entities. Participants included the City of Irvine, the County of Orange, The Irvine Company and other public and private entities. As a result of the IA the participants funded and developed the "The Nature Reserve of Orange County" (Reserve). The Reserve consists of 38,000 acres of habitat that is protected under the IA. Reserve Open Space in this report referres to parts of the Reserve located within the Protocol Area.

Foothill/Eastern Transportation Corridor and the vegetation was in various stages of recovery.

Site topography varies and includes canyons, hillsides and low lying land, with elevations ranging from 170 feet at the western corner of PA 8 to approximately 1,770 feet along the eastern boundary of Planning Area 3, along Loma Ridge (Exhibit 3). The climate is typically Mediterranean, with warm dry summers and cool wet winters. Early morning coastal fog frequently clouds the hillsides during spring.

Figure 1Exhibit 1: Protocol Area vicinity map.

Figure 2Exhibit 2: Protocol Area showing the NCCP Reserve, Non Reserve Open Space and the Development Area.

Figure 3Exhibit 3: Protocol Area topography.

3.0 SURVEY METHODOLOGY AND RESULTS

3.1 INFORMATION SOURCES

Focused surveys were conducted for all federal and state listed endangered/threatened species with potential to occur in the Protocol Area. Focused surveys were also conducted for all special status plant species with potential to occur in the Protocol Area (except in PA 3 which is not being developed). Information on other sensitive wildlife and plant species and NCCP Identified species was collected during the focused surveys, during habitat assessments and during general wildlife surveys conducted specifically for this project, in addition to existing available information.

In addition to field surveys, vegetation mapping, wildlife inventories, and habitat assessments, information on the biological resources of the Protocol Area was obtained by reviewing existing available data. Databases such as the baseline NCCP database, records of the California Natural Diversity Database (CNDDB 2001) and California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California (Skinner 1994) were reviewed regarding the potential occurrence of any federal or state listed or proposed endangered, threatened or candidate species, or otherwise sensitive species or habitat within or in close proximity of the project site. In addition, reports from biological surveys conducted in the project area and relevant published literature were reviewed for occurrences of sensitive biological resources.

Existing and ongoing studies being conducted as part of the Nature Reserve of Orange County monitoring program were particularly useful in providing information on Identified Species within Reserve Open Space.

The resources used in this thorough archival review included the following;

- Baseline database from the Natural Communities Conservation Plan & Habitat Conservation Plan – County of Orange Central & Coastal,
- California Natural Diversity Data Base (CNDDB) for the USGS 7.5' quadrangle which comprised the study area: El Toro and neighboring quads for pertinent data,
- California Native Plant Society Inventory of rare and endangered vascular plants of California (Skinner and Pavlik 1994; 6th Edition of CNPS Inventory),
- Review of various biological assessment reports and species lists for the region and neighboring areas such as biological assessment reports conducted for the Irvine Company (Harmsworth Associates 2001a; 1999a,b; 1998a-d; and Bloom 1999), and the TCA ETC report (LSA & Earthworks 2000),
- Existing and ongoing biological survey reports conducted for the Nature Reserve of Orange County (Crooks *et al*. 1999, Roberts 1999, Fisher 2000, Smith Pers. Comm.),

- Published literature (Roberts 1990, Hamilton and Willick 1996, Gallagher 1997).

3.2 METHODS

3.2.1 Vegetation mapping

Field surveys for mapping vegetation were conducted in February, March, June and July 2001. The surveys were conducted by walking meandering transects throughout the study area. Meandering transects stress high elevation vista points, potential sensitive species habitat, boundaries of rapid vegetation change, riparian habitat, roadways, animal paths, and easy access points. Within Planning Area 3 we conducted a verification of the NCCP vegetation mapping, rather than mapping from scratch (as was done in the rest of the Protocol Area). In Planning Area 3 the surveys primarily utilized the established network of access roads, firebreaks, and trails.

The vegetation classification system followed the system adopted for Orange County (Jones & Stokes 1993), which, is roughly equivalent to mapping at the association level and consists of using the common name of the two most common species in the designation along with the vegetation type. A general plant species list was compiled concurrently with the vegetation mapping and rare plant surveys (Appendix B). Scientific nomenclature in Hickman (1993) was used as the taxonomic resource; common names according to Roberts (1998).

3.2.2 Special status plant surveys

Focused surveys for special status taxa were conducted between May and July, 2001. These surveys primarily utilized the established network of access roads, firebreaks, and trails. Field surveys were conducted using a floristic approach in order to address the composition of the flora, and to identify the presence of special status taxa. At the end of each field day, a running species list was generated, and notes recorded which described the characteristics of the vegetation. Voucher specimens were collected to confirm species identification and document new special status taxa localities. The locations of sensitive botanical resources were mapped in the field on 500-scale topographic maps, ortho-rectified aerial photographs and/or recorded by GPS technology, then transferred to a GIS database for data presentation.

Initial reconnaissance surveys of existing habitats within the study area were conducted to qualify potential sensitive plant habitats, and establish the accuracy of the data generated from the literature, maps, and aerial photographs. Aerial photographs and topographic vegetation maps were used to determine the community types, and other physical habitat features that may support sensitive and uncommon taxa or communities within the study area.

The focused field studies concentrated on habitats with the highest potential for yielding special status species and were performed during the peak of the blooming period when possible. Fieldwork was focused within specific areas and habitats, specifically open barrens, rock outcrops and heavy clays where non-native species were limited. Each of the habitats within the study area was traversed on foot, examining the areas for particular features such as seeps, unique geologic types, exposures, etc., that would indicate the presence of a preferred habitat for each special status plant species.

In many of the most remote sections of Planning Area 6 (within Reserve Open Space), north of the Foothill/Eastern Transportation Corridor, focused surveys utilized, and were often limited to, the habitats within a short hiking distance of the established access roads. Few trails were located in these areas due to the inaccessibility of the area, which is characterized by steep and rugged slopes.

Field notes recorded included the date, location, time searched, habitat characteristics, and other information pertinent to the CNDDB field survey data form. This information was completed whether or not special status species were located. If a species was located, the following information was collected: plant phenology, relative abundance, estimated number of individuals, micro-site conditions and general habitat type. The exact location was also mapped (mapped on USGS map and UTM readings were collected with a Garmin II GPS unit). Native and non-native species that occur almost exclusively in the vicinity of special status plant species, soil, geologic, and topographic features were noted and used as visual cues for locating additional sensitive plant populations during the focused surveys.

3.2.3 Wildlife surveys

The reconnaissance level wildlife surveys were conducted in May and July 2001. The site was traversed on foot to survey each vegetation community and look for evidence of wildlife presence. All wildlife and wildlife sign, including tracks, fecal material, nests and vocalizations were noted. Information on the distribution and status of sensitive species, including western spadefoot toad (*Scaphiophis hammondi*), white-tailed kite (*Elanus caeruleus*), burrowing owl (*Speotyto cunicularia*), California horned lark (*Eremophila alpestris actia*), loggerhead shrike (*Lanius ludovicianus*), grasshopper sparrow (*Ammodramus savannarum*), coyote (*Canis latrans*) and American badger (*Taxidea taxus*), was collected during the general wildlife surveys. Potential habitat for federal/state listed or proposed endangered, threatened or candidate species, or otherwise sensitive species was also documented during the reconnaissance surveys. Specific wildlife surveys were not conducted in PA 3, which is not being developed, however, all wildlife, wildlife sign and potential habitat for sensitive species detected during the vegetation mapping conducted in PA 3 was noted.

3.2.4 California gnatcatcher and cactus wren surveys

To determine the status of California gnatcatchers and the cactus wren in the Development Area focused presence/absence surveys were conducted. All potentially suitable gnatcatcher and wren habitat in the Development Area was surveyed three times. Surveys were conducted on June 17, 20, 23 and 25 and July 6, 9, 10, 13, 19 and 20, 2001.

During the focused gnatcatcher and wren surveys information on the distribution and status of other sensitive species that utilize CSS, including San Diego horned lizard (*Phrynosoma coronatum blainvillei*), orange-throated whiptail (*Cnemidophorus hyperthrus*), Bell's sage sparrow (*Amphispiza belli belli*), southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*), San Diego black-tailed jackrabbit (*Lepus californicus*) and San Diego desert woodrat (*Neotoma lepida intermedi*), was collected.

The methodology used in the surveys followed the guidelines of Mock *et al*. (1990), the Southern California Coastal Sage Scrub Scientific Review Panel (Brussard *et al*. 1992) and the USFWS monitoring protocol (USFWS 1997), as follows;

- Surveys were conducted during the morning hours and when the temperature exceeded 55°F.
- No more than 100 acres were surveyed by each biologist per day, and no surveys were conducted during windy (>15 miles per hour), rainy, or extremely hot (>95°F) conditions.
- Taped vocalizations of gnatcatchers and cactus wrens were used to elicit a response from resident birds, if they were present.
- All located birds were observed long enough to determine their breeding status (whether paired or unpaired).
- Located birds were observed long enough to determine if they were banded.
- All data were recorded on standardized data sheets and male/pair locations were plotted on topographic maps of the project site.

3.2.5 Least Bell's vireo and willow flycatcher surveys

To determine the status of least Bell's vireo and willow flycatcher in the Protocol Area focused presence/absence surveys were conducted. All potentially suitable vireo/flycatcher habitat in the Protocol Area was surveyed eight times. Although the surveys were conducted concurrently on some days, the methods used were slightly different.

During the focused vireo and flycatcher surveys information on the distribution and status of other sensitive species that utilize riparian habitats, including coast range newt, Cooper's hawk (*Accipiter cooperi*), red-shouldered hawk (*Buteo lineatus*), yellow warbler (*Dendroica petechia brewsteri*), and yellow-breasted chat (*Icteria virens*), was collected.

The methodology used in the vireo surveys followed the least Bell's vireo Working Group and most recent USFWS survey guidelines (USFWS 2001). The use of tape-playback is no longer recommended for vireo surveys. The survey protocol used was as follows;

- Surveys were conducted at all potentially suitable vireo habitat in the Protocol Area a total of eight times. Surveys were conducted on the following dates: April 20, May 8, 22 and 28, June 12 and 25 and July 6, 10 and 13, 2001.
- Surveys were conducted in the morning hours. No surveys were conducted during periods of excessive heat, wind, rain or other inclement weather.
- The project biologist walked through, or adjacent to all suitable habitat, searching each area thoroughly. Where vegetation was too dense to walk through, surveys were conducted from the periphery. The project biologist stopped frequently in each area for spontaneous singing by nearby male vireos.
- All located birds were observed long enough to determine their breeding status (whether paired or unpaired).
- All located birds were observed long enough to determine if they were banded.
- All brown-headed cowbirds detected during the surveys were recorded.
- All data were recorded on standardized data sheets and male/pair locations were plotted on topographic maps of the project site.

The methodology used in the flycatcher surveys followed the most recent USFWS survey protocol (USFWS 2000, Sogge *et al.* 1997). This protocol is primarily a tape-playback survey. The survey protocol used was as follows:

- Surveys were conducted at all potentially suitable flycatcher habitat in the Protocol Area a total of five times. Surveys were conducted on the following dates: May 22, June 12 and 25 and July 6, 10 and 13, 2001.
- Surveys were conducted between first light and 1000 hours. No surveys were conducted during periods of excessive heat, wind, rain or other inclement weather.
- The project biologist walked through, or adjacent to all suitable habitat, searching each area thoroughly. Where vegetation was too dense to walk through, surveys were conducted from the periphery. The project biologist stopped frequently in each area and, initially listened for approximately 3 minutes for spontaneous singing by nearby flycatchers. When no birds were detected, the project biologist broadcast taped calls of flycatchers to elicit a response from any birds present.
- All located birds were observed long enough to determine their breeding status (whether paired or unpaired).
- All located birds were observed long enough to determine if they were banded.
- All brown-headed cowbirds detected during the surveys were recorded.
- All data were recorded on standardized data sheets and male/pair locations were plotted on topographic maps of the project site.

3.3 VEGETATION COMMUNITIES

A total of thirteen vegetation/habitat communities were identified during the field surveys (Table 1, Exhibit 4). They consisted of coastal sage scrub, chaparral, grassland, irrigation-fed wetlands, freshwater seep, marsh, riparian, woodland, cliff and rock, lakes/reservoirs and basins, watercourse, agriculture, developed, and disturbed.

3.3.1 Coastal Sage Scrub

Coastal Sage Scrub is a covered habitat[2] under the NCCP/HCP. Coastal Sage Scrub is a diverse community forming many associations determined by soil factors, fire, and topography. It is a community of low growing, soft, woody, drought-deciduous subshrubs and herbaceous plants that grow in thin rocky soils. Scrub vegetation varied between relatively moist (mesic) and relatively dry (xeric) sites. Mesic sites generally occurred in microhabitats characterized by north-facing slopes, in canyons and small drainages and xeric habitats occurred in the remaining areas on ridges and south-facing slopes. These mesic microsites included such vegetation as lemonadeberry (*Rhus integrifolia*) and toyon (*Heteromeles arbutifolia*). Xeric scrub habitats were comprised of various proportions of California sagebrush (*Artemisia californica*), bush buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*), white sage (*Salvia apiana*), coast prickly pear cactus (*Opuntia littoralis*) and coastal cholla (*Opuntia prolifera*). In PA 6, southeast of Portola and N Street, near the General Electric Field Station, several dense patches of prickly pear and cholla (cactus scrub) occurred on the south and southeastern facing slopes.

Portions of the study area in PAs 3 and 6, northeast of the Foothill/Eastern Transportation Corridor were burned during a wildfire in September 1998 and the vegetation was in various states of recovery. Vegetation sub-associations were not mapped in this area due to difficulty of determining climax communities from successional species. Coastal sage scrub habitat at Siphon Reservoir consisted of naturally occurring vegetation and revegetated habitat (associated with compensatory mitigation for construction of the Eastern Transportation Corridor). Eucalyptus windrows remained from previous agricultural uses of the area.

A total of 3,545.9 acres of coastal sage scrub was recorded in the Protocol Area, 3,263.9 in Reserve Open Space, 106.1 in Non Reserve Open Space and 175.9 in the Development Area (Table 1, Exhibit 4). Most of the scrub was located in PAs 3 and 6, only 2.9 acres occurred in PA 9, none occurred in PA 5b or 8a.

The amount and location of coastal sage scrub in the Protocol Area was not significantly different to that documented in the NCCP/HCP plan. The actual increase since the NCCP/HCP surveys was approximately 1% (33.6 acres). Biological communities can fluctuate markedly over time under natural conditions. Vegetation communities such as coastal sage scrub tend to change gradually in response to climate change and natural ecological succession but can change rapidly after fires or other man-made and natural events.

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[2] Covered habitat means those habitat types protected by the NCCP/HCP in a manner comparable to the protection of CSS.

Table 1: Vegetation types (in acres) within the Protocol Area Development Areas, Non Reserve Open Space and Reserve Open Space, based on habitat mapping conducted in 2001.

Vegetation type	**Development Area**					**Non Reserve Open Space**		**Reserve Open Space**		**Open Space Total**	**Protocol Area Total**
	PA 5b	PA 6	PA 8a	PA 9	**Total**	PA 3	PA 6	PA 3	PA 6		
Coastal sage scrub		173.0		2.9	**175.9**	17.2	88.9	2,435.0	828.9	**3,370.0**	**3,545.9**
Chaparral					**0.0**	1.2	7.1	368.3	10.4	**387.0**	**387.0**
Grassland		25.7			**25.7**	41.5	35.3	256.1	124.4	**457.3**	**483.0**
Irrigation-fed Wetland		0.4			**0.4**					**0.0**	**0.4**
Freshwater seep		0.17			**0.17**					**0.0**	**0.17**
Marsh					**0.0**		3.6		0.4	**4.0**	**4.0**
Riparian[1]		8.1		0.7	**8.8**		25.0	134.0	27.7	**186.7**	**195.5**
Woodland		2.0			**2.0**		0.6	192.9	0.5	**194.0**	**196.0**
Cliff and Rock					**0.0**			12.5		**12.5**	**12.5**
Lakes, Reservoirs and Basins		5.6			**5.6**		15.5		1.7	**17.2**	**22.8**
Watercourses		7.8	2.4		**10.2**		7.5	1.9		**9.4**	**19.6**
Agriculture	292.6	941.1	70.7	1,073.8	**2,378.2**		148.8	2.1	123.5	**274.4**	**2,652.6**
Developed[2]	18.0	107.2		246.9	**372.1**	0.1	37.8	7.4	452.8	**498.1**	**870.2**
Disturbed		24.5		2.0	**26.5**	116.2	5.3	153.2	16.8	**291.5**	**318.0**
TOTAL	**310.6**	**1,295.6**	**73.1**	**1,326.2**	**3,005.6**	**176.2**	**375.3**	**3,563.4**	**1,587.1**	**5,702.1**	**8,707.7**

Vegetation communities according to Jones & Stokes (1993), acreages provided by RBF. [1] Acreages of riparian, marsh, wetlands and watercourses represent the area covered by these habitat types according to the Jones & Stokes methodology, they do not document acreages that are jurisdictional under either ACOE or CDFG. Habitat mapped as riparian under Jones & Stokes can include areas not jurisdictional under ACOE and/or CDFG, for example areas without a definite streambed and upland areas where artificially supplied water allows riparian/wetland vegetation to develop. Acreages of ACOE and CDFG jurisdiction are provided in the delineation report (Volume 2). [2] Tollroad slopes were included in the developed area although many of the slopes were revegetated with CSS, particularly from the confluence of the 241 and the 133 north to the project boundary.

3.3.2 Chaparral

The term chaparral applies to a variety of vegetation associations made up of sclerophyllus shrubs that occur on relatively xeric sites. Most species are adapted to repeated fires and stump sprouting (Holland 1986). Primarily one association occurs on the project site.

North-facing slopes in the higher elevations of the Protocol Area supported toyon-sumac chaparral (Jones & Stokes 1993). North-facing slopes generally provide a more mesic environment where leaf litter accumulates and deeper soils can develop. These conditions support evergreen, broadleaf chaparral species, including hollyleaf redberry (*Rhamnus ilicifolia*), toyon (*Heteromeles arbutifolia*), laurel sumac (*Malosma laurina*) and scrub oak (*Quercus berberidifolia*). The understory supported components of coastal sage scrub including black sage, bush monkeyflower, California buckwheat, and sagebrush. A total of 387.0 acres of chaparral occurred in the Protocol Area, 378.7 acres within Reserve Open Space and 8.3 in Non Reserve Open Space (Table 1, Exhibit 4). Chapparal was absent from the Development Area.

3.3.3 Grasslands

The majority of the grasslands in the Protocol Area were characterized by low herbaceous vegetation dominated by annual, ruderal and perennial grass species, which typically occur in deep, well-developed, well-drained soils on gentle slopes and valleys (Jones & Stokes 1993). The assemblage of species within the grasslands were influenced by several environmental, climatic and edaphic factors including soil structure, texture, parent material and chemistry, slope, aspect and angle, and level of disturbance. During the mapping exercise, grassland sub-associations were assigned as follows: annual, ruderal, and needlegrass. The characteristic components of each sub-association are described below:

Annual grassland occurred primarily on gradual slopes and as small patches in bare openings on steep slopes. The largest contiguous patches occurred in the eastern and southern portions of PA 6, dominated by non-native annual species of Mediterranean origin including genera such as brome (*Bromus* spp.), oats (*Avena* spp.), fescue (*Vulpia* spp.), ryegrass (*Lolium* spp.), and barley (*Hordeum* spp.). Ruderal non-native forb species were invariably scattered in heavily disturbed areas of this community, including filaree (*Erodium* spp.), mustards (*Brassica* spp. and *Hirschfeldia incana*), and artichoke thistle (*Cynara cardunculus*). Smaller patches of non-native annual grassland occurred throughout the Protocol Area interspersed among coastal sage scrub, along ridge tops where disturbances were concentrated, and adjacent developed and agricultural areas.

The most common grassland sub-association within the Protocol Area was grasslands supporting ruderal species. Ruderal grasslands are dominated by tall, early successional forb species that colonize recently disturbed areas. Sweet clover (*Melilotus* spp.) and mustards (*Brassica nigra, Hirschfeldia incana*) dominated these grasslands in early spring, replaced by tocalote (*Centaurea melitensis),* cheeseweed (*Malva* spp.), and tumbleweed (*Salsola tragus*) in late spring and summer. Ruderal grasslands differ in density and diversity depending on species composition and soil conditions. For example, solid stands of black mustard (*Brassica nigra*) occurred in heavily disturbed hilltops and provided little opportunity for other species compared to more open disturbed grasslands dominated by tocalote and summer mustard (*Hirschfeldia incana*). Shallow soils contained lower growing species such as filaree (*Erodium botrys* and *E. cicutarium*) and smooth cat's ear (*Hypochaeris glabra*). Early successional native forbs such as doveweed, common sand aster (*Lessingia filaginifolia*), annual bur-weed (*Ambrosia acanthicarpha*) and telegraph weed (*Heterotheca grandiflora*) may also dominate in late summer and fall. Over time, and in the absence of further disturbances, these areas generally succeed to non-native annual grasslands. Ruderal grasslands were scattered throughout the Protocol Area primarily occurring in fallow agricultural fields, along manufactured berms and abandoned roads.

Native perennial grasslands occurred on clay or clay loam soils, and in areas where grazing and past agricultural uses were less intensive. These native grasslands persist as mosaic patches within and adjacent to nonnative annual grassland and coastal sage scrub. These small isolated patches occurred on hilltops, slopes or on rocky soils. The native grassland community is dominated by 10 percent or more cover of perennial bunchgrasses from genera such as needlegrass (*Nassella* spp.) and melic grass (*Melica* spp.) (Jones & Stokes 1993). In the study area, needlegrass (*Nassella pulchra* and *N. lepida*) dominated these grasslands, although other annual and perennial native forbs and geophytes made up a diverse grassland flora. Other grasses that occurred within the community included Italian ryegrass (*Lolium multiflorum*) and oats.

A total of 483.0 acres of grassland was recorded in the Protocol Area, 380.5 in Reserve Open Space, 76.8 in Non Reserve Open Space and 25.7 in the Development Area (Table 1, Exhibit 4). Grassland was only located in PAs 3 and 6, none occurred in PAs 5b, 8a or 9.

3.3.4 Irrigation-fed wetland and freshwater seep

Perennial and annual herbaceous hydrophytic vegetation dominating seasonally saturated soils constitute freshwater sweeps, many may dry out during drought periods (Jones and Stokes 1993). Two locations within the Protocol Area supported vegetation characterized as a freshwater seep. At one of these locations (between Portola and Foothill/Eastern Transportation Corridor) the seep feature developed as a result of runoff from adjacent agricultural irrigation activities within the avocado orchards and is therefore referred to as an irrigation-fed wetland[3]. This area exhibited vegetation typically associated with freshwater sweeps and was comprised of toad rush (*Juncus bufonius*), great-water speedwell (*Veronica anagallis-aquatica*), rabbitfoot grass (*Polypogon monspeliensis*),

[3] This irrigation-fed wetland is not subject to ACOE jurisdiction under the 404 program.

cattails (*Typha* sp.), marsh fleabane (*Pluchea odorata*) and Bermuda grass (*Cynodon dactylon*). The irrigation-fed wetland totaled 0.4 acres and occurred in the Development Area of PA 6 (Table 1, Exhibit 4).

The other freshwater sweep was located north of, and adjacent to Portola Parkway, in the Development Area of PA 6 (Table 1, Exhibit 4). It totaled 0.17 acres and receives water from a concrete pipe that runs under Portola Parkway[4]. Vegetation within the freshwater sweep was comprised of hairy willow-herb (*Epilobium ciliatum*), rabbitfoot grass (*Polypogon monspeliensis*), southern cattail (*Typha* domingensis) and Bermuda grass (*Cynodon dactylon*).

3.3.5 Marsh

Marsh habitats consist of permanently or seasonally flooded or saturated sites dominated by persistent herbaceous plants. The only marsh vegetation in the Protocol Area occurred at Siphon Reservoir[5]. This freshwater marsh covered 4.0 acres, 3.6 acres in Non Reserve Open Space and 0.4 acres in Reserve Open Space (Table 1, Exhibit 4). The marsh occurred on the fluctuation shoreline and mudflats and the vegetation included California rush (*Scirpus californicus*), mulefat, black willow (see riparian habitat description), rabbitfoot grass, white sweet clover, bull thistle (*Cirsium vulgare*), alkali mallow (*Malvella leprosa*), Spanish sunflower (*Pulicaria paludosa*) and bristly ox-tongue (*Picris echioides*).

3.3.6 Riparian

Riparian habitats consist of trees, shrubs, or herbs that occur along watercourses and water bodies. The vegetation is adapted to flooding and soil saturation during at least a portion of the growing season[6]. Jones and Stokes define a number of different riparian sub-associations including;

- Herbaceous – an early success ional stage of riparian scrub and forest,
- Willow riparian scrub – dominated by willow species,
- Mulefat scrub – dense stands of mulefat with lesser amounts of willows,
- Sycamore riparian woodland – woodland dominated by western sycamore with coast live oak, understory of mulefat or willow scrub,
- Coast live oak riparian forest - woodland dominated by coast live oak with western sycamore, Mexican elderberry and California walnut,
- Arroyo willow riparian forest – forest with closed canopy of arroyo willows,

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[4] This sweep exhibited wetland vegetation, soils and hydrology and is subject to ACOE jurisdiction under 404 as a wetland.

[5] The water body for Siphon Reservoir is within Non Reserve Open Space while the surrounding lands and habitat are within Reserve Open Space.

[6] Areas defined as riparian by Jones and Stokes are not always subjection to CDFG or ACOE jurisdiction.

- Black willow riparian forest – multilayered forest with canopy dominated by black willow,
- Cottonwood-willow riparian forest - multilayered forest dominated by cottonwoods and willows.

Riparian habitats occurred in several locations within the study area including Siphon Reservoir, the northeastern end of Lambert Reservoir, Round and Bee Canyons, Agua Chinon wash, detention basins and riparian corridors scattered through PA 3 and 6.

Herbaceous riparian habitat comprised pioneering early successional species within drainages, channels and sedimentation ponds. The northeastern portion of Lambert Reservoir[7], contained saturated soils with native and non-native herbaceous species persisting in the sandy hydric soils. Species observed within the drained reservoir included rabbitfoot grass, willow smartweed (*Polygonum lapathifolium*), cocklebur (*Xanthium strumarium*), great-water speedwell, tamarisk (*Tamarix* sp.), bent grass (*Agrostis* sp.), green willow herb (*Epilobium ciliatum*), Mexican tea (*Chenopodium ambrosioides*), nutsedges (*Cyperus* sp.), toad rush and mud nama (*Nama stenocarpum*). Herbaceous riparian habitat in earthen drainage channels within PA 6 was sparsely vegetated with spikerush (*Eleocharis* sp.), green willow herb, great-water speedwell, castor bean (*Ricinus communis*), and duckweed (*Lemna* sp.). The large sedimentation pond in the southeastern portion of PA 6 (which is a County maintaince facility and would is located within Non Reserve Open Space) comprised species characteristic of both herbaceous riparian and marsh habitats including narrow leaved and broad leaved cattail (*Typha augustifolia* and *T. latifolia*), white sweet clover (*Melilotus alba*), Mexican rush (*Juncus mexicanus*), coastal bulrush (*Scirpus robustus*) and salt grass (*Distichlis spicata*). Near the sedimentation earthen berm, black and arroyo willows (*Salix gooddingii* and *S. lasiolepis*) saplings were common.

Willow riparian scrub, dominated by arroyo willow with lesser amounts of mulefat (*Baccharis salicifolius*) and black willow occurred in the vicinity of Siphon Reservoir, the northeastern portion of Lambert Reservoir (with *Typha* marsh understory) and along the riparian corridor in the southeastern portion of PA 6 between Portola and the Foothill/Eastern Transportation Corridor. Black willow riparian forest occurred in the vicinity of Siphon Reservoir, the northeastern portion of Lambert Reservoir and the sedimentation pond in Bee Canyon.

Several isolated patches of mulefat scrub were scattered throughout the study area occurring in shallow canyons, associated with ephemeral drainages and local seeps. Vegetation consisted of dense stands of mulefat with lesser amounts of tarragon (*Artemisia dracunculus*), telegraph weed (*Heterotheca grandiflora*), tree tobacco (*Nicotiana glauca*) and arroyo willows (*S. lasiolepis*). Mulefat also occurred in small

[7] Lambert Reservoir was artificially created in upland habitat and was used to store water for agricultural activities. Lambert no longer receives water for agricultural uses and the soils are expected to dry out over time. The jurisdictional status of Lambert is discussed in the delineation report (Volume 2) and is the subject of current consultation with ACOE and CDFG.

patches among coastal sage scrub in low depressions and in areas that were disturbed or along dirt roads.

Sycamore and coast live oak riparian woodland habitats were limited to the natural broad drainages in PA 3 north of the Foothill/Eastern Transportation Corridor in Agua Chinon wash, Hicks Canyon wash, Bee and Round Canyons. Western sycamore (*Platanus racemosa*) and coast live oak (*Quercus agrifolia*) with sub-canopy and understory components representative of willow riparian and mulefat scrub characterized the open woodland community.

A total of 195.5 acres of riparian was recorded in the Protocol Area, 161.7 in Reserve Open Space, 25.0 in Non Reserve Open Space and 8.8 in the Development Area (Table 1, Exhibit 4). In PA 9, the only riparian area was a small linear strip of willow riparian scrub measured approximately 0.7 acre, while no riparian habitats occurred in PAs 5b or 8a.

3.3.7 Woodland

Woodland habitats consist of multilayered vegetation with tree canopy cover between 20 and 80 percent. Coast live oak (*Quercus agrifolia)* woodlands occurred throughout PA 3 in moist areas with deep soil, along canyon bottoms, valleys and on north- facing slopes. The majority of coast live oak woodland was found in Round, Hicks and Bee Canyon and Aqua Chinon wash. A total of 196 acres of woodland occurred in the Protocol Area, no oak woodlands occurred in the Development Area. Oak woodland is a covered habitat under the NCCP. Mexican elderberry (*Sambucus mexicana)* woodlands occurred in one location on the eastern portion of PA 3 and two small areas in the southern portion of PA 6. Mexican elderberry trees dominated the shallow drainages, while mulefat comprised the understory vegetation. A total of 2.0 acres of Mexican elderberry woodland habitat occurred in the Development Areas of PA 6 (Table 1, Exhibit 4).

3.3.8 Lakes and Reservoirs

Siphon Reservoir comprised the main open body of water within the Protocol Area. Freshwater marsh vegetation occurred on the fluctuation shoreline and mudflats (Table 1, Exhibit 4). A small reservoir occurred in the agricultural fields within the Development Area of PA 6. Formerly, Lambert Reservoir contained open water but it no longer receives water for agricultural purposes and was dry at the time of the survey.

3.3.9 Cliff and Rock

Cliff and rock habitats consist of areas with vascular plants and lichens (Jones and Stokes 1993). The only location within the study area where cliff and rock were found was in PA 3 (Table 1, Exhibit 4). A large cliff and rock area occurred along the northeastern section and a small area was found in the southeastern corner, together totaling 12.5 acres.

3.3.10 Watercourses

Narrow earthen channelized drainage ditches were commonplace throughout the nurseries and row crop agricultural lands. These were not mapped as a unique habitat type since the drainage ditches were created for agricultural activities, are frequently managed for weeds and were generally devoid of vegetation. More extensive earthen berm and concrete lined flood control channels supporting sparse vegetation cover were mapped as watercourses. Approximately 19.6 acres of watercourses occurred with the Protocol Area (Table 1, Exhibit 4). The drainage ditches within the agricultural lands were not mapped as watercourses. The jurisdictional status of drainage ditches and concrete lined flood control channels is discussed in the delineation report, Volume 2.

3.3.11 Agriculture

Agriculture lands included active irrigated and non-irrigated annual crops, orchards, and nurseries (mostly container nurseries). Earthen and concrete trapezoidal drainages ditches were common throughout the nurseries and agricultural lands but were not called out on the vegetation map since these were created for agricultural activities. Similarly, Eucalyptus trees which lined many of the irrigated fields and nurseries were not mapped as a unique habitat type since they provided windbreaks and thus were also treated as a feature of the agricultural land use. Common agricultural weeds were observed on the edges of the fields, including knotweed (*Polygonum arenastrum*), flax-leaved horseweed (*Conyza bonariensis*), Johnson grass (*Sorghum halepense*), cheeseweed (*Malva parviflora*) and dense-flowered sprangletop (*Leptochloa univervia*).

A total of 2,652.8 acres of agriculture was recorded in the Protocol Area, 125.6 in Reserve Open Space, 148.8 in Non Reserve Open Space and 2,378.2 in the Development Area (Table 1, Exhibit 4). Most of PA 5b (292.6 acres) within the survey limits comprised agricultural lands. Strawberry row crops comprised the landscape in the southern portion of the Planning Area immediately adjacent Irvine Boulevard extending north to the Eucalyptus windrows. North of the windrows, a nursery comprised the remainder of the Planning Area. Most of PA 8a (70.7 acres) was composed of tomato row crops bisected by a Eucalyptus windrow. Row crops are rotated seasonally, results presented represents the row crops present at the time of the survey.

A total of 1,073.8 acres of agricultural lands occurred in PA 9. Tomato and strawberry row crops (also rotated seasonally) and other associated agricultural facilities comprised the portion of PA 9 south of Irvine Boulevard, north of Trabuco Road and between the Eastern Transportation Corridor and Jeffrey Road. Nurseries comprised the remainder of the PA north of Irvine Boulevard.

PA 6 contained nursery lands, row crops and avocado orchards primarily located south of the Foothill Transportation Corridor, although there was several orchards located north of the Corridor, and one nursery located north of Portola Parkway, west of Bee Canyon Road. A total of 1,213.4 acres of agricultural lands occurred in PA 6. Only 2.1 acres of agriculture land occurred in PA 3, and was an existing use at the time the NCCP/HCP was created.

3.3.12 Developed

Developed sites within the Protocol Area totaled 870.2 acres (Table 1, Exhibit 4) and included non-urban commercial and rural buildings. Developed areas within PA 5b included the nursery buildings and facilities comprising 18.0 acres. Developed areas within PA 6 included nursery buildings and facilities, other buildings and tollroad slopes comprising 597.8 acres. Developed sites within PA 9 included the Northwood Golf Center at the corner of Trabuco and Jeffrey Roads, Irvine Valencia Growers and Garguila, and Irvine Packing and Cooling Plant and water tank/reservoir locality adjacent Sand Canyon Avenue and tollroad slopes (246.9 acre). Developed areas within the PA 3 were located in the Frank R. Bowerman Landfill.

3.3.13 Disturbed

Disturbed areas were characterized as recently cleared areas lacking vegetation, mined areas, or disturbed industrial sites. Within PA 6, fertilizer operations, a General Electric Field Station, and disked lands within the vicinity of Lambert Reservoir comprised approximately 46.6 acres. Disturbed areas within PA 3 occurred within the Frank R. Bowerman Landfill and totaled 269.4 acres (Table 1, Exhibit 4).

3.4 JURISDICTIONAL WATERS AND WETLANDS

A jurisdictional delineation of the waters, wetlands and streambeds located within the Protocol Area was conducted by Glenn Lukos Associates and is presented in Volume 2. That report provides the acreages subject to ACOE and CDFG jurisdiction. The vegetation mapping done as part of this report followed the Jones & Stokes methodology and the acreages reported for riparian, marsh, seasonal wetlands, watercourses and lakes/reservoirs/basins will not necessarily match exactly with the acreages in the delineation report.

Habitat mapped under Jones & Stokes can include areas not jurisdictional under ACOE and/or CDFG. For example isolated areas of mulefat scrub without a definite streambed are typically not jurisdictional under CDFG but are considered riparian under Jones & Stokes, and upland areas where artificially supplied water allows riparian vegetation to develop is mapped as riparian under Jones & Stokes but may not be jurisdictional under ACOE and/or CDFG.

The Protocol Area includes extensive areas of Reserve and Non Reserve Open Space[8] that support approximately 187.02 acres of riparian habitat. This riparian habitat consists of:

- 141.36[9] acres of riparian habitat that are not associated with springs, streams or drainage features and consequently are not ACOE or CDFG jurisdictional. Much of this habitat consists of sycamore and coast live oak riparian woodland that covers the broad drainages in PA3 (Exhibit 4b) but also includes isolated patches of mulefat scrub scattered throughout the Protocol Area. The remaining 45.66 acres of riparian habitat are associated with stream/drainage features and are ACOE and/or CDFG jurisdictional,
- 3.96 acres of the jurisdictional riparian habitat that qualifies as wetlands under the ACOE identification guidelines, the most restrictive of the jurisdictional resources,
- 16.37 acres of the riparian habitat, including 4.62[10] acres that are ACOE and/or CDFG jurisdictional (which includes 0.3[10] acres of wetlands), constitute potential vireo nesting habitat.

The Development Area contains a total of 8.8 acres of riparian habitat that would potentially be impacted by the project. This riparian habitat consists of;

- 4.70 acres of riparian habitat not subject to regulation under ACOE Section 404 or CDFG Section 1603 program (Exhibit 8). These riparian areas are not subject to these regulations since they are isolated and not associated with drainage features (see jurisdictional report, Volume 2). Of these 4.70 acres;
    - 2.11 acres does not constitute least Bell's vireo habitat,
    - 0.7 acres consists of unoccupied vireo habitat and,
    - 1.89 acres consists of vireo habitat occupied in 2001.
- 4.10 acres of riparian habitat subject to regulation under Section 404 or Section 1603 (Exhibit 8). Of these 4.10 acres;
    - 1.29 acres does not constitute least Bell's vireo habitat (0.05 acres of this habitat qualify as wetlands under ACOE jurisdiction),
    - 2.28 acres consists of unoccupied vireo habitat (0.21 acres of this habitat qualify as wetlands under ACOE jurisdiction) and,
    - 0.53 acres consists of vireo habitat occupied in 2001, (all of this 0.53 acres of occupied habitat qualify as wetlands under ACOE jurisdiction but none qualify as CDFG jurisdiction under the 1603 program).

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[8] 162.02 acres in Reserve Open Space and 25.0 acres in Non Reserve Open Space.

[9] Includes approximately 29 acres of riparian located at Siphon Reservoir and in Agua Chinon sedimentation basin that was not delineated for CDFG or ACOE jurisdiction. Much of this habitat probably is jurisdictional.

[10] Does not include any jurisdictional areas at Siphon Reservoir, as these have not been delineated.

Occupied and unoccupied least Bell's vireo habitat totaled 5.4 acres (2.59 acres not subject to CDFG jurisdiction under 1603 or ACOE under 404 and 2.81 acres subject to CDFG jurisdiction under 1603 and/or ACOE under 404).

The Protocol Area also includes extensive areas of non-riparian streambeds subject to CDFG jurisdiction (mostly mapped as watercourses in this report). These consist of:

- 8.81 acres in Reserve and Non Reserve Open Space and,
- 2.80 acres in the Development Area.

Non-riparian wetlands subject to ACOE jurisdiction in the Protocol Area consist of;

- 0.02 acres in Reserve and Non Reserve Open Space and,
- 0.17 acres in the Development Area.

Non-wetland waters of the U.S. subject to ACOE jurisdiction in the Protocol Area consist of;

- 17.47 acres in Reserve and Non Reserve Open Space and,
- 2.75 acres in the Development Area.

Figure 4Exhibit 4: Protocol Area vegetation types.

3.5 FLORAL INVENTORY

Weather conditions were optimal for locating special status plants. Above normal spring rains occurring in late May prolonged the flowering season and temperatures remained cool through much of May and early June. In mid to late June, temperatures increased although many early flowering species were still readily identifiable. Directed surveys were conducted on May 28, June 1, 4, 13, 14, 20, 26, 27, and July 5 and 10. In early June, several of the species, which typically fade by early to mid May, were in bloom (e.g. *Calochortus splendens*), as a result of the extended May rainfall. In addition, typically early and late summer flowering taxa bloomed early.

A total of 233 vascular plant species were recorded within the study area, representing 56 families. This only includes those species growing in natural areas and does not include species under agriculture or in the nurseries. Of the 233 total species detected, 156 species (67%) were native, and the remaining 77 species (33 %) exotic. Over half of the species (121 species, 52 %) belong to six families, namely Asteraceae (54 species: 38 native, 16 exotic), Poaceae (29 species: 13 native, 16 exotic), Brassicaceae (9 species: 4 native, 5 exotic), Fabaceae (8 species: 4 native, 4 exotic), Scrophulariaceae (10 species: 9 native, 1 exotic) and Liliaceae (11 species: 8 native, 3 exotic).

3.6 SPECIAL STATUS PLANT SPECIES

Based on a review of the CNDDB and the County GIS database, suitable habitat existed within the study area for 19 special status plant species (Table 3). Of the 19, five special status species were observed during the surveys, namely;

- intermediate mariposa lily (*Calochortus weedii* var. *intermedius*),
- Catalina mariposa lily (*Calochortus catalinae*),
- many-stemmed dudleya (*Dudleya multicaulis*),
- prostrate spineflower (*Chorizanthe procumbens*), and,
- mud nama (*Nama stenocarpum*).

An additional special status species, small-flowered microseris (*Microseris douglasii* ssp. *platycarpha*) was observed within the area in 1998, but was not detected during the 2001 survey. Special status plant species (and their respective federal, state and California Native Plant Society [CNPS] status) detected onsite are tabulated in (Table 3).

Other special status plants that have moderate potential to occur within the project area, but were not detected during the surveys included;

- chocolate lily (*Fritillaria biflora*, locally rare),
- Palmer's grapplinghook (*Harpagonella palmeri*, CNPS List 2),
- small-flowered morning glory (*Convolvulus simulans,* CNPS List 4),

- Fish's milkwort (*Polygala cornuta* var. *fishiae*, CNPS List 4),
- Coulter's matilija poppy (*Romneya coulteri*, CNPS List 4),
- golden flowered pentachaeta (*Pentachaeta aurea*, List 1B),
- rayless ragwort (*Senecio aphanactis*, CNPS List 2), and,
- Cooper's rein orchid (*Piperia cooperi*, CNPS proposed List 4).

Although suitable habitat was present and was surveyed within the study area, these species may have been overlooked since the majority of the surveys were conducted after the peak flowering period for these species.

Other special status species that were not found during the surveys and for which suitable habitat is limited within the project site included;

- chaparral beargrass (*Nolina cismontana*, CNPS list 1B),
- Coulter's saltbush (*Atriplex coulteri*, CNPS List 1B),
- thread-leaved Brodiaea (*Brodiaea filifolia*, Federal threatened, State endangered, CNPS List 1B),
- Tecate cypress (*Cupressus forbesi*, CNPS List 1B),
- Engelmann oak (*Quercus engelmanii*, CNPS List 1B),
- western dichondra (*Dichondra occidentalis*, CNPS List 4), and,
- Robinson's peppergrass (*Lepidium virginicum* var. *robinsonii*, CNPS List 1B).

3.6.1 Intermediate/Foothill mariposa lily (*Calochortus weedii* var. *intermedius*)

Intermediate mariposa lily is a federal species of concern, a conditionally covered species[11] under the NCCP and CNPS List 1B species. It is a near Orange County endemic (Roberts 1999) and occurs in the coastal ranges and Northern Peninsula Ranges and is known from Chino Hills, San Joaquin Hills, Santa Ana Mountains, Starr Ranch and Gypsum Canyon. Riverside populations include Vail Lake north to Winchester (Bramlet, pers. comm.). The geophyte is found in chaparral, coastal sage scrub, and valley & foothill grassland primarily on dry rocky open slopes and hills in sandstone outcrops.

Not all bulbs flower in any given year and plants are more conspicuous after fires and other disturbances. Typically, more plants are present than can be detected above ground. Salvage operations have found between three and ten times more bulbs in the ground than were detected during above ground surveys (Bomkamp Pers. Comm.).

Foothill mariposa lily was abundant in the Protocol Area, twenty-three (23) colonies, totaling 827 individuals, of intermediate mariposa lily were located in the Protocol Area (Exhibit 5). Only two (2) colonies, totaling 28 individuals, occurred within the

[11] Conditionally covered species means those species which the NCCP/HCP addresses as if they were listed as endangered species under FESA and CESA, and whose conservation and management is provided for in the NCCP/HCP, under the specific conditions listed for that species.

Development Area, four (4) colonies, 184 individuals, occurred in Non Reserve Open Space and the remaining seventeen (17) colonies, 615 individuals, occurred within Reserve Open Space (Table 2; Exhibit 5). Six of these colonies were recorded by Roberts (1999) within PA 3. PA 3 was not surveyed for special status plants during the current surveys. The species was found in open CSS vegetation primarily along ridgelines, and on calcareous soils on steep slopes or rocky barrens. Indicator species for the lily included our Lord's candle (*Yucca whipplei*), black sage along ridgelines, and foothill needlegrass (*Nassella lepida*).

Table 2: Colonies and individuals of Foothill Mariposa Lily in the Protocol Area.

	Foothill Mariposa Lily	
	Colonies	Individuals
Development Area	**2**	**28**
Open Space		
Non Reserve	4	184
Reserve	17	615
Total Open Space	**21**	**799**
Protocol Area Total	23	827

Description of individual colonies

<u>Reserve Open Space</u>

Colony CW1 with at least 63 individuals occurred to the west of Siphon Reservoir spillway within openings of coastal sage scrub. Associated species included sagebrush, buckwheat, red brome (*Bromus madritensis*), wild oats, and Catalina mariposa lily. The second location comprised one individual (CW2) detected east of the reservoir along the ridgeline in mature coastal sage scrub dominated by sagebrush, buckwheat, deerweed, black sage and bushmallow (*Malacothamnus fasciculatus*). The third colony occurred north of the reservoir, between the SCE access road, Transportation Corridor and Bee Canyon access road, where five individuals (CW3) were detected in coastal sage scrub dominated by black sage, buckwheat, sagebrush, matchweed (*Gutierrezia californica*), wishbone bush (*Mirabilis californica*), California encelia (*Encelia californica*), bushmallow and Turkish rugging (*Chorizanthe staticoides*). A total of 58 individuals (CW4) were encountered along an abandoned road northeast of the gravel mining operation west of the ETC. Associated species included purple needlegrass (*Nassella pulchra*), sagebrush, buckwheat, fascicled tarweed (*Hemizonia fasciculata*), encelia, deerweed, common sand aster (*Lessingia filaginifolia*), rattail fescue (*Vulpia myuros*), rattlesnake weed (*Daucus pusillus*), red brome, splendid mariposa lily (*Calochortus splendens*) and Catalina mariposa lily.

Colonies CW6 through CW12 occurred in Reserve Open Space north of the FTC (Figure Exhibit 5). CW6 colony contained at least 10 plants interspersed in cactus scrub openings with three-awned grass (*Aristida* sp.), matchweed, silver beard grass (*Botriochloa barbinoides*), sagebrush, Turkish rugging, deerweed, buckwheat, prickly pear cactus, Mexican elderberry, lance-leaved dudleya (*Dudleya lanceolata*), foothill needlegrass and our Lord's candle. At least 19 plants were located in colony CW7 with deerweed, red brome, sand aster (*Lessingia filaginifolia*), goldenstars, lance-leaved dudleya, cliff malacothrix (*Malacothrix saxatilis*), june grass (*Koeleria macrantha*) and our Lord's candle. A total of 4 plants along the ridgeline in burned CSS were detected in colony CW8, dominated by deerweed, buckwheat, prickly pear cactus, sagebrush, purple needlegrass, black sage, our Lord's candle, matchweed, foothill needlegrass. One plant (CW9) was detected in habitat similar to CW8, however foothill needlegrass was more abundant in the area. A contiguous colony of 27 plants (CW10) were dispersed along the spine of a ridge west of CW9, overlooking Agua Chinon. Vegetation along the spine contained more mesic CSS species including bushmallow (*Malacothamnus fasciculata*) with similar xeric CSS components found adjacent to CW8 and CW9. Colony CW11 comprised at least 40 plants on calcareous soils on a west-facing slope in burned CSS, east of the historic Agua Chinon sand and gravel operation. CSS habitat components in the vicinity of CW11 included bushmallow, black sage, sagebrush, bedstraw, red brome, our Lord's candle, white sage (*Salvia apiana*), sand aster, and morning glory (*Calystegia macrostegia*). North of the toll plaza along a north-south trending ridge, 23 plants comprised colony CW12, although it is expected that additional plants occurred to the north of the Planning Area 6 boundary. Similar CSS habitat components to CW11 were present within this colony, however Catalina mariposa lily seedpods were detected in the same area.

Roberts documented two populations of Intermediate Mariposa lily in PA 3 during his surveys of the Limestone Canyon area (Roberts 1999). Those surveys were conducted following the Limestone fire of 1998. One population occurred on the west slopes of Agua Chinon, in Calleguas clay soils and at elevations ranging from 1,001 to 1,289 feet. The population consisted of four colonies and 344 individuals. This population occurred mostly on south-facing slopes in grassy burned CSS and southern needlegrass grassland. The other population occurred along Lomas Ridge, in Cieneba sandy loam soil and at elevations ranging from 1,699 to 1,759 feet. The population consisted of two colonies and 20 individuals, one on a north-facing slope and one on a south-facing slope. Roberts documented eight other populations consisting of 135 colonies and approximately 29,755 individuals within Limestone Park, all of which is part of the Nature Reserve of Orange County.

Non Reserve Open Space

A colony of four individuals (CW5) occurred in disturbed coastal sage scrub west of the spring and north of Lambert Reservoir and Portola Parkway. The small colony was detected in fruit with buckwheat, sagebrush, southern rosinweed (*Osmadenia tenella*), Turkish rugging, filago (*Filago californica*), goldenbush (*Isocoma menzeisii*) and coast prickly pear. Three colonies (CW15, CW16 and CW17) were detected along the CSS dominated ridgelines and in grassy saddles east of Agua Chinon, south of the FTC. Common species associated within these colonies included foothill needlegrass, sagebrush, buckwheat, black sage, our Lord's candle, and prickly pear cactus. A total of 8, 36 and 136 plants were detected in CW15, CW16 and CW17, respectively.

Development Area

The first colony (CW14) located within the Development Area comprised one individual on a rocky conglomerate ledge in unburned CSS vegetation. Associated species included buckwheat, sagebrush, melic grass (*Melica imperfecta*), goldenstars (*Bloomeria crocea*), red-brome, monkeyflower (*Mimulus aurantiacus*), San Diego bent grass (*Agrostis pallens*), and bed-straw (*Galium angustifolium*). More individuals are likely to occur within the area, and would be more noticeable after natural disturbances such as a wildfire. The second colony (CW13) within the Development Area comprised at least 27 individuals on clay and sandy soils west of Agua Chinon, south of ETC, and east of Portola Parkway. The plants were distributed along the exposed soils in open CSS dominated by our Lord's candle, prickly pear cactus, buckwheat, black sage, chalk-leaved dudleya (*Dudleya pulverulenta*), prostrate spineflower, sagebrush, cholla, laurel sumac, red brome, and summer mustard.

3.6.2 Catalina mariposa lily (*Calochortus catalinae*)

The Catalina mariposa lily is an NCCP covered[12] and CNPS List 4 species. Its range extends from San Luis Obispo County south to central Orange County and is also found near Portuguese Bend, in the Santa Monica Mountains in Los Angeles County and the Channel Islands. This perennial herb occurs in heavy soils on open grassy slopes and amongst openings in chaparral, coastal sage scrub, and valley and foothill grassland. It blooms from February to May.

Twenty colonies, totaling 3,485 individuals, of Catalina mariposa lily were located in the Protocol Area, all within Reserve Open Space (Table 3, Exhibit 5). Fifteen of these colonies were recorded by Roberts (1999) within PA 3. PA 3 was not surveyed for special status plants during the current surveys. No colonies were located in the Development Area or Non Reserve Open Space.

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[12] Covered species means those species which the NCCP/HCP addresses as if they were listed as endangered species under FESA and CESA, and whose conservation and management is provided for in the NCCP/HCP.

Description of individual colonies

During the 1998 sensitive grassland plant survey, approximately 20 individuals were located along a ridge of native grassland-coastal sage scrub ecotone at Siphon Reservoir southeast of the spillway (Harmsworth Associates 1999a). This colony was verified during the current surveys (CC1). The second colony (CC2) with at least 30 individuals occurred to the west of Siphon Reservoir spillway within openings of coastal sage scrub. Associated species included sagebrush, buckwheat, red brome, wild oats, and intermediate mariposa lily. The third colony (CC3) comprised more than 10 individuals along an abandoned road northeast of the gravel mining operation. Associated species included purple needlegrass, sagebrush, buckwheat, fascicled tarweed, encelia, deerweed, common sand aster, rattail fescue, rattlesnake weed, red brome, splendid mariposa lily and intermediate mariposa lily. The fourth colony (CC4) occurred in the southwestern portion of Siphon Reservoir near the intersection of Portola and Bee Canyon Road. At least 110 individuals occured within this colony along with rattail fescue, buckwheat, purple needlegrass, Turkish rugging, dwarf plantain (*Plantago erecta*), derived microseris (*Uropappus lindleyi*), purple false brome (*Brachypodium distachyon*) and fascicled tarweed. North of the toll plaza along a north-south trending ridge, 5 plants comprised colony CC5, although it is expected that additional plants occurred to the north of the Planning Area 6 boundary. CSS species included black sage, sagebrush, bedstraw, red brome, our Lord's candle, white sage, sand aster, morning glory, and foothill mariposa lily (CW12).

Roberts documented three populations of Catalina Mariposa lily in PA 3 during his surveys of the Limestone Canyon area (Roberts 1999). Those surveys were conducted following the Limestone fire of 1998. One population occurred in upper Agua Chinon, in Alo variant clay and Cieneba sandy loam soils and at elevations ranging from 1,280 to 1,499 feet. The population consisted of five colonies and 492 individuals growing on ridges in burned CSS. The second population occurred above Agua Chinon along Loma Ridge, in Calleguas clay loam and at elevations ranging from 1,539 to 1,621 feet. The population consisted of six colonies and 2,627 individuals growing on north or west facing slopes near ridge tops in burned CSS. The other population occurred along the west slopes of Auga Chinon, in Calleguas clay loam soil and at elevations ranging from 1,010 to 1,201 feet. The population consisted of four colonies and 191 individuals growing in burned CSS. Roberts documented nine other populations consisting of 167 colonies and approximately 67,720 individuals within Limestone Park, all of which is part of the Nature Reserve of Orange County

3.6.3 Many-stemmed Dudleya (*Dudleya multicaulis*)

Many-stemmed dudleya (*Dudleya multicaulis*) is a drought deciduous leaf-succulent perennial that remains dormant below ground throughout late summer and fall. It is listed as rare by the CNPS (List 1B) but is not federally or state listed as endangered or threatened nor is it a NCCP covered species. The species ranges from Los Angeles

County south to northern San Diego County and east to western Riverside and San Bernardino Counties

The many-stemmed dudleya is a distinctive succulent with terete leaves and evident but non-showy flowers. This species primary habitat is thin well-drained soils on slopes, ridge tops, rock outcrops, cliff faces, and hillside grasslands. This dudleya species has also suffered from loss of habitat due to urbanization and direct loss of plants and habitat to cattle grazing. The cattle eat the succulent dudleyas and trample the shallow soils on rock ledges leading to erosion and sloughing off of soil to form bare rock.

Two populations, totaling 573 individuals, occurred within Reserve Open Space within Planning Area 6 (Table 3, Exhibit 5). No colonies were located in the Development Area or Non Reserve Open Space. One small population of 57 many-stemmed dudleya individuals (DM1) was located southwest of Siphon Reservoir in openings in coastal sage scrub dominated by rattail fescue, sagebrush, buckwheat, lanceleaved dudleya (*Dudleya lanceolata*), wild oats, common popcorn flower (*Cryptantha intermedia*), fascicled tarweed, derived microseris, and smooth cat's ear.

The second population (DM2) comprised 516 plants in a single colony on a north-west facing slope on the east side of Hicks Canyon Road, 1.25 miles northwest of the canyon mouth (Roberts 1991, CNDDB rarefind). This locality was not confirmed during the surveys, although the habitat is extant.

3.6.4 Mud Nama (*Nama stenocarpum*)

Mud nama is distributed from Los Angeles County to San Diego County and Baja, California, and across the Colorado Desert. The small prostrate to ascending annual or perennial herb occurs in intermittently wet or muddy areas, lake margins and river banks of marshes and swamps. Mud Nama is a CNPS List 2 species. It blooms from January to July.

One population of Mud nama was recorded in the Protocol Area in 2001. This population was located in Lambert Reservoir, in the Development Area (Table 3, Exhibit 5). Most of the plants were found in the low area with moist soils in the northeastern portion of the former reservoir but a few were found on the southern edge of the former reservoir. Mud nama was also recorded at this souther edge during a special status wetland plant survey conducted in 1998 (Harmsworth Associates 1999b). At this southern location mud nama occurred within a *Scirpus* marsh in association with red-stem (*Ammania robusta*), grass poly (*Lythrum hyssopifolia*), and toad rush. At the northeastern location, more than 140 individuals were observed in the former reservoir with Mexican speedwell (*Veronica peregrina*), curly dock (*Rumex crispus*), prickly sows thistle (*Sonchus asper*), cocklebur, and western yellow cress (*Rorippa curvisiliqua*). Mud nama had been recently recorded at a few others localities in Orange County (Fairview Park, Peter's Canyon channel, Emerald Canyon, Laguna Lakes, Chiquita Ridge and two locations in south Orange County) and also at one location in Riverside County (Provance *et al.* 2000, Bonkamp Pers. Comm.).

3.6.5 Prostrate spineflower (*Chorizanthe procumbens*)

Prostrate spineflower is a CNPS list 4 species. Although not abundant in Orange County (Roberts 1990) this spineflower is known from Los Angeles, Riverside, San Bernardino, San Diego, Ventura Counties and Baja California. In Orange County, the species is known from the San Joaquin Hills in little Sycamore Canyon (Harmsworth Associates 1999a). It blooms April through June, occurs in chaparral, coastal sage scrub, pinyon juniper woodlands, valley foothill grasslands in gabbroic clay/granitic (Skinner 1994).

The prostrate spineflower was recorded at three locations, totaling 970 individuals, in the Protocol Area, all localities within PA 6 in the Development Area (Table 3, Exhibit 5). The first colony (CP1) of more than 700 individuals occurred on heavy clay soils supporting cryptogamic crusts with scattered sagebrush, buckwheat, fascicled tarweed, goldenbush (*Isocoma menzeisii*), rattlesnake root, scarlet pimpernel (*Anagallis arvensis*). The second colony (CP2) occurred east of the General Electric Field Station where over 150 individuals persisted on bare eroding soils between buckwheat, summer mustard, soft chess (*Bromus hordaeceus*), red brome and sagebrush. The third colony comprised more than 120 individuals on clay and sandy soils west of Agua Chinon, south of ETC, and east of Portola Parkway. The plants were distributed along the exposed soils in open CSS dominated by our Lord's candle, prickly pear cactus, buckwheat, black sage, chalk-leaved dudleya (*Dudleya pulverulenta*), foothill mariposa lily, sagebrush, cholla, laurel sumac, red brome, and summer mustard.

3.6.6 Small-flowered microseris (*Microseris douglasii* ssp. *platycarpha*)

Small flowered microseris is distributed from Los Angeles County to Baja, California, and from the channel islands of Santa Catalina and San Clemente. The species is reported as common in rapidly disappearing grassy areas in San Diego County (Reiser 1998), and is also known from Lake Mathews area in Riverside County, and San Jose Hills in Los Angeles County (Bramlet 1996). The flower and fruit are required for species identification. The main character for the species is the length of the pappus awn (bristle) versus the length of the scale. Distinguished from *M.d. douglasii* whose pappus scales are much smaller than the fruit length; *Stebbinoseris heterocarpa* whose flowers are generally larger, with spined pappus scales; and *Uropappus lindleyi* whose fruit is widest at center with deep yellow flowers.

Small-flowered microseris is a CNPS List 4 species. This annual herb, which blooms from March to May occurs on clay soils in coastal sage scrub, valley and foothill grasslands, and cismontane woodland habitats.

No small-flowered microseris plants were recorded during the 2001 surveys, however, during the 1998 sensitive grassland plant survey at Siphon Reservoir, small-flowered microseris was observed southeast of the spillway, in Reserve Open Space. Individuals occurred along ridgetops and grassy knolls in purple needlegrass grassland growing in association with snakeroot (*Sanicula* sp.), blue dicks (*Dichelostemma capitatum*), and mosses. Over an acre of suitable habitat was identified. This locality was not confirmed during the current surveys although the grassland habitat where the species was detected was extant.

Table 3: Federal and state endangered, threatened and special status plant species which occurred or have the potential to occur in the Development Area (DA) and Non Reserve Open Space or Reserve Open Space (OS) within the Protocol Area. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area.

Scientific Name FAMILY	Common name	Status	NCCP	DA	OS	Comments/Habitat
Atriplex coulteri CHENOPODIACEAE	Coulter's saltbush	Fed: none State: none CNPS: 1B[1]	NC	Low	Medium	Limited habitat onsite. Occurs from Santa Barbara County south to Baja California, the Channel Islands, and east to San Bernardino County. Alkaline depressions or clay soils and ridges in poorly drained soils on coastal bluffs, coastal sage scrub, valley foothill grassland. Blooms March through October.
Brodiaeae filifolia LILIACEAE	Thread-leaved Brodiaea	Fed: threatened State: endangered CNPS: 1B	NC	Low	Low	Limited habitat onsite. Occurs on clays, or silty alkaline substrates on edges of vernal pools, valley and foothill grasslands, coastal sage scrub, chaparral, and cismontane woodlands, below 2000 feet. Blooms March through June.
Calochortus catalinae LILIACEAE	Catalina Mariposa Lily	Fed: none State: none CNPS: 4[3]	C	Medium	Occurs	Detected onsite in the openings of CSS in the vicinity of Siphon Reservoir, perennial herb; blooms February to May; occurring in heavy soils, open grassy slopes and opening in brush in chaparral, coastal sage scrub, and valley and foothill grassland.
Calochortus weedii var. intermedius LILIACEAE	Intermediate Mariposa Lily	Fed: FSC State: none CNPS: 1B	CC	occurs	Occurs	Detected onsite in the vicinity of Siphon Reservoir, Hicks Canyon Road Ridges, etc. Perennial herb; in bloom from May-July; habitat is dry rocky open slopes and hills in chaparral, coastal sage scrub, valley & foothill grassland.

[1] California Native Plant Society: (CNPS) List 1B indicates species rare, threatened, or endangered in California and elsewhere); [2]: CNPS List 2 denotes plants rare, threatened, or endangered in California, but more common elsewhere, [3]: CNPS List 4 denotes plants of limited distribution (a watch list); FSC = federal species of concern.

Table 3, continued: Federal and state endangered, threatened and special status plant species which occurred or have the potential to occur in the Development Area (DA) and Non Reserve Open Space or Reserve Open Space (OS) within the Protocol Area. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area.

Scientific Name **FAMILY**	**Common name**	**Status**	**NCCP**	**DA**	**OS**	**Comments/Habitat**
Chorizanthe procumbens POLYGONACEAE	Prostrate Spineflower	Fed: none State: none CNPS: 4	NC	Occurs	High	Detected onsite in the openings of CSS in Planning Area 6, annual herb, blooms April through June, occurs in chaparral, coastal sage scrub, pinyon juniper woodlands, valley foothill grasslands in gabbroic clay/granitic (Skinner 1994)
Convolvulus simulans CONVOLVULACEAE	Small-flowered morning-glory	Fed: none State: none CNPS: 4	NC	Low	Medium	Moderate habitat onsite but easily overlooked. Occurs from Baja north to San Luis Obispo County and inland to Riverside and Kern Counties, on wet clay, serpentine seeps and ridges, near rock outcrops, south-facing slopes in shallow or clay soils on edges of coastal sage scrub and perennial grasslands. Blooms March through June.
Cupressus forbesi CUPRESSACEAE	Tecate Cypress	Fed: FSC State: none CNPS: 1B	C	Low	Low	Limited habitat onsite. Closed-cone coniferous forest, Chaparral. Known from the upper Fremont, Gypsum and Coal Canyons in the Santa Ana Mountains.
Dichondra occidentalis CRASSULACEAE	Western dichondra	Fed: none State: none CNPS: 4	NC	Low	Low	Limited habitat onsite. Occurs on channel islands and south from Santa Barbara County to northern Baja, California. Fire follower, occurs in rock outcrops, under shrubs in loamy alluvium, Huerhuerco complex, Hambright gravely clay loam in southern mixed chaparral, Diegan sage scrub, oak woodland and grasslands. Blooms January through July.

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Table 3, continued: Federal and state endangered, threatened and special status plant species which occurred or have the potential to occur in the Development Area (DA) and Non Reserve Open Space or Reserve Open Space (OS) within the Protocol Area. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area.

Scientific Name FAMILY	**Common name**	**Status**	**NCCP**	**DA**	**OS**	**Comments/Habitat**
Dudleya multicaulis CRASSULACEAE	Many Stemmed Dudleya	Fed: FSC State: none CNPS: 4	NC	Medium	Occurs	Detected onsite in the openings of CSS in the vicinity of Siphon Reservoir, perennial herb; flowering in May-July; microhabitat is rocky outcrops, clay soil in chaparral, coastal sage scrub, valley & foothill grassland.
Fritillaria biflora var. *biflora* LILIACEAE	California Chocolate Lily	Fed: none State: none CNPS: none Local concern	NC	Low	Medium	Moderate potential to occur. Occurs on mesic native bunchgrass grasslands on north-facing slopes on clay soils, mesas and serpentine barrens in Southern coastal needlegrass grasslands. Flowers usually early in February but may extend until June.
Harpagonella palmeri BORAGINACEAE	Palmer's grapplinghook	Fed: FSC State: none CNPS: 2[2]	NC	Medium	Medium	Moderate potential to occur. Occurs on clay soils, dry slopes and mesas in coastal sage scrub openings and grasslands. Flowers March to April. More readily found after fires.
Lepidium virginicum var. *robinsonii* BRASSICACEAE	Robinson's peppergrass	Fed: none State: none CNPS: 1B	NC	Low	Medium	Grows in openings of coastal sage and chaparral, typically away from the coast. Few recent collections of these species from cismontane southern California. Blooms January through July.
Microseris douglasii ssp. *platycarpha* ASTERACEAE	Small-flowered Microseris	Fed: none State: none CNPS: 4	NC	Medium	Occurs	Detected onsite in the interstitial grasslands in the vicinity of Siphon Reservoir, annual herb; blooms March to May ; occurs on clay soils in coastal sage scrub, valley and foothill grasslands, and cismontane woodland habitats.
Nama stenocarpum HYDROPHYLLACEAE	Mud Nama	Fed: none State: none CNPS: 2	NC	Occurs	Medium	Detected onsite in Lambert Reservoir, annual/perennial herb; blooms January to July; occurs along lake margins and riverbanks.
[1] California Native Plant Society: (CNPS) List 1B indicates species rare, threatened, or endangered in California and elsewhere); [2]: CNPS List 2 denotes plants rare, threatened, or endangered in California, but more common elsewhere, [3]:CNPS List 4 denotes plants of limited distribution (a watch list); FSC = federal species of concern.						

Table 3, continued: Federal and state endangered, threatened and special status plant species which occurred or have the potential to occur in the Development Area (DA) and Non Reserve Open Space or Reserve Open Space (OS) within the Protocol Area. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area.

Scientific Name FAMILY	**Common name**	**Status**	**NCCP**	**DA**	**OS**	**Comments/Habitat**
Nolina cismontana LILIACEAE	Chaparral beargrass	Fed: none State: none CNPS: none Local concern	NC	Low	Low	Limited habitat onsite. Distributed from western Ventura County south through Simi Hills, Santa Ana Mountains to the foothills of Palomar and Cuyamaca Mountains in San Diego County. Bloom from April through June.
Pentachaeta aurea ASTERACEAE	Golden-flowered Pentachaeta	Fed: none State: none CNPS: 4	NC	Medium	Medium	Occurs in Los Angeles, Orange, Riverside, San Bernardino, San Diego Counties, Baja California. Habitat includes cismontane woodland, coastal scrub, lower montane coniferous forest, valley and foothill grassland. Blooms March through July.
Piperia cooperi ORCHIDACEAE	Chaparral rein orchid	Fed: none State: none CNPS: 4	NC	Low	Medium	Occurs in chaparral, cismontane woodland, valley and foothill grassland Blooms March through April.
Polygala cornuta var. fishiae POLYGOLACEAE	Fish's Milkwort	Fed: none State: none CNPS: 4	NC	Low	Medium	Limited habitat in Development Areas. Occurs in Los Angeles, Orange, Riverside, Santa Barbara, San Diego, Ventura, Baja California in chaparral, cismontane woodland, and riparian woodland. Blooms May through August.

[1] California Native Plant Society: (CNPS) List 1B indicates species rare, threatened, or endangered in California and elsewhere); [2]: CNPS List 2 denotes plants rare, threatened, or endangered in California, but more common elsewhere, [3]:CNPS List 4 denotes plants of limited distribution (a watch list); FSC = federal species of concern.

Table 3, continued: Federal and state endangered, threatened and special status plant species which occurred or have the potential to occur in the Development Area (DA) and Non Reserve Open Space or Reserve Open Space (OS) within the Protocol Area. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area.

Scientific Name FAMILY	**Common name**	**Status**	**NCCP**	**DA**	**OS**	**Comments/Habitat**
Quercus engelmanii FAGACEAE	Engelmann oak	Fed: none State: none CNPS: 4	NC	Low	Low	Limited habitat onsite. Occurs from Pasadena inland region to San Dimas to east San Diego Co., and one tree left on Santa Catalina Island (Skinner 1994). Dry fans, foothills, and slopes in Chaparral, valley and foothill grassland, riparian woodland, and cismontane woodland. Deciduous tree which blooms from April to May.
Romneya coulteri PAPAVERACEAE	Coulter's Matilija Poppy	Fed: none State: none CNPS: 4	NC	Low	Medium	Moderate potential to occur in upper portions and slopes of Bee, Round and Agua Chinon Canyons. Occurs in Los Angeles, Orange, Riverside, San Diego in chaparral, coastal scrub / often in burns. Blooms March through July
Senecio aphanactis ASTERACEAE	Rayless raywort	Fed: none State: none CNPS: 2	NC	Medium	Medium	Occurs in coastal sage scrub and extends from Contra Costa County to Baja California and on the Channel Islands. Known from lower Hicks Canyon and UCI ecological preserve. Blooms January through April, and easily overlooked.

[1] California Native Plant Society: (CNPS) List 1B indicates species rare, threatened, or endangered in California and elsewhere); [2]: CNPS List 2 denotes plants rare, threatened, or endangered in California, but more common elsewhere, [3]:CNPS List 4 denotes plants of limited distribution (a watch list); FSC = federal species of concern.

Figure 5Exhibit 5: Rare plant locations in the Protocol Area.

3.7 WILDLIFE

Endangered/Threatened Wildlife

Three Federal and/or State endangered/threatened wildlife species occur or have the potential to occur in the Protocol Area: the California gnatcatcher, least Bell's vireo and southwestern willow flycatcher. Focused presence/absence surveys were designed and conducted for the California gnatcatcher, least Bell's vireo and southwestern willow flycatcher.

3.7.1 Coastal California Gnatcatcher

The California gnatcatcher was listed as a "threatened" species by the United States Fish and Wildlife Service (USFWS) in 1993, pursuant to Section 4(d) of the Federal Endangered Species Act ("FESA"), and it is a covered and target species under the NCCP/HCP. It is an obligate resident of coastal sage scrub ("CSS") habitat, and the rapid conversion of occupiable CSS to developed area was the basis for the listing. The final Section 4(d) "special rule" listing the California gnatcatcher as a threatened species, recognizes this basis for the listing, and states:

> "Incidental take of the coastal California gnatcatcher will not be considered a violation of Section 9 of the Endangered Species Act of 1973, as amended (Act), if it results from activities conducted pursuant to the State of California's Natural Community Conservation Planning Act of 1991 (NCCP), and in accordance with a NCCP Plan for the protection of coastal sage scrub habitat, prepared consistent with the State's NCCP Conservation and Processing Guidelines…."

The Protocol Area is part of the Central/Coastal Orange County NCCP approved in 1996. The Development Area was identified in the NCCP for development, while at the same time a habitat reserve of in excess of 37,000 acres was established for the protection of the coastal California gnatcatcher and other CSS dependent species.

During the preparation of the NCCP/HCP all habitat within the plan area was evaluated. Within the Protocol Area the Development Area and most of the Non Reserve Open Space is considered of low conservation value, while most of the Reserve Open Space and the Non Reserve Open Space adjacent Agua Chinon Wash is considered of high conservation value (NCCP/HCP Map Section, Map 35). Habitat with high evaluations are 1) larger, 2) close to or contiguous with other habitat types, 3) provide linkages between areas, 4) contain a diversity of habitat types, associations, elevations, etc. or 5) can be protected from encroachment to remain viable over the long term.

Exhibit 6 documents the locations of gnatcatchers in the Protocol Area;

- Locations in the Development Area are from surveys conducted in 2001,

- Locations in Non Reserve Open Space (except the landfill area within PA 3) are from surveys conducted in 2001,
- Locations in the Reserve Open Space and in Non Reserve Open Space at the landfill within PA 3 are from the NCCP/HCP baseline data (County of Orange Environmental Management Agency 1995).

In the Development Area gnatcatchers were recorded at 19 locations (16 pairs and three unpaired adult gnatcatchers), all were within Planning Area 6. Gnatcatchers were not recorded from PAs 5b, 8a or 9 (Exhibit 6). Gnatcatchers were sighted at seven locations (four pairs and three unpaired adult gnatcatchers) in the Development Area of PA 6 during the NCCP baseline surveys (County of Orange Environmental Management Agency 1995). Gnatcatchers were not recorded from PAs 5b, 8a or 9 during the NCCP baseline surveys.

In the Non Reserve Open Space During gnatcatchers were recorded at two locations (two pairs), both within PA 6 (Exhibit 6). Within the Reserve Open Space gnatcatchers were sighted at 53 locations (36 pairs and 17 singles), all in PAs 3 and 6 (County of Orange Environmental Management Agency 1995; Exhibit 6).

As described in the NCCP/HCP and its EIR/EIS bird populations are not static entities, they can fluctuate markedly over time under natural conditions. California gnatcatcher populations can change significantly between years for many reasons, including climate change, habitat changes, population dynamics and immigration from adjacent areas where habitat has been altered. Population changes in excess of 50% between successive years have been documented for the California gnatcatcher at several sites in Orange County (Harmsworth Associates 2001b,c). In the Palos Verdes peninsula the gnatcatcher population decreased by 54% one year and increased by 50% the following year (Atwood *et al.* 1998).

In the Development Area there has been an increase in the gnatcatcher population since the NCCP data was collected, in 1991/1992. The average yearly increase was within the range previously documented for this species (Atwood *et al.* 1998, Harmsworth Associates 2001b,c). These population fluctuations were considered and anticipated in the development of the NCCP Plan.

Cactus wren

The cactus wren is not a listed species but it is discussed here because it is a NCCP covered species and it is shown on the same exhibit as the gnatcatcher and is also an obligate resident of coastal sage scrub.

Exhibit 6 documents the locations of gnatcatchers in the Protocol Area;

- Locations in the Development Area are from surveys conducted in 2001,
- Locations in Non Reserve Open Space (except the landfill area within PA 3) are from surveys conducted in 2001,

- Locations in the Reserve Open Space and in Non Reserve Open Space at the landfill within PA 3 are from the NCCP/HCP baseline data (County of Orange Environmental Management Agency 1995).

In the Development Area cactus wrens were recorded at eight locations (8 pairs), all were within Planning Area 6. Cactus wrens were not recorded from PAs 5b, 8a or 9 in 2001 (Exhibit 6). Cactus wrens were recorded at four locations (two pairs and two singles) in the Development Area of PA 6 during the NCCP baseline surveys (County of Orange Environmental Management Agency 1995). Cactus wrens were not recorded from PAs 5b, 8a or 9 during the NCCP baseline surveys.

In Non Reserve Open Space cactus wrens were recorded at two locations (two pairs) in PA 6 and at two additional locations (one pair and one single) in PA 3. Within the Reserve Open Space cactus wrens were sighted at 139 locations (76 pairs and 63 singles), all in Pas 3 and 6 (County of Orange Environmental Management Agency 1995).

As described in the NCCP/HCP and its EIR/EIS bird populations are not static entities, they can fluctuate markedly over time under natural conditions. Cactus wren populations have not been as well studied as California gnatcatcher populations but are thought to undergo similar fluctuations. Population changes on the order of 25% between years have been recorded at Chiquita Canyon (Harmsworth Associates 2001b,c) and in the Palos Verdes peninsula (Atwood *et al.* 1998). In the Development Area there has been an increase in the wren population since the NCCP data was collected, in 1991/1992. The average yearly increase is within that recorded previously for this species, and increases as well as decreases in population are anticipated by the NCCP.

3.7.2 Least Bell's vireo

The least Bell's vireo is a federal and state endangered species and is a conditionally covered species under the NCCP. This vireo is an obligate resident of willow dominated riparian woodland. Vireos occurred in the Development Area and in Reserve Open Space at Siphon Reservoir. In the Development Area a single vireo pair occurred in a small area of willow woodland (0.53 acres) adjacent to the northern end of Lambert Reservoir, within Planning Area 6 (Exhibit 7). This pair made several nesting attempts, all of which failed. The pair likely also used the two adjacent patches of woodland at the northeastern portion of Lambert Reservoir totaling 1.89 acres, as these were suitable for vireos

Figure 6Exhibit 6: California gnatcatcher and coastal cactus wren locations in the Protocol Area.

Figure 7Exhibit 7: Least Bell's vireo and southwestern willow flycatcher locations in the Protocol Area.

One vireo pair and two additional unpaired territorial male vireos occurred at Siphon Reservoir (Exhibit 7). All these vireos occurred in the willow scrub adjacent the reservoir. This land is Reserve Open Space and would not be impacted by the proposed project. The vireo pair at Siphon nested successfully, fledgling four young. Least Bell's vireo had not previously been recorded from theses areas despite focused surveys in recent years (Harmsworth Associates 1998a). Vireos were absent from the suitable habitat located northeast of Portola Parkway. Vireos were also absent from PAs 5b, 8a and 9 during the 2001 surveys. No suitable vireo habitat occurred within PA 3.

3.7.3 Willow flycatcher

The willow flycatcher is a state endangered species and is a conditionally covered species under the NCCP. One subspecies, the southwestern willow flycatcher (*Empidonax trallii exttimus*) is also a federal endangered species. Only the southwestern subspecies breeds in southern California but northern subspecies (*E. t. brewsteri* and *E. t. adastus*) do pass through southern California during migration. The willow flycatcher is an obligate resident of willow dominated riparian woodland. No willow flycatcher was recorded in the project Development Area or Reserve Open Space during the 2001 focused surveys. During the 1997 focused surveys no willow flycatcher was recorded in the Development Area but a single migrant willow flycatcher was recorded in Reserve Open Space, at Siphon Reservoir, (Harmsworth Associates 1998a, Exhibit 6). Siphon Reservoir holds the only potential flycatcher breeding habitat within the Protocol Area.

3.7.4 Other listed species

Four federal endangered species that do not have potential to occur in the Protocol Area are also addressed here since they are all conditionally covered species under the NCCP.

Two federal endangered fairy shrimps, the San Diego fairy shrimp and the Riverside fairy shrimp occur exclusively in vernal pools. No vernal pools exist within the Protocol Area and therefore no suitable habitat for either fairy shrimp species exists.

The quino checkerspot butterfly is another conditionally covered endangered species. Surveys to locate the quino checkerspot's host plants were conducted in the Protocol Area in 1998 as part of a more extensive survey within the Coastal/Central NCCP Subregion. No suitable habitat was detected within the Protocol Area for quino and no adults or larvae butterfly were recorded. In fact, the 1998 surveys found that the quino butterfly was absent from all Irvine Company lands (Harmsworth Associates 1998b). No quino butterfly adults or larvae were recorded during the 2001 surveys in the Protocol Area.

The arroyo toad is also a conditionally covered endangered species. The Protocol Area was assessed for arroyo toad habitat in 1998 as part of a more extensive survey within the

Coastal/Central NCCP Subregion (Harmsworth Associates 1998c) and again during the 2001 surveys. No suitable arroyo toad habitats existed within the Protocol Area.

3.7.5 Unlisted sensitive wildlife

A number of California Department of Fish and Game "species of special concern" (CSC) occur or have the potential to occur in the project area (Table 4, Appendix A). These species are considered sensitive due to declining populations, partially as a result of habitat destruction.

Amphibians

The western spadefoot toad was not recorded in the Protocol Area during the 2001 surveys, however populations of western spadefoot toads are known from near Hicks Canyon Haul Road, Bee Canyon and Agua Chinon, all within Reserve Open Space (Harmsworth Associates 1998c, Fisher 2000, CNDDB 2001). No records exist for the Development Area. Suitable breeding and foraging habitat does exist for this species in the Development Area. Due to the presence of suitable habitat and the close proximity of known populations the spadefoot toad is presumed to occur in the Development Area. The western spadefoot toad is a NCCP covered species in the coastal subarea only.

Reptiles

Four sensitive reptile species occurred or are presumed to occur in the Protocol Area (Table 4, Appendix A). The San Diego horned lizard was recorded during the 2001 surveys in the Development Area and in the Reserve Open Space. The horned lizard is a NCCP covered species.

The Coronado skink (*Eumeces skiltonianus interparietalis*) was not recorded in the Protocol Area during the 2001 surveys but is known to occur in the Reserve Open Space. It probably also occurs in the Development Area and Non Reserve Open Space as suitable habitat occurs there for the skink. The skink is a NCCP covered species.

The orange-throated whiptail was recorded in Reserve Open Space during the 2001 surveys and is presumed to occur in the Non Reserve Open Space and Development Area. The whiptail is a NCCP covered species.

The northern red-diamond rattlesnake (*Crotalus ruber ruber*) was recorded in Reserve Open Space during the 2001 surveys and is presumed to occur in the Non Reserve Open Space and Development Area. The northern red-diamond rattlesnake is a NCCP covered species.

The southwestern pond turtle (*Clemmys marmorata pallida*) is also considered a sensitive species but is not covered under the NCCP. Surveys for the pond turtle were conducted throughout the Central/Coastal NCCP Subregion in 1998. No turtles were recorded from the Protocol Area. All of the potential turtle habitat in the Protocol Area was categorized as poor, except Siphon Reservoir which was categorized as moderate (Harmsworth Associates 1998d). The southwestern pond turtle is unlikely to occur in the Development Area but possibly could occur in Non Reserve Open Space, at Siphon Reservoir.

<u>Birds</u>
A number of sensitive bird species are known to use the Protocol Area (Table 4, Appendix A). Two species which have occasionally been recorded at Siphon Reservoir are the double-crested cormorant (*Phalacrocorax auritus*) and the white-faced ibis (*Plegadis chichi*). Both species are closely associated with aquatic habitats, the ibis requiring freshwater marshes or flooded fields. The agricultural fields in the Protocol Area never flood and are not suitable for the ibis. Neither species is expected to occur in the Development Area due to lack of appropriate habitat.

Several sensitive raptor species are known to use the Protocol Area (Table 4). The white-tailed kite was recorded foraging within Reserve Open Space during the 2001 surveys. Suitable nesting habitat occurs at Siphon Reservoir. Oak or sycamore woodlands (kites favored nest sites) were absent from the Development Area and the willow trees in the Development Area were likely too small or too prone to disturbance for nesting kites. Kites are unlikely to nest within the Development Area. Kites are presumed to forage there occasionally. No kites were recorded in the Development Area during the 2001 surveys.

The sharp-shinned hawk (*Accipiter striatus*) does not breed in Orange County but is a common migrant and winter resident. It is presumed to forage in the Development Area, Non Reserve Open Space and Reserve Open Space during migration and winter. It is a NCCP covered species.

The Cooper’s hawk was recorded foraging in the Development Area, Non Reserve Open Space and in Reserve Open Space during the 2001 surveys. The majority of Cooper’s hawk nests are located in small groves of oak trees but dense stands of mature willows are also used. Suitable nesting sites exist in the Reserve Open Space but are very limited in the Development Area. No nest sites were recorded during the 2001 surveys or during surveys conducted in 1998 (Bloom 1999).

Red-shouldered hawks were recorded foraging during the 2001 surveys in the Development Area and are presumed to forage in Non Reserve Open Space and Reserve Open Space also. Although breeding could occur in the Development Area, Non Reserve Open Space and Reserve Open Space, none were recorded breeding onsite during surveys conducted in 1998 (Bloom 1999). The red-shouldered hawk is a NCCP covered species.

The golden eagle is a conditionally covered species under the NCCP. It may occasionally forage in the Protocol Area, although no foraging birds were recorded during the 2001 surveys. Nesting opportunities do not exist in the Development Area for the eagle but there may be some suitable nesting locations within PA 3. The nearest current or historic golden eagle nest site is in Black Star Canyon (Gallagher 1997) which is approximately four miles from the Development Area.

The peregrine falcon (*Falco mexicanus*) was formarly a state endangered species but was recently delisted as the population has recovered. The peregrine is also a NCCP covered species. This species was not recorded in the Impact Area or Reserve Lands during the 2001 surveys but may occasionally forage within the project area. Peregrines forage over open country in a variety of habitats, including grassland, marsh and scrub. They nest on cliffs, rock outcroppings or on the tops of buildings, usually near water. The only current nesting site in Orange County is in Newport Beach, on the top of a building (Hamilton and Willick 1996, Gallagher 1997). There are no potential nest sites within the project vicinity.

Another sensitive raptor is the burrowing owl. Burrowing owls require flat ground or rolling hills with short grass. Over grazed areas seem to be preferred. They nest in holes in the ground, which are usually made by California ground squirrels (*Citellus beecheyi*). Suitable habitat is limited in the Protocol Area and where grasslands do occur they generally do not consist of short grass due to the lack of grazing. There was no evidence from the surveys conducted in 2001 that burrowing owls occurred in the Protocol Area. Their potential for occurring in the Protocol Area is low. In addition, Gallager (1997) predicted that the burrowing owl would be extirpated from Orange County, outside Seal Beach National Wildlife Refuge, by the year 2000.

Six sensitive passerine species, California horned lark, cactus wren (already discussed), yellow warbler, yellow-breasted chat, southern California rufous-crowned sparrow and grasshopper sparrow were recorded in the Protocol Area during the 2001 surveys (Table 4). The rufous-crowned sparrow is a NCCP covered species.

Horned larks and rufous-crowned sparrows were recorded in the Development Areas, Non Reserve Open Space and Reserve Open Space during the 2001 surveys. The grasshopper sparrow was only recorded in Reserve Open Space but may also occur in the Development Area.

Yellow-breasted chats were recorded at one location in the Development Area in 2001. The chat utilized a Mexican elderberry woodland and an adjacent area of mulefat scrub in Planning Area 6. Yellow-breasted chats were recorded at three locations in Reserve Open Space in 2001. All three were detected in willow or mulefat scrub at Siphon Reservoir.

A few migrant yellow warblers were recorded in both the Development Area, at Planning Area 6, and in Reserve Open Space in 2001. Good quality habitat does occur in the Reserve Open Space for yellow warblers.

The loggerhead shrike was not recorded in 2001 but is presumed to occur in the Development Area, Non Reserve Open Space and Reserve Open Space as suitable nesting and foraging habitat occurs there for this species.

Mammals

A single sensitive mammalian species, the San Diego desert woodrat was recorded in the Protocol Area (Table 4, Appendix A). This species, which is covered under the NCCP/HCP, occupies cactus patches and rock outcroppings in coastal sage scrub and was recorded in both the Development Area and Reserve Open Space.

Focused mammal surveys were not conducted for this project and there is little specific data available on the usage of the Protocol Area by mammals. Therefore mammals, such as bats, pocket mouse and American badger, are not discussed here. Mammalian species whose habitat requirements coincide with those present in the Protocol Area are listed in Table 4.

A number of additional sensitive wildlife species, including coast range newt, Bell's sage sparrow and tricolored blackbird (*Agelaius tricolor*), have a medium or low potential to occur in the Protocol Area. These species are addressed in Table 4 but are not addressed in the text unless specific information on these species is available from the project vicinity. Although the habitat requirements of these species generally coincide with the existing native habitats located in the Protocol Area they have a low or medium potential to occur due to the size and nature of the existing habitat, the fact that they have not been recorded in the project vicinity in recent years and since there is no evidence to indicate they occur onsite currently.

3.7.6 Other wildlife

In total 121 wildlife species, including 5 amphibian, 13 reptile, 89 bird and 14 mammal species, were recorded in the Protocol Area during the current surveys and/or recent surveys conducted as part of the Nature Reserve of Orange County monitoring program (Appendix C). This is not an exhaustive list of the species that occur onsite as no surveys were conducted in fall or winter, or at night and, no trapping or other special techniques were used. Within the Reserve Open Space, 117 wildlife species, including 5 amphibian, 13 reptile, 85 bird and 14 mammal species, were recorded (Appendix C). In the Development Area 79 wildlife species, including 4 amphibian, 4 reptile, 62 bird and 9 mammal species, were recorded (Appendix C). In the Development Area most species were recorded in PA 6, few species were recorded in Planning Areas 5b, 8a and 9.

In addition to the threatened/endangered and sensitive species, the following NCCP covered species were recorded in the Protocol Area:

- coastal western whiptail lizard (*Cnemidophorus tigris multiscutatus*)
- coyote
- gray fox (*Urocyon cinereoargenteus*).

3.7.7 Wildlife corridors and habitat linkages

The Reserve Open Space within the Protocol Area is contiguous with more Reserve Open Space at Hicks Canyon, Rattlesnake Canyon and Loma Ridge to the northwest and with Loma Ridge, Limestone Canyon and upper Borrego Canyon to the northeast. These areas provide a linkage with Reserve Open Space further to the north, the North Ranch Policy Plan Area and the Cleveland National Forest. A wildlife movement corridor created as part of the mitigation for the construction of the Eastern Transportation Corridor is located just east of Siphon Reservoir. This corridor serves as a link between Siphon Reservoir and Reserve Open Space to the north and east of the Eastern Transportation Corridor. Due to this corridor and the contiguous nature of the habitat, wildlife can move freely throughout this entire Central subarea.

Another corridor, located where the Eastern Transportation Corridor crosses Agua Chinon Wash, serves to link Non Reserve Open Space within the Protocol Area with Reserve Open Space to the north of the corridor.

Table 4: Federal and state endangered, threatened and sensitive wildlife species which occurred or have the potential to occur in the Development Area (DA) and Non Reserve Open Space or Reserve Open Space (OS) within the Protocol Area. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area, FE = Federal endangered, FT = Federal threatened, SE = State endangered, CSC = California species of special concern, none = no federal or state listing.

Scientific Name	Common Name	Status	NCCP	DA	OS	Habitat
Euphydryas editha quino	quino checkerspot butterfly	FE	CC	low	low	scrub and chaparral habitats with openings containing host plant and nectar species
Taricha torosa torosa	coast range newt	CSC	NC	low	medium	scrub, chaparral, woodland; ponds, reservoirs and slow moving streams for breeding
Scaphiophis hammondi	western spadefoot toad	CSC	C	high	occurs	grassland, open habitats with sandy or gravelly soil; temporary rainpools for breeding
Clemmys marmorata pallida	southwestern pond turtle	CSC	NC	low	medium	slow-water aquatic habitats, ponds, marshes, rivers, streams and irrigation ditches
Phrynosoma coronatum blainvillei	San Diego horned lizard	CSC	C	occurs	occurs	sandy washes and open sandy areas within coastal sage scrub, grassland, chaparral, oak and riparian woodland
Eumeces skiltonianus interparietalis	Coronado skink	CSC	C	medium	occurs	mesic areas of coastal sage scrub, chaparral, grasslands and woodlands; heavily forested areas and dense brush avoided
Cnemidophorus hyperthrus beldingi	orange-throated whiptail	CSC	C	high	occurs	open, sparsely covered land, often with well-drained sandy or loose soils in coastal sage scrub, grassland, chaparral, oak woodland and riparian habitats
Anniella pulchra pulchra	silvery legless lizard	CSC	NC	medium	medium	chaparral, oak woodland, coastal sage scrub
Thammophis hammondii	two-striped garter snake	CSC	NC	low	low	associated with freshwater wetlands
Salvadora hexalepis virgultea	coast patch-nosed snake	CSC	NC	medium	medium	associated with brushy or shrubby vegetation
Crotalus ruber ruber	northern red-diamond rattlesnake	CSC	C	high	occurs	chamise, coastal sage scrub, desert slope scrub and other habitats with heavy brush associated large rocks or boulders
Phalacrocorax auritus	double-crested cormorant	CSC	NC	low	occurs	primarily coastal, but also utilize inland lakes
Plegadis chichi	white-faced ibis	CSC	NC	low	occurs	freshwater marshes, lake edges, irrigated fields, ditches and channels
Circus cyaneus	northern harrier	CSC	C	medium	medium	grassland, marshes, agricultural land, open areas in scrub and chaparral; ground or shrub nesting
Elanus caeruleus	white-tailed kite	CSC	NC	high	occurs	forages in grasslands; nests and roosts in oak and riparian woodland

Table 4, continued: Federal and state endangered, threatened and sensitive wildlife species which occurred or have the potential to occur in the Development Area (DA) and Non Reserve Open Space or Reserve Open Space (OS) within the Protocol Area. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area, FE = Federal endangered, FT = Federal threatened, SE = State endangered, CSC = California species of special concern, none = no federal or state listing.

Scientific Name	Common Name	Status	NCCP	DA	OS	Habitat
Accipter striatus	sharp-shinned hawk	CSC	C	high	high	wide variety of habitats used by wintering and migrating birds, but mostly associated with woodland and scrubland; breeds in mountains
Accipiter cooperi	Cooper's hawk	CSC	NC	occurs	occurs	mature forests, open woodlands, wood edges, river groves, riparian woodland
Buteo lineatus	red-shouldered hawk	none	C	occurs	high	riparian woodland specialist, oak and sycamore woodlands
Buteo regalis	ferruginous hawk	CSC	NC	medium	medium	plains, prairies, grasslands
Aquila chrysaetos.	golden eagle	CSC	CC	medium	medium	open mountains, foothills, plains, open country
Falco peregrinus	peregrine falcon	delisted	C	medium	medium	nest on cliffs or rock outcroppings, usually near water; forages over open country (grassland, scrub, marshes)
Speotyto cunicularia	burrowing owl	CSC	NC	low	low	grasslands, farmland and other open habitats
Asio flammeus	short-eared owl	CSC	NC	low	low	grasslands
Asio otus	long-eared owl	CSC	NC	low	low	widespread forager; nests in dense woodlands
Eremophila alpestris actia	California horned lark	CSC	NC	occurs	occurs	Open areas with little or no ground cover, such as grassland or ruderal vegetation
Campylorhynchus brunneicapillus	cactus wren	CSC	C	occurs	occurs	cactus patches and yucca within coastal sage scrub and chaparral habitats
Polioptila californica californica	California gnatcatcher	FT, CSC	C	occurs	occurs	coastal sage scrub
Empidonax trallii	willow flycatcher	FE[1], SE	CC	medium	occurs	dense riparian habitats, especially willow dominated woodland
Lanius ludovicianus	loggerhead shrike	CSC	NC	high	high	grassland, scrub and other open habitats with perching structures; nests in trees and shrubs
Vireo belli pusillus	least Bell's vireo	FE, SE	CC	occurs	occurs	dense riparian habitats, especially willow dominated woodland
Dendroica petechia brewsteri	yellow warbler	CSC	NC	occurs	occurs	riparian habitats, streams, wet thickets
Icteria virens	yellow-breasted chat	CSC	NC	occurs	occurs	riparian habitats, streams, wet thickets, marshes
Amphispiza belli belli	Bell's sage sparrow	CSC	NC	low	medium	primarily chaparral, also coastal sage scrub
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	CSC	C	occurs	occurs	grass covered hillsides in coastal sage scrub and chaparral

[1] only the southwestern subspecies *Empidonax trallii exttimus* is listed as Federally endangered.

Table 4, continued: Federal and state endangered, threatened and sensitive wildlife species which occurred or have the potential to occur in the Development Area (DA) and Non Reserve Open Space or Reserve Open Space (OS) within the Protocol Area. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area, FE = Federal endangered, FT = Federal threatened, SE = State endangered, CSC = California species of special concern, none = no federal or state listing.

Scientific Name	Common Name	Status	NCCP	DA	OS	Habitat
Ammodramus savannarum	grasshopper sparrow	none	NC	medium	occurs	grasslands
Agelaius tricolor	tricolored blackbird	CSC	NC	low	low	freshwater emergent marsh with nearby grasslands
Macrotus californicus	California leaf-nosed bat	CSC	NC	low	low	roosts in caves or old mines
Antrozous pallidus	pallid bat	CSC	NC	medium	high	coastal sage scrub, oak woodland and chaparral; roosts in caves, mines, rock crevices, trees and buildings
Eumops perotis californicus	California mastif bat	CSC	NC	medium	medium	widespread forager; roosts in cliffs and buildings
Lepus californicus bennettii	San Diego black-tailed jackrabbit	CSC	NC	medium	medium	coastal sage scrub, grassland and chaparral
Chaetodipus fallax fallax	northwestern San Diego pocket mouse	CSC	NC	medium	medium	coastal sage scrub, grassland and chaparral
Neotoma lepida intermedia	San Diego desert woodrat	CSC	C	occurs	occurs	cactus patches and rock outcroppings in coastal sage scrub
Onychomys torridus ramona	Ramona grasshopper mouse	CSC	NC	medium	medium	annual grassland and coastal sage scrub
Canis latrans	Coyote	none	C	occurs	occurs	widespread, habitat generalist
Taxidea taxus	American badger	CSC	NC	medium	occurs	widespread in natural habitats

4.0 POTENTIAL IMPACTS AND LEVELS OF SIGNIFICANCE

4.1 POTENTIAL IMPACTS

4.1.1 Potential impacts to CSS and federal/state listed and NCCP/HCP covered and conditionally covered species

The potential direct impacts of the proposed project on CSS and federal or state listed species and NCCP/HCP covered and conditionally covered species, are summarized in Table 5.

Table 5: Potential direct impacts of the proposed project on CSS and federal or state listed species and NCCP/HCP covered and conditionally covered species.

Habitat/ Species	Acreage/Numbers Impacted	NCCP Status
CSS [13]	175.9 acres	Fully Covered
California gnatcatcher	19 locations	Fully Covered
Cactus wren	8 locations	Fully Covered
least Bell's vireo	One pair	Conditionally Covered
Intermediate/Foothill Mariposa Lily	2 colonies (currently 28 individuals)	Conditionally Covered

4.1.2 Potential impacts to unlisted species and habitats

Direct impacts would occur to 25.7 acres of grasslands located in the project Development Area. All plant and animal species using grassland in the Development Area would also be directly impacted, including white-tailed kite and California horned lark. Grassland habitat for these species would no longer exist in the Development Area.

Direct impacts would occur to 8.8 acres of riparian habitat located in the project Development Area. All plant and animal species using riparian habitat in the Development Area would also be impacted, including white-tailed kite, Cooper's hawk, yellow warbler and yellow-breasted chat. Riparian habitat for these species would no longer exist in the Development Area.

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[13] This habitat includes coastal California gnatcatchers, cactus wren, and other CSS obligate species. Actual numbers of displaced individuals will depend on occupancy of habitat at time of project grading.

Direct impacts would occur to 2.0 acres of Mexican elderberry woodland located in the project Development Area. All plant and animal species using this woodland habitat in the Development Area would also be impacted, including yellow-breasted chat.

Direct impacts would occur to 0.4 acres of irrigation-fed wetlands and 0.17 acres of freshwater seep located in the project Development Area.

Direct impacts would also occur to two special status plant, the mud nama and the prostate spineflower. A population of Mud nama at Lambert Reservoir would be impacted by the proposed development. Three colonies of prostrate spineflower would be impacted by the proposed developoment. Three other special status plant specis that occur in the Protocol Area, the Catalina mariposa lily, many-stemmed dudleya and small-flowered microseris were not recorded in the Development Area and therefore no impacts would occur to these species.

Direct impacts may occur to potential breeding and foraging habitat of the western spadefoot toad. Although the toad was not recorded in the Development Area it is presumed to occur and, potential breeding and foraging habitat does exist in the Development Area. This habitat would be impacted by the proposed development and therefore it is likely that the project would impact toads.

Direct impacts may also occur to potential breeding and foraging habitat of the loggerhead shrike. Although the shrike was not recorded in the Development Area it is presumed to occur and, potential breeding and foraging habitat does exist in the Development Area. This habitat would be impacted by the proposed development, and therefore it is likely that the shrike would be impacted.

Chapparral, marsh and Cliff and Rock habitats are not present within the Development Area and therefore no impacts would occur to these habitats.

4.1.3 Potential impacts to wildlife corridors and habitat linkages

No wildlife corridors or habitat linkages would be impacted by the proposed project. The two wildlife corridors within the Protocol Area which serve as links across the Eastern Transportation Corridor would be unaffected by the proposed project. Wildlife movement and existing wildlife movement corridors were extensively reviewed during the planning phase of the NCCP/HCP. The location of future developments were considered during this review.

One of the design objectives of the NCCP reserve system was to provide linkages between core habitat areas and areas of locally high concentrations of target species. This connectivity assists in the proper functioning of the reserve system. The Central subarea reserve, which includes the Reserve Open Space within the Protocol Area, incorporates habitat linkages and corridors that serve to connect all of the important habitat blocks within the reserve into a contiguous Reserve System. The Reserve Open Space within the Protocol Area is contiguous with Reserve Open Space at Hicks Canyon, Rattlesnake Canyon and Loma Ridge to the northwest and with Loma Ridge, Limestone Canyon and upper Borrego Canyon to the northeast. These areas provide a linkage with Reserve Open Space further to the north, the North Ranch Policy Plan Area and the Cleveland National Forest. These habitat linkages provide connectivity throughout this area and provide for animal movement within the Central Reserve subarea.

No wildlife movement corridors or habitat linkages are located in the Development Area and therefore no impacts would occur.

4.1.4 Potential indirect and offsite impacts

In addition to direct impacts to habitats within the Development Areas, urban development adjacent to the NCCP Reserve creates certain potential indirect impacts to the biological resources in the Reserve. These potential impacts include; intrusion of humans and domestic pets into the Reserve, predation of sensitive wildlife by domestic animals, increase populations of species adapted to urban development (eg. raccoons, opossum, skunk) at the expense of more sensitive wildlife, increased fire risk and increased risk of invasion by exotic plant species.

Indirect impacts associated with construction activities include potential erosion on exposed slopes, sedimentation of watercourses, dust accumulation on native vegetation and increased dumping of trash and other pollutants.

4.2 SIGNIFICANCE OF POTENTIAL IMPACTS

4.2.1 Significance of potential impacts to CSS and federal/state listed and NCCP/HCP covered and conditionally covered species

Coastal Sage Scrub and associated species[14]

As explained in the Joint Programmatic EIR/EIS for the Central/Coastal Orange County NCCP, the NCCP Program was established by the California Legislature when it enacted the NCCP Act of 1991. The purpose of the NCCP Program is to provide long-term, regional protection of natural vegetation and wildlife diversity while allowing compatible land uses and appropriate development and growth. The NCCP process was initiated to provide an alternative to "single species" conservation efforts that were relied on prior to the NCCP Act. The shift in focus from single species, project-by-project conservation efforts to conservation planning at the natural community level was intended to facilitate regional protection of a range of species that inhabit a designated natural community, in this instance CSS.

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[14] This habitat includes coastal California gnatcatchers, cactus wren, and other CSS obligate species. Actual numbers of displaced individuals will depend on occupancy of habitat at time of project grading.

The evolution and focus of the NCCP Program was described by the State of California Resources Agency as follows (excerpted from the Resources Bulletin, “Natural Communities Conservation Planning: Questions and Answers”):

> “Experience over the 20-year life of the Federal Endangered Species Act (ESA) has shown that the results of listing species individually as threatened or endangered under the ESA often does not achieve its objectives. Such listings – despite intensive regulatory powers available under the law – do not necessarily assure the long-term survival of the species and can have serious economic consequences in affected regions. This is because the listing of a single species in a multi-species habitat makes it difficult for land management agencies and developers to determine how best to plan for all the species that may someday be in danger in that area. Bureaucratic indecision encouraged by this uncertainty can thwart not only needed private development, but also sound habitat management efforts crucial to species survival.
>
> The NCCP Program is an innovative State effort to protect critical habitat … before it becomes so fragmented or degraded by development and other use that a listing of individual species as threatened or endangered is required under the State or Federal Endangered Species Acts. The program is designed to save critical habitat and, at the same time, allow for reasonable economic activity and development on affected land, much of which is privately owned.
>
> The first application of NCCP is a pilot program in an ecosystem called Coastal Sage Scrub in southern California …. The ecosystem … is the home of the California gnatcatcher and more than 50 pother potentially threatened or endangered species.”

The IA allows incidental take of Covered Habitats and Identified Species based on a comprehensive conservation program that includes the conservation of over 18,500 acres of CSS in the Reserve, mitigation requirements in the IA, the adaptive management plan, and implementation of construction minimization measures such as: no grading during the breeding season and flushing of species immediately prior to clearing.

As described in the NCCP/HCP EIR/EIS the project specific and cumulative impacts that would occur to CSS in the Development Area have been mitigated to a level of less than significant through this NCCP Program. The direct and cumulative impacts to species associated with CSS, including the coastal California gnatcatcher and cactus wren, are also mitigated to a level of less than significant through this NCCP Program.

The clearing of the CSS within the Development Area would be undertaken outside of the breeding season which would allow the birds to relocate to other areas that are conserved by the NCCP/HCP plan. Adjacent areas include the 3,369 acres of CSS that would be preserved in the Protocol Area Open Space areas. Also, the 1,100 acres of CSS in the El Toro MCAS area would provide additional suitable habitat.

The proposed development of the Development Area is consistent with, and indeed was contemplated by, the NCCP. The NCCP was approved by the USFWS, CDFG, County of Orange, City of Irvine, and other governmental entities and agencies, as full and adequate mitigation for anticipated development impacts to CSS and its obligate species, including the coastal California gnatcatcher.

<u>Least Bell's vireo</u>
Impacts would occur to one pair of least Bell's vireos and to approximately 2.42 acres of habitat likely used by this pair, as well as to several small patches scattered throughout the Development Area, totaling another 2.97 acres. The habitat where the vireo pair was detected totaled 0.53 acres. This small area is close to the minimum territory size required for least Bell's vireo (USFWS 1998). It is unlikely that this area could support more than one vireo pair. The pair likely also used the two adjacent patches of woodland at the northeastern portion of Lambert Reservoir totaling 1.89 acres, as these were suitable for vireos. Most of the other areas where potentially suitable vireo habitat would be impacted were unlikely to support breeding pairs because these areas were typically small and contained few willows, being dominated mostly by mulefat scrub. One area of potentially suitable habitat (approx. 3.15 acres), within PA 6 that could support breeding vireos was located north of Portola Parkway and was part of a larger area of willow woodland, most of which would be protected as Non Reserve Open Space.

The vireo habitat in the Development Area consisted of several small patches that could support migrants and a very limited number of breeding birds. Higher quality vireo habitat occurred within the Protocol Area at Siphon Reservoir and offsite within the same watershed at Rattlesnake Reservoir, Peter's Canyon Reservoir, San Diego Creek at Spectrum V, Sand Canyon Wash, Mason Park and San Joaquin Marsh (Harmsworth Associates 1998a). These are the areas with potentially significant long term conservation value. The best vireo habitat in the Protocol Area was located at Siphon Reservoir (11.75 acres of riparian habitat) and in Round Canyon, just north of Portola Parkway (3.15 acres of riparian habitat). These areas would be preserved as Reserve Open Space (Siphon Reservoir) or Non Reserve Open Space (at Portola Parkway) and would not be impacted by the proposed project (all but 0.2 acres would be preserved).

The least Bell's vireo population has increased dramatically in California over the past decade, due to conservation efforts. When the USFWS listed the least Bell's vireo as an endangered species in 1986 the vireo population was estimated to be 300 pairs (Franzreb 1989) and is currently estimated to be in excess of 1,500 pairs throughout its range. This increase also occurred in Orange County (Harmsworth Associates 1998a) and appears to be continuing, as evidenced by the new locations documented during the current surveys. The impacts to the vireo pair must be set in the context of this increasing local and regional vireo population.

In conclusion, the least Bell's vireo habitat which would be impacted by the proposed development supports migrants and a very limited number of nesting birds in locations with lesser long term conservation value than Siphon Reservoir, Rattlesnake Reservoir or the other sites listed above. We would conclude that the Development Area is not an area of long term conservation value, however, under the NCCP, that final determination must be made by USFWS and CDFG.

Under the NCCP, Least Bell's vireo is a conditionally covered species, subject to specific requirements of the NCCP. If USFWS and CDFG determine that the Development Area is of lesser long term conservation value, potential impacts to least Bell's vireo within the Development Area would be covered under the NCCP/HCP, but would still require development of a special mitigation plan in consultation with USFWS, CDFG and the NCCP Non-Profit Corporation (NCCP/HCP IA, Section 8.3).

As provided in the NCCP Implementation Agreement:

> "Planned activities that would affect habitat of this species shall be consistent with a mitigation plan that: 1) addresses design modifications and other on-site measures that are consistent with the project's purposes, minimizes impacts, and provides appropriate feasible protections, 2) provides for compensatory habitat restoration/enhancement activities at an appropriate location (which may include land in the Reserve System or other open space) and which may include planting of riparian trees and shrubs and/or cowbird trapping, and 3) provides for monitoring and Adaptive Management of habitat, within the Reserve System including cowbird trapping, consistent with Chapter 5 of the NCCP/HCP. The mitigation plan will be developed in coordination with USFWS, CDFG, and the NCCP Non-Profit Corporation."

If the least Bell's vireo habitat is determined to be of long term conservation value, a Section (7) consultation or other appropriate authorization would be required to impact the habitat. Under either the NCCP/HCP, or a section (7) consultation or other appropriate authorization, absent adequate mitigation, direct impacts to the least Bell's vireo would be significant.

<u>Intermediate/Foothill Mariposa Lily</u>
Two colonies of the Intermediate/Foothill Mariposa Lily (consisting of 28 individuals) would be impacted by the proposed project. The Intermediate/Foothill mariposa lily is a conditionally covered species under the NCCP/HCP. Planned activities affecting populations smaller than 20 individuals are fully authorized and fully mitigated for by the NCCP/HCP plan. If activities will affect lily populations larger than 20 individuals, a mitigation plan must be prepared in consultation with CDFG and USFWS. Two colonies would be impacted by the proposed project. One consisted of a single individual and is therefore mitigated by the NCCP/HCP. The other consisted of 27 individuals and therefore a mitigation plan must be prepared under the terms of the NCCP/HCP.

The NCCP/HCP IA (Section 8.3) details the mitigation plan participating landowners must develop for planned activities that would affect populations larger than 20 individuals. The mitigation plan must; 1) address design modifications or other on-site measures that are consistent with the project's purposes, minimize impacts to the foothill mariposa lily habitat, and provide appropriate protections for any adjoining conserved foothill mariposa lily habitat, 2) provide for an evaluation of salvage, restoration/enhancement/management of other conserved mariposa lily, or other mitigation techniques to determine the most appropriate mitigation technique to offset impacts, and implement mitigation consistent with the foregoing evaluation, and, 3) provide for monitoring and adaptive management of foothill mariposa lily consistent with Chapter 5 of the NCCP/HCP, 4) the mitigation plan must be developed in coordination with USFWS, CDFG and the NCCP Non-Profit Corporation, and approved by the USFWS.

This mitigation plan, and the other conservation and mitigation measures of the NCCP/HCP, reduce the project impacts to a level of less than significant.

4.2.2 Significance of potential impacts to unlisted sensitive species/habitats

Riparian habitat

Significance Criteria and Overall Framework for riparian habitat
The project has been designed to avoid and preserve areas of riparian habitat that exhibit the highest levels of function; nevertheless, the project will result in unavoidable impacts to areas of fragmented and/or isolated stands of mulefat scrub and southern willow scrub. In order to evaluate the level of significance associated with the proposed impacts the criteria listed below have been applied to the impact analysis set forth below. Impacts affecting one or more of the following would be considered significant prior to mitigation.

- The loss of threatened or endangered species;
- The loss of sensitive habitats (as identified by the CNDDB);
- The loss of riparian resources subject to CDFG jurisdiction;
- Filling of wetlands subject to ACOE jurisdiction, and/or
- Filing of ephemeral drainages subject to ACOE and CDFG jurisdiction.

In order to provide an additional framework for evaluating impacts to wetlands, riparian habitat and other jurisdictional waters, this CEQA analysis has utilized two additional documents that address riparian habitat within the Protocol project area: 1) the *Assessment of Riparian Ecosystem Integrity in the San Diego Creek Watershed, Orange County, California*[15] and 2) *Planning Level Delineation and Geospatial Characterization*

[15] Smith, R. Daniel. 2000. *Assessment of Riparian Ecosystem Integrity in the San Diego Creek Watershed, Orange County, California*. Prepared for the ACOE of Engineers, Los Angeles District Regulatory Branch by the ACOE of Engineers Engineering Research and Development Center, Waterways Experiment Station, Vicksburg, Mississippi.

of Riparian Ecosystems of San Diego Creek Watershed, Orange County, California.[16] These documents have been recently prepared by the Army ACOE of Engineers Waterways Experiment Station (WES) for the Los Angeles District of the ACOE. These documents have been utilized in two ways. First, these documents provide a watershed-level context that allows for an evaluation that considers the hydrologic, water quality, and habitat value of upstream and downstream resources. Second, by using the data set forth by the ACOE and provided in the above-mentioned documents, Glenn Lukos Associates has prepared an analysis of the hydrologic, water quality, and habitat functions associated with the Protocol Area Open Space areas and Development Area (Appendix E).[17] The methodology and results set forth by the ACOE were utilized by GLA for a number of reasons: 1) they provide a quantitative tool for evaluating the jurisdictional resources, 2) the methodology is a recognized wetland/riparian assessment tool developed by a federal agency (the ACOE) that has been used in various parts of the country including a number of southern California areas (e.g., Camp Pendleton), 3) they are part of the assessment tools that the ACOE is utilizing to support the SAMP associated with the San Diego Creek Watershed, and 4) the methods were developed by the ACOE to evaluate areas of riparian habitat that extend beyond ACOE jurisdiction, extending to the limits CDFG jurisdiction, and in some instances beyond CDFG jurisdictional limits, providing a suitable tool for evaluating impacts to CDFG jurisdiction as well as ACOE jurisdiction.[18]

The Assessment conducted by the ACOE and utilized by GLA indicates that for hydrologic, water quality, and habitat function, "Integrity Indices" are substantially higher for the open space areas than for the Development Area.[19] The extent of the

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[16] Lichvar, Robert, Gregg Gustina, Dan MacDonald, and Mike Ericsson. 2000. *Planning Level Delineation and Geospatial Characterization of Riparian Ecosystems of San Diego Creek Watershed, Orange County, California.* Prepared by the Army ACOE of Engineers Engineering and Research Development Center and the Cold Regions Research and Engineering Laboratory, Hanover NH.

[17] Glenn Lukos Associates. 2001. *Riparian Ecosystem Integrity Assessment of Planning Areas 3, 5, 6, 8, and 9 (The Protocol Area) Including potential Development Areas and the Open Space.* Prepared for The Irvine Company (Volume 2).

[18] Smith, R. Daniel. 2000. *Assessment of Riparian Ecosystem Integrity in the San Diego Creek Watershed, Orange County, California*. Prepared for the ACOE of Engineers, Los Angeles District Regulatory Branch by the ACOE of Engineers Engineering Research and Development Center, Waterways Experiment Station, Vicksburg, Mississippi. See pages 6-8 for a discussion of riparian habitats and the scope of the assessment relative to ACOE and CDFG jurisdiction.

[19] In order to conduct the Assessment, the ACOE divided the San Diego Creek watershed into Riparian Reaches and associated sub-watersheds. Each Riparian Reach was evaluated for indicators of hydrologic, water quality, and habitat integrity that were the Assessment endpoints. Based upon the conditions identified for each Riparian Reach, an "Integrity" value or "Index" was calculated by the ACOE for each Riparian Reach. In determining the Integrity Index for each Riparian Reach, the Assessment considered the degree to which the Riparian Reaches exhibit characteristics typical of conditions that existed before cultural alteration. For each of the assessment endpoints (hydrology, water quality, and habitat) indicators

jurisdictional resources subject to ACOE and CDFG is substantially greater for both ACOE and CDFG within the Open Space areas than within Development Areas. Tables 6 and 7 provide a summary the hydrologic, water quality, and habitat functional capacities for the Proposed Development Areas (PDA) and Open Space Areas associated with the Protocol Area. Acreage totals for ACOE and CDFG jurisdiction are also provided in the tables[20]. Calculation of "Functional Capacity", as provided in the tables is, obtained multiplying the integrity index by the acreage of the aquatic feature under analysis. Calculation of the functional capacity in this manner is the standard practice when conducting functional assessments.[21]

As summarized in the tables, the functional capacity associated with hydrologic, water quality and habitat functions, exhibited by the drainage courses and associated riparian habitat within preserved open space substantially exceeds the same functions that would be impacted within the Development Area. For example, drainage courses and riparian areas subject to CDFG jurisdiction within open space portions of the project exhibits eight times greater functional capacity than habitat within the Development Area. Land use and conservation planning and project design have ensured that all medium and high quality riparian resources have been avoided and that only areas that exhibit low function will potentially be impacted by development.

Table 6: Summary of hydrologic, water quality and habitat functions for Protocol Area Development Areas and Open Space (Reserve and Non Reserve) associated with ACOE jurisdiction.

	Hydrologic Integrity			**Water Quality Integrity**			**Habitat Integrity**		
Area	Index 30 possible	Acres	Functional Capacity	Index 45 possible	Acres	Functional Capacity	Index 30 possible	Acres	Functional Capacity
PDA (West)	7.20	0.4	2.88	15.40	0.4	6.16	5.33	0.4	2.13
PDA (East)	13.90	5.62	78.14	22.38	5.62	125.76	8.55	5.62	48.07
Open Space	20.92	19.14	400.40	30.60	19.14	585.69	18.38	19.14	351.71

were examined and assigned a value from one to five, with five representing the highest value. Six separate indicators were examined for hydrologic and habitat integrity, while nine separate indicators were examined for water quality integrity. This equates to highest possible scores for each Riparian Reach of 30 for hydrologic and habitat integrity and 45 for water quality integrity.

[20] Acreages taken from jurisdictional report (Glenn Lukos Associates 2001, Volume 2).

[21] Smith, R. Daniel, Alan Ammann, Candy Bartoldus, and mark Brinson. *An Approach for Assessing Functions Using Hydrogeomorphic Classification, Reference Wetlands, and Functional Indice.*

Table 7: Summary of hydrologic, water quality and habitat functions for Protocol Area Development Areas and Open Space (Reserve and Non Reserve) associated with CDFG jurisdiction.

Area	**Hydrologic Integrity**			**Water Quality Integrity**			**Habitat Integrity**		
	Index 30 possible	Acres	Functional Capacity	Index 45 possible	Acres	Functional Capacity	Index 30 possible	Acres	Functional Capacity
PDA (West)	7.20	0.40	2.88	15.40	0.40	6.16	5.33	0.40	2.13
PDA (East)	13.90	11.57	160.85	22.38	11.57	258.93	8.55	11.57	98.94
Open Space	20.92	45.30	947.68	30.60	45.30	1,386.17	18.38	45.30	832.39

<u>Significance of impacts to riparian habitat</u>
A total of 8.8 acres of riparian habitat would potentially be impacted by project grading. As noted previously 4.70 acres of this riparian habitat is not subject to regulation by ACOE under Section 404 or CDFG under Section 1603 (Exhibit 8). Findings of significance are addressed below:

Of the 4.70 acres of riparian habitat not subject to regulation under Section 404 or Section 1603;

- The loss of the 2.11 acres that does not constitute least Bell's vireo habitat, would not be considered significant because 1) the loss would not result in impacts to least Bell's vireo or any federally or state-listed species or other special-status species; 2) the loss would not result in impacts to ACOE or CDFG jurisdictional areas; 3) this habitat (mulefat scrub) is not listed as a special-status vegetation association in the CNDDB, and 4) these areas exhibit very low habitat functional capacity and no hydrologic or water quality values because they are not associated with, or connected to aquatic features,
- The 0.7 acres of unoccupied least Bell's vireo habitat exhibits low hydrologic, water quality, and habitat integrity values due to isolation (it is not connected to upstream or downstream riparian resources), however, due to its potential to support vireos, loss of this 0.7 acre willow woodland would be considered significant. In order to avoid significant impacts, the project proponent is proposing mitigation measures that would require coordination with FWS, CDFG and the ACOE. Regardless of the significance finding, avoidance of this area is not warranted due to the low level of hydrologic, water quality, and habitat function exhibited,
- The 1.89-acre area of southern willow scrub that exhibited use by one pair of least Bell's vireo would be considered significant because of the presence of a listed species. In order to avoid significant impacts, the project proponent is proposing mitigation measures that would require coordination with FWS, CDFG and the ACOE, to avoid impacts to occupied vireo habitat areas.

Of the 4.10 acres of riparian habitat subject to regulation under Section 404 or Section 1603;

- Loss of the 1.29 acres that does not constitute least Bell's vireo habitat would not result in impacts to least Bell's vireo or any federally or state-listed species or other special-status species. These areas exhibit low hydrologic, water quality, and habitat integrity values. However, impacts to these habitat patches would be considered significant because of their CDFG jurisdictional status (0.05 acres of this habitat qualify as wetlands under ACOE jurisdiction). Regardless of the significance finding, avoidance of these areas is not warranted due to their low level of hydrologic, water quality, and habitat function.
- The 2.28 acres of unoccupied least Bell's vireo habitat occurs in several different drainages. One 0.2 acre area within the Development Area is adjacent to 2.95 acres of willow riparian habitat located in Open Space and located between Portola Parkway and SR 241. This 0.2 acre of habitat, when considered together with the 2.95 acres of habitat exhibits the potential for supporting least Bell's vireo and other sensitive avian species.[22] Impacts to this 0.2-acres would be considered significant. In order to avoid significant impacts, the project proponent is proposing mitigation measures that will require coordination with CDFG and the ACOE, and replacement, restoration, or enhancement or habitat. The remaining 2.08 acres of unoccupied least Bell's vireo habitat has a low potential to support vireos due to the small size of the patches. In addition these areas exhibits low hydrologic, water quality, and habitat integrity values. However, impacts to these habitat patches would be considered significant because of their CDFG jurisdictional status (0.21 acres of this habitat qualify as wetlands under ACOE jurisdiction). Regardless of the significance finding, avoidance of these areas is not warranted due to their low level of hydrologic, water quality, and habitat function.
- The 0.53-acre area of southern willow scrub that exhibited use by one pair of least Bell's vireo would be considered significant because of the presence of a listed species. In addition, this area was determined to exhibit wetland hydrology, soils, and vegetation and would be regulated by the ACOE as a jurisdictional riparian wetland, although it is not subject to CDFG jurisdiction under the 1603 program. In order to avoid significant impacts, the project proponent is proposing mitigation measures that would require coordination with FWS, CDFG and the ACOE, to avoid impacts to occupied vireo habitat areas.

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[22] Many of the listed and special-status avian species exhibit meta-population dynamics and isolated patches as small as one acre can provide refugia for individuals or pairs during years when other more suitable habitat areas are at carrying capacity. While such areas can be important in contributing to the overall stability of such meta-populations avoidance of specific areas is not as important as is maintaining the overall carrying capacity within a region through ensuring no-net-loss of suitable (or at least potentially suitable) habitat. It is important to note that there is no evidence that the 3.15-acre area has been used by listed or sensitive species; rather, surveys indicate that this area is not being used by listed or sensitive species. Nevertheless, because of its size (greater than one acre), it is capable of supporting least Bell's vireo and other special-status avian species at least on an occasional basis.

Finally, the project would impact 3.71 acres of ACOE jurisdiction, including 0.96 acres of jurisdictional wetlands (including the 0.17 acre freshwater seep and the 0.79 acres of riparian habitat noted above) and 2.75 acres of ephemeral drainage channels. The project would also impact 6.37 acres of CDFG jurisdiction, including 3.57 acres of riparian habitat (noted above) and 2.80 acres of ephemeral drainage channels. Regardless of the significance finding, avoidance of these areas is not warranted due to their low level of hydrologic, water quality, and habitat function.

Recommendations for riparian habitat

The largest areas of riparian habitat with the highest function and value, including Agua Chinon, are in non-development areas of the Protocol Area and are being avoided by land use and conservation planning as well as project design. An assessment of hydrologic, water quality, and habitat integrity and an evaluation of wetland function associated with the riparian areas within the open space and development areas indicate that the highest levels of ecosystem integrity and wetland function are associated with the proposed open space areas. The areas of riparian habitat that have not been avoided generally exhibit low measures of hydrologic, water quality and habitat integrity and because of the limited

Figure 8Exhibit 8: **Riparian areas subject to CDFG/ACOE jurisdiction within the Development Area.**

extent of these areas, also exhibit very limited function. The largest stand of riparian willow habitat within the development area has been largely avoided through land use and conservation planning as well as project design. The only riparian area occupied by least Bell's vireo in the development area is recommended for avoidance, which should be accomplished through proposed mitigation measures designed to assure avoidance at the tentative tract map level. In order to avoid significant impacts to riparian habitat associated with CDFG and ACOE jurisdiction, but not of vireo quality the project proponent is proposing mitigation measures that will require coordination with CDFG and the ACOE, and replacement, restoration, or enhancement or habitat. With mitigation, impacts to these areas can be reduced to a level below significance.

In addition to the substantial avoidance and preservation, it is recommended that the project should mitigate impacts by identifying key areas in the Protocol Area and/or off-site within the San Diego Creek Watershed where hydrologic, water quality, and habitat functions can be created, expanded, or enhanced to ensure a net increase in these functions in the post-project condition within the Development Area (as compared with existing conditions). In order to ensure non-net-loss of jurisdictional resources on an acre-for-acre basis, all impacted ACOE and CDFG jurisdiction will be compensated by restoration, enhancement or creation at a 1.25:1 ratio.

At this preliminary stage, three areas within the Protocol Area suggest potential as mitigation sites, these are located at;

- Agua Chinon south of the sedimentation basin,
- upland areas adjacent the 2.95 acres willow woodland north of Portola Parkway in Open Space,
- upland areas adjacent the three patches of riparian woodland which was occupied by vireos (if preserved).

<u>Grasslands</u>

The direct and cumulative impacts that would occur to grasslands and its associated species are not likely to be significant. Grasslands are not a major component of the Protocol Area. Only 25.7 acres of grassland would be impacted by the proposed project. A total of 380.5 acres would be preserved in the Reserve Open Space and a further 76.8 acres in Non Reserve Open Space of the Protocol Area. The 380.5 acres are part of the approximately 7,500 acres of grasslands that are included in the NCCP/HCP Reserve. These preserved grasslands, including the 457.3 acres within the Protocol Area, provide habitat for sensitive species that utilize grasslands and would reduce any impacts to a level of less than significant.

<u>Mexican elderberry woodland</u>

The direct impacts that would occur to Mexican elderberry woodland and its associated species are not likely to be significant. This habitat is found throughout the county. The plant and animal species found in this woodland are also typical of scrub, chaparral and riparian habitats. No unique flora or fauna occur in this habitat. The small area of Mexican elderberry woodland (2.0 acres) that would be impacted is less than significant.

Irrigation-fed wetland

The 0.4 acre irrigation-fed wetland that would be impacted is associated with agricultural runoff. The vegetation in the wetland consisted of herbaceous species and did not provide habitat for any federal or state listed or sensitive species. Species using the wetland are common and widespread. The impacts to any species using this wetland are not likely to be significant. This irrigation-fed wetland is not subject to ACOE jurisdiction.

Mud nama

A population of mud nama located at Lambert Reservoir[23] would be impacted by the proposed project. Mud nama is neither state or federally listed but is on the CNPS list 2, which means it is rare or endangered in California but common elsewhere. This species has recently been recorded at several other locations in Orange County, including a number of locations that are protected (Fairview Park, Emerald Canyon, Laguna Lakes, Chiquita Ridge, Provance *et al.* 2000, Bonkamp Pers. Comm.). Because agricultural water is not longer stored at Lambert Reservoir, it is unlikely that sufficient water will be available to allow the species to persist at Lambert even if the plant is not impacted by the proposed project. In addition, this site is degraded, as it was recently disked. Although this population would be impacted by the proposed project, due to the elimination of agricultural water storage of the site, the degraded nature of the site, and the extant populations in nearby protected areas, this impact is not likely to be significant.

Prostrate spineflower

Three colonies of prostrate spineflower would be impacted by the proposed development. Prostrate spineflower is neither state or federally listed but is on the CNPS list 4, which means it is of limited distribution and must be watched. It's CNPS R-E-D status is 1-2-2, which means it is rare but found in sufficient numbers and distributed widely enough that the potential for extinction is low at this time. In San Diego county the prostrate spineflower is regarded as stable and wide ranging (Reiser 1994), although it is apparently less common in Orange County. Habitat for this species (CSS and chaparral) would continue to exist within the Protocol Area in Non Reserve Open Space and in Reserve Open Space. Impacts to this species are not likely to be significant.

Western spadefoot toad

Any project specific and cumulative impacts that would occur to the western spadefoot toad habitat are not likely to be significant. No spadefoot toads were recorded in the Development Area although suitable habitat does occur there. Extant populations are known from three areas in Reserve Open Space within the Protocol Area. These populations, and others in the Reserve System, will provide for the continued existence of the toad in the NCCP/HCP area. Any impacts that would occur are therefore likely to be less than significant.

[23] Lambert Reservoir was artificially created in upland habitat and was used to store water for agricultural activities. Lambert no longer receives water for agricultural uses and the soils are expected to dry out over time.

White-tailed kite

Any project specific and cumulative impacts that would occur to the white-tailed kite habitat are not likely to be significant. No kites were recorded in the Development Area. Kites are unlikely to nest in the Development Area but probably do forage there. Loss of the limited foraging habitat (25.2 acres of grasslands) available in the Development Area is unlikely to significantly impact the white-tailed kite, in light of nearby habitat in Reserve Open Space.

Loggerhead shrike

Any project specific and cumulative impacts that would occur to the loggerhead shrike habitat are not likely to be significant. No shrikes were recorded in the Development Area in 2001 and there are no previous records for this area. Shrikes could possibly nest in the Development Area and probably do forage there. Loggerhead shrikes prefer relatively flat, open country with lookout posts and areas of dense vegetation for nest sites. Such habitat was present in PA 6. While the proposed project would result in the loss of this habitat, this is not likely to be significant as that the bird itself has not been recorded onsite, also suitable habitat would remain within the Reserve Open Space.

4.2.3 Significance of potential indirect and offsite impacts

Any indirect and offsite impacts to Reserve and Non Reserve Open Space are not likely to be significant. Any such impacts are mitigated by the NCCP/HCP (County of Orange, Environmental Management Agency 1996). Any mitigation plan developed for least Bell's vireo in consultation with USFWS and CDFG will have to take into account indirect impacts to the species.

5.0 ACKNOWLEDGEMENTS

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7.0 APPENDICES

7.1 APPENDIX A: EXPLINATION OF TABLE 4.

Explanation of how low, medium and high potential to occur assigned to wildlife species from Table 4. Definitions: DA = Development Area, OS = Non Reserve Open Space or Reserve Open Space, low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area.

Scientific Name	Common Name	DA	OS	Habitat
Euphydryas editha quino	quino checkerspot butterfly	low	low	No suitable habitat in Protocol Area and no larvae or adults recorded during focused surveys in 1998
Taricha torosa torosa	coast range newt	low	medium	Breeding habitat limited in development area, has not been recorded from project vicinity in recent years
Scaphiophis hammondi	western spadefoot toad	high	occurs	Suitable habitat present in development area and open space, recorded in open space
Clemmys marmorata pallida	southwestern pond turtle	low	medium	Habitat poor in development area, moderate in open space, absent during focused surveys conducted in 1998
Phrynosoma coronatum blainvillei	San Diego horned lizard	occurs	occurs	Recorded during current surveys
Eumeces skiltonianus interparietalis	Coronado skink	high	occurs	Suitable habitat present in development area and open space, recorded in open space
Cnemidophorus hyperthrus beldingi	orange-throated whiptail	high	occurs	Suitable habitat present in development area and open space, recorded in open space, widespread species
Anniella pulchra pulchra	silvery legless lizard	medium	medium	Suitable habitat present but species has not been recorded from project vicinity in recent years
Thammophis hammondii	two-striped garter snake	low	low	Suitable habitat limited
Salvadora hexalepis virgultea	coast patch-nosed snake	medium	medium	Suitable habitat present but species has not been recorded from project vicinity in recent years
Crotalus ruber ruber	northern red-diamond rattlesnake	high	occurs	Suitable habitat present in development area and open space, recorded in open space, widespread species

Explanation of how low, medium and high potential to occur assigned to wildlife species from Table 4. Definitions: DA = Development Area, OS = Non Reserve Open Space or Reserve Open Space, low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area.

Scientific Name	**Common Name**	**DA**	**OS**	**Habitat**
Phalacrocorax auritus	double-crested cormorant	low	occurs	No suitable habitat in development area, recorded in open space
Plegadis chichi	white-faced ibis	low	occurs	No suitable habitat in development area, recorded in open space
Circus cyaneus	northern harrier	medium	medium	Suitable habitat present but species has not been recorded from project vicinity in recent years
Elanus caeruleus	white-tailed kite	high	occurs	Suitable foraging habitat present in development area and open space, recorded in open space, unlikely to nest within development area
Accipter striatus	sharp-shinned hawk	high	high	Suitable habitat present in development area and open space, expected to forage onsite during migration and winter seasons
Accipiter cooperi	Cooper's hawk	occurs	occurs	Recorded during current surveys
Buteo lineatus	red-shouldered hawk	occurs	high	Suitable habitat present in development area and open space, recorded in development area
Buteo regalis	ferruginous hawk	medium	medium	Suitable foraging habitat present, small numbers winter in Orange County
Aquila chrysaetos.	golden eagle	medium	medium	Suitable foraging habitat present, no historic or current nest sites nearby
Falco peregrinus	peregrine falcon	medium	medium	Suitable foraging habitat present, no historic or current nest sites nearby
Speotyto cunicularia	burrowing owl	low	low	Suitable habitat limited and species has not been recorded from project vicinity in recent years
Asio flammeus	short-eared owl	low	low	Suitable habitat limited and species has not been recorded from project vicinity in recent years
Asio otus	long-eared owl	low	low	Suitable habitat limited in development area and species has not been recorded from project vicinity in recent years, also species now rare in Orange County
Eremophila alpestris actia	California horned lark	occurs	occurs	Recorded during current surveys
Campylorhynchus brunneicapillus	cactus wren	occurs	occurs	Recorded during current surveys
Polioptila californica californica	California gnatcatcher	occurs	occurs	recorded during current surveys
Empidonax trallii	willow flycatcher	medium	occurs	Suitable habitat present in development area and open space, migrants possible

Explanation of how low, medium and high potential to occur assigned to wildlife species from Table 4. Definitions: DA = Development Area, OS = Non Reserve Open Space or Reserve Open Space, low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2001 surveys and/or during other recent surveys in the Protocol Area.

Scientific Name	Common Name	DA	OS	Habitat
Lanius ludovicianus	loggerhead shrike	high	high	Suitable habitat present in development area and open space
Vireo belli pusillus	least Bell's vireo	occurs	occurs	recorded during current surveys
Dendroica petechia brewsteri	yellow warbler	occurs	occurs	recorded during current surveys
Icteria virens	yellow-breasted chat	occurs	occurs	recorded during current surveys
Amphispiza belli belli	Bell's sage sparrow	low	medium	Suitable limited in development area
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	occurs	occurs	Recorded during current surveys
Ammodramus savannarum	grasshopper sparrow	medium	occurs	grasslands
Agelaius tricolor	tricolored blackbird	low	low	Suitable habitat limited, no recent records
Macrotus californicus	California leaf-nosed bat	low	low	Suitable habitat limited, no recent records
Antrozous pallidus	pallid bat	medium	high	Suitable habitat present, especially in open space
Eumops perotis californicus	California mastif bat	medium	medium	Suitable habitat present in development area and open space
Lepus californicus bennettii	San Diego black-tailed jackrabbit	medium	medium	Suitable habitat present in development area and open space
Chaetodipus fallax fallax	northwestern San Diego pocket mouse	medium	medium	Suitable habitat present in development area and open space
Neotoma lepida intermedia	San Diego desert woodrat	occurs	occurs	Detected during current surveys
Onychomys torridus ramona	Ramona grasshopper mouse	medium	medium	Suitable habitat present in development area and open space,
Canis latrans	Coyote	occurs	occurs	Detected during current surveys
Taxidea taxus	American badger	medium	occurs	Suitable habitat present in development area and open space, recorded in open space

7.2 APPENDIX B: BOTANICAL INVENTORY OF PROTOCOL AREA.

SCIENTIFIC NAME	COMMON NAME
FERN AND FERN-ALLIES	
POLYPODIACEAE	**POLYPODY FAMILY**
Polypodium californicum	California Polypody
PTERIDACEAE	**BRAKE FAMILY**
Pellaea mucronata	Bird's Foot Cliff Brake
Pentagramma triangularis	Goldenback Fern
SELAGINELLACEAE	**SPIKE-MOSS FAMILY**
Selaginella bigelovii	Bigelow's Mossfern
PINACEAE	**PINE FAMILY**
Pinus sp.*	Ornamental Pine
ANGIOSPERMS-DICOTS	
AIZOACEAE	**FIG-MARIGOLD FAMILY**
*Mesembryanthemum crystallinum**	Crystalline Iceplant
AMARANTHACEAE	**AMARANTH FAMILY**
*Amaranthus albus**	Tumbleweed
ANACARDIACEAE	**SUMAC OR CASHEW FAMILY**
Malosma laurina	Laurel Sumac
Rhus integrifolia	Lemonadeberry
*Schinus molle**	Peruvian Pepper Tree
*Schinus terebinthifolius**	Brazilian Pepper Tree
Toxicodendron diversilobum	Poison Oak
APIACEAE	**CARROT FAMILY**
*Conium maculatum**	Poison Hemlock
Daucus pusillus	American Carrot
ASCLEPIADACEAE	**MILKWEED FAMILY**
Asclepias fascicularis	Narrow-leaf Milkweed
ASTERACEAE	**SUNFLOWER FAMILY**
Ambrosia acanthicarpa	Annual Bur Ragweed
Ambrosia psilostachya	Western Ragweed
Artemisia californica	Coastal Sagebrush
Artemisia douglasiana	Mugwort
Artemisia dracunculus	Tarragon/ Dragon Sagewort
Baccharis pilularis	Chaparral Broom/Coyote Brush
Baccharis salicifolia	Mulefat
Brickellia californica	California Brickelbush
*Carduus pynocephalus**	Italian Thistle/ Wild Artichoke
*Centaurea melitensis**	Tocalote
Chaenactis glabriuscula	Yellow pincushion
Chaenactis artemisiaefolia	Pincushion
*Chrysanthemum coronarium**	Garland/ Crown Daisy
Cirsum occidentale	Cobweb Thisle
*Cirsium vulgare**	Bull Thistle

*Conyza bonariensis**	Conyza
Conyza canadensis	Horseweed/Mare's Tail
*Cynara cardunculus**	Cardoon/ Artichoke Thistle
Encelia californica	California Encelia
Encelia farinosa	Incienso/ Brittlebush
Ericameria palmeri ssp. *pachylepis*	Grassland Goldenbush
Erigeron folisus	Fleabane
Eriophyllum confertiflorum	Golden Yarrow
Euthamia occidentalis	Western Goldenrod
Filago californica	California Fluffweed
*Filago gallica**	Narrow-leaved Filago
Gnaphalium californicum	California Everlasting
*Gnaphalium luteo-album**	Everlasting
Gnaphalium microcephalum	White Everlasting
Gutierrezia sarothrae	Matchweed
Helianthus annuus	Common Sunflower
Hemizonia fasciculata	Fascicled Tarweed
Heterotheca grandiflora	Telegraph Weed
*Hypochoeris glabra**	Smooth Cat's Ear
Isocoma menziesii	Goldenbush
*Lactuca serriola**	Prickly Lettuce
Lessingia filaginifolia	California Aster
Malacothrix saxatilis	Cliff Malacothrix
Microseris douglasii ssp. *platycarpha*	Small flowered microseris
Microseris heterocarpa	Microseris
Osmadenia tenella	Osmadenia
*Picris echioides**	Bristly Ox Tongue
Pluchea odorata	Salt Marsh Fleabane
*Pulicaria paludosa**	Spanish Sunflower
Rafinesquia californica	California Chicory
*Senecio vulgaris**	Common Groundsel
*Silybum marianum**	Milk Thistle
*Sonchus asper**	Prickly Sow-thistle
*Sonchus oleraceus**	Common Sow-thistle
Stephanomeria exigua	Wreath plant
Stephanomeria virgata	Tall Stephanomeria
Stylocline gnaphalioides	Everlasting Next Straw
Uropappus lindleyi	Silver Puffs
Xanthium strumarium	Cocklebur
BORAGINACEAE	**BORAGE FAMILY**
Amsinckia menziesii ssp. *intermedia*	Fiddleneck
Cryptantha intermedia	Popcorn Flower
Cryptantha maritima	Popcorn Flower
Heliotropium curassavicum	Salt Heliotrope
Plagiobothrys sp.	Popcornflower

BRASSICACEAE	**MUSTARD FAMILY**
*Hirschfeldia incana**	Summer Mustard
*Brassica nigra**	Black Mustard
*Brassica tournefortii**	Mustard
Caulanthus heterophyllus	San Diego Jewel Flower
Descuriana pinnata	Yellow Tansy Mustard
Lepidium nitidum	Peppergrass
*Raphanus sativus**	Radish
Rorippa curvisiliqua	Yellow Cress/ Water Cress
*Rorippa nasturtium-aquaticum**	Water Cress
CACTACEAE	**CACTUS FAMILY**
*Opuntia ficus-indica**	Indian-fig
Opuntia littoralis	Coastal Prickly Pear
Opuntia prolifera	Coast Cholla
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**
Lonicera sp.*	Honeysuckle
Sambucus mexicana	Mexican Elderberry
CARYOPHYLLACEAE	**PINK FAMILY**
*Silene gallica**	Catchfly/ Campion
Silene laciniata ssp. *major*	Southern Pink/Mexican Pink
*Spergularia villosa**	Sand-spurrey
CHENOPODIACEAE	**GOOSEFOOT FAMILY**
Atriplex californica	California Saltbush
*Atriplex semibaccata**	Australian Saltbush
*Chenopodium ambrosioides**	Mexican Tea
Chenopodium californicum	California Goosefoot
*Chenopodium murale**	Goosefoot/ Pigweed
*Salsola tragus**	Russian Thistle
CONVOLVUACEAE	**MORNING-GLORY FAMILY**
Calystegia macrostegia	Morning-glory
*Convolvulus arvensis**	Bindweed
CRASSULACEAE	**STONECROP FAMILY**
Crassula connata	Pygmy-weed
Dudleya lanceolata	Lanceleaved Dudleya
Dudleya multicaulis (sensitive)	Many-stemmed Dudleya
Dudleya pulverulenta	Chalk Dudleya
CUCURBITACEAE	**GOURD FAMILY**
Cucurbita foetidissima	Calabazilla
Marah macrocarpus	Wild Cucumber
CUSCUTACEAE	**DODDER FAMILY**
Cuscuta californica var. *californica*	California Witch's Hair
EUPHORBIACEAE	**SPURGE FAMILY**
Chamaesyce albomarginata	Rattlesnake Weed
Croton californicus	California Croton
Eremocarpus setigerus	Dove Weed
*Ricinus communis**	Castor Bean
FABACEAE	**LEGUME FAMILY**

Acacia sp.*	Acacia
Lotus purshianus	Spanish Lotus
Lotus scoparius	Deer Weed
Lotus strigosus	Hairy Lotus
Lupinus succulentus	Arroyo Lupine
*Medicago polymorpha**	California Burclover
*Melilotus alba**	White Sweetclover
*Melilotus indica**	Yellow Sweet Clover
FAGACEAE	**OAK FAMILY**
Quercus agrifolia var. *agrifolia*	Coast Live Oak
Quercus berberidifolia	Scrub Oak
GENTIANACEAE	**GENTIAN FAMILY**
Centaurium venustum	Canchalagua
GERANIACEAE	**GERANIUM FAMILY**
*Erodium botrys**	Long-beaked Filaree
*Erodium cicutarium**	Red-stemmed Filaree
GROSSULARIACEAE	**GOOSEBERRY FAMILY**
Ribes speciosum	Fuchsia-flowered Gooseberry
HYDROPHYLLACEAE	**WATERLEAF FAMILY**
Eucrypta crysanthemifolia	Common Eucrypta
Nama stenocarpum (sensitive)	Mud Nama
Phacelia parryi	Parry's Phacelia
Phacelia ramosissima var. *latifolia*	Branhcing Phacelia
LAMIACEAE	**MINT FAMILY**
*Marrubium vulgare**	Horehound
Salvia apiana	White Sage
Salvia mellifera	Black Sage
Trichostema lanceolatum	Vinegar Weed
MALVACEAE	**MALLOW FAMILY**
Malacothamnus fasciculatus	Mesa Bushmallow
*Malva parviflora**	Cheeseweed/ Little Mallow
Malvella leprosa	Alkali Mallow/ Whiteweed
MYOPORACEAE	**MYOPORUM FAMILY**
*Myoporum laetum**	Myoporum
MYRTACEAE	**MYRTLE FAMILY**
Eucalyptus sp.*	Eucalyptus/ Gum Tree
NYCTAGINACEAE	**FOUR O'CLOCK FAMILY**
Mirabilis californica	California Wishbone Bush
ONAGRACEAE	**EVENING PRIMROSE FAMILY**
Camissonia hirtella	Primrose
Clarkia purpurea	Four-spot Clarkia
Epilobium canum ssp. *canum*	Narrow-leaved Fucshia
Epilobium ciliatum	Green Willow Herb
*Gaura coccinea**	Scarlet gaura
PLANTAGINACEAE	**PLANTAIN FAMILY**

Plantago erecta	California Plantain
Plantago ovata	Woolly Plantain
PLATANACEAE	**PLANE TREE, SYCAMORE FAMILY**
Platanus racemosa	Western Sycamore
POLEMONIACEAE	**PHLOX FAMILY**
Eriastrum sapphirinum	Sapphire Woolly-Star
Navarretia hamata spp. *leptantha*	Skunkweed
POLYGONACEAE	**BUCKWHEAT FAMILY**
Chorizanthe procumbens (sensitive)	Prostrate Spineflower
Chorizanthe staticoides	Turkish Rugging
Eriogonum fasciculatum	California Buckwheat
Eriogonum gracile	Slender Eriogonum
*Polygonum arenastrum**	Common Knotweed
Polygonum lapathifolium	Pale Smartweed
*Rumex crispus**	Curly Dock
PORTULACACEAE	**PURSLANE FAMILY**
*Portulaca oleraceae**	Common Purslane
PRIMULACEAE	**PRIMROSE FAMILY**
*Anagallis arvensis**	Scarlet Pimpernel
RHAMNACEAE	**BUCKTHORN FAMILY**
Rhamnus ilicifolia	Holly-leaved redberry
ROSACEAE	**ROSE FAMILY**
Heteromeles arbutifolia	Toyon/ Christmas Berry
RUBIACEAE	**MADDER FAMILY**
Galium angustifolium	Bedstraw
SALICACEAE	**WILLOW FAMILY**
Salix gooddingii	Goodding's Black Willow
Salix laevigata	Red Willow
Salix lasiolepis	Arroyo Willow
SCROPHULARIACEAE	**FIGWORT FAMILY**
Castilleja exserta	Purple Owl's Clover
Keckiella antirrhinoides	Yellow Bush Penstemon
Keckiella cordifolia	Heart Leaved Bush Penstemon
Mimulus aurantiacus	San Diego Monkey Flower
Mimulus brevipes	Slope semaphore
Mimulus guttatus	Common Monkey Flower
Mimulus pilosus	Downy Monkey Flower
Scrophularia californica	California Bee Plant
*Veronica anagallis-aquatica**	Water Speedwell
Veronica peregrina	Mexican Speedwell
SOLANACEAE	**NIGHTSHADE FAMILY**
*Nicotiana glauca**	Tree Tobacco
Nicotiana quadrivalvis	Tobacco
Solanum douglasii	Douglas' Nightshade
Solanum xanti	Purple Nightshade
*Lycopersion escultentum**	Tomato
TAMARICACEAE	**TAMARISK FAMILY**

Tamarix sp.*	Salt Cedar/ Tamarisk
VERBENACEAE	**VERVAIN FAMILY**
Verbena lasiostachys	Western Verbena
ZYGOPHYLLACEAE	**CALTROP FAMILY**
*Tribulus terrestris**	Puncture Vine/ Caltrop
ANGIOSPERMS-MONOCOTS	
ARECACEAE	**PALM FAMILY**
Washingtonia sp.*	Fan Palm
CYPERACEAE	**SEDGE FAMILY**
Cyperus eragrostis	Tall umbrella sedge
Cyperus esculentus	Yellow Umbrella sedge
Eleocharis sp.	spikerush
Scirpus californicus	California Bulrush
Scirpus robustus	Robust Bulrush
IRIDACEAE	**IRIS FAMILY**
Sisyrinchium bellum	Blue-eyed Grass
JUNCACEAE	**RUSH FAMILY**
Juncus bufonius	Common Toad Rush
Juncus mexicanus	Mexican Rush
LEMNACEAE	**DUCKWEED FAMILY**
Lemna sp.	Duckweed
LILIACEAE	**LILY FAMILY**
Agave sp.*	Agave
Aloe sp.*	Ornamental Aloe
Bloomeria crocea	Common Goldenstar
Calochortus catalinae (sensitive)	Catalina Mariposa Lily
Calochortus splendens	Splendid Mariposa Lily
Calochortus weedii var. *intermedius* (sensitive)	Intermediate Mariposa Lily
Chlorogalum pomeridianum	Wavy Leaved Soap Plant
Chlorogalum parviflorum	Small Flowered Soap Plant
Dichelostemma capitatum	Blue Dicks
Yucca sp.*	Spanish Bayonet
Yucca whipplei	Our Lord's Candle
POACEAE	**GRASS FAMILY**
Achnantherum coronata	Giant Needlegrass
*Agrostis viridis**	Water Bent Grass
Agrostis pallens	San Diego Bentgrass
Aristida pupurea	Three-awn
*Avena fatua**	Wild Oat
Botriochloa barbinoides	silver beard grass
*Brachypodium distachyon**	Purple False Brome
*Bromus diandrus**	Ripgut Grass
*Bromus hordeaceus**	Soft Chess
Bromus madritensis ssp. *rubens**	Red Brome/ Foxtail Chess

*Cynodon dactylon**	Bermuda Grass
Digitaria sp.*	Crab Grass
Distichilis spicata	Salt Grass
Hordeum murinum ssp. *leporinum**	Mediterranean Barley
Koeleria macrantha	Junegrass
*Lamarckia aurea**	Goldentop
Leptochloa uninervia	Dense flowered sprangletop
Leymus condensatus	Giant Wild Rye
*Lolium multiflorum**	Italian Ryegrass
*Lolium temulentum**	Darnel Ryegrass
Melica imperfecta	Coast Range Melic
Muhlenbergia microsperma	Littleseed Muhly
Muhlenbergia rigens	Deergrass
Nassella lepida	Foothill Needlegrass
Nassella pulchra	Purple Needlegrass
*Pennisetum setaceum**	African Fountaingrass
*Poa annua**	Annual Bluegrass
*Polypogon monspeliensis**	Rabbitfoot Grass
*Vulpia myuros var. hirsuta**	Foxtail Fescue/ Vulpia
TYPHACEAE	**CATTAIL FAMILY**
Typha angustifolia	Narrow-leaved Cattail
Typha latifolia	Broad-leaved Cattail
** denotes non-native species*	

7.3 APPENDIX C: Wildlife species recorded in the Protocol Area Development Area (DA) and Non Reserve Open Space/Reserve Open Space (OS) in spring/summer 2001. Species recorded during other recent surveys dented by *.

SCIENTIFIC NAME	COMMON NAME	DA	OS
PELOBATIDAE	**SPADEFOOT TOADS**		
Scaphiopus hammondii	western spadefoot toad		X*
BUFONIDAE	**TRUE TOADS**		
Bufo boreas	western toad	X	X
HYLIDAE	**TREEFROGS**		
Hyla cadaverina	California treefrog	X	X
Hyla regilla	Pacific treefrog	X	X
RANIDAE	**TRUE FROGS**		
Rana catesbeiana	bullfrog	X	X
IGUANIDAE	**IGUANIDS**		
Sceloporus occidentalis	western fence lizard	X	X
Uta stansburiana	side-blotched lizard	X	X
Phrynosoma coronatum blainvillei	San Diego horned lizard	X	X
SCINCIDAE	**SKINKS**		
Eumeces gilberti	Gilbert Skink		X*
Eumeces skiltonianus	western Skink		X*
TEIIDAE	**WHIPTAILS**		
Cnemidophorus hyperythrus	orange throated whiptail		X
Cnemidophorus tigris multiscutatus	coastal western whiptail		X
ANGUIDAE	**ALLIGATOR LIZARDS**		
Elgaria multicarinatus	southern alligator lizard		X*
ANNIELLIDAE	**LEGLESS LIZARDS**		
Anniella pulchara	California legless lizard		X*
COLUBRIDAE	**COLUBRIDS**		
Masticophis lateralis	striped racer		X*
Pituophis melanoleucus	gopher snake	X	X
VIPERIDAE	**VIPERS**		
Crotalus atrox	western diamondback rattlesnake		X
Crotalus ruber ruber	northern red-diamond rattlesnake		X
PODICIPEDIDAE	**GREBES**		
Podilymbus podiceps	pied-billed grebe		X
Aechmophorus occidentalis	western grebe		X
PHALACROCORACIDAE	**CORMORANTS**		
Phalacrocorax auritus	double crested cormorant		X
ARDEIDAE	**HERONS & BITTERNS**		
Ardea herodias	great blue heron		X
Casmerodius albus	great egret	X	X

SCIENTIFIC NAME	**COMMON NAME**	**DA**	**OS**
Egretta thula	snowy egret	X	X
Nycticorax nycticorax	black-crowned night-heron		X
THRESKIORNITHIDAE	**IBISES AND SPOONBILLS**		
Plegadis chichi	white-faced ibis		X
ANATIDAE	**SWANS, GEESE & DUCKS**		
Anas platyrhynchos	mallard	X	X
Oxyura jamaicensis	ruddy duck		X
CATHARTIDAE	**AMERICAN VULTURES**		
Cathartes aura	turkey vulture	X	X
ACCIPITRIDAE	**KITES, HAWKS, EAGLES & VULTURES**		
Elanus caeruleus	white-tailed kite		X
Accipiter cooperii	cooper's hawk	X	X
Buteo jamaicensis	red-tailed hawk	X	X
Buteo lineatus	red-shouldered hawk	X	
FALCONIDAE	**FALCONS**		
Falco sparverius	American kestrel	X	X
PHASIANIDAE	**PHEASANTS, PARTRIDGES & QUAIL**		
Callipepla californica	California quail	X	X
RALLIDAE	**RAILS & COOTS**		
Fulica americana	American coot		X
CHARADRIIDAE	**PLOVERS**		
Charadrius vociferus	killdeer	X	X
LARIDAE	**SKUAS, GULLS & TERNS**		
Sterna forsteri	Forester's tern		X
COLUMBIDAE	**PIGEONS & DOVES**		
Zenaida macroura	mourning dove	X	X
Colmbina passerina	common ground dove	X	X
Columba livia	rock dove	X	X
CUCULIDAE	**CUCKOOS & ROADRUNNERS**		
Geococcyx californianus	greater roadrunner	X	X
STRIGIDAE	**OWLS**		
Bubo virginianus	great horned owl		X
CAPRIMULGIDAE	**GOATSUCKERS**		
Chordeiles acutipennis	lesser nighthawk	X	X
Phalaenoptilus nuttallii	common poorwill	X	X
APODIDAE	**SWIFTS**		
Aeronautes saxatalis	white-throated swift	X	X
TROCHILIDAE	**HUMMINGBIRDS**		
Archilochus alexandri	black-chinned hummingbird		X*
Calypte anna	Anna's hummingbird	X	X

SCIENTIFIC NAME	COMMON NAME	DA	OS
Calypte costae	Costa's hummingbird	X	X
PICIDAE	**WOODPECKERS**		
Melanerpes formicivorus	acorn woodpecker		X
Colaptes auratus	northern flicker		X
Picoides nuttallii	Nuttall's woodpecker	X	X
TYRANNIDAE	**TYRANT FLYCATCHERS**		
Tyrannus verticalis	western kingbird	X	X
Myiarchus cinerascens	ash-throated flycatcher	X	X
Contopus sordidulus	western wood-pewee		X*
Empidonax hammondii	Hammond's flycatcher		X*
Sayornis nigricans	black phoebe	X	X
Sayornis saya	Say's phoebe	X	
Empidonax difficilis	Pacific-slope flycatcher	X	X
ALAUDIDAE	**LARKS**		
Eremophila alpestris	horned lark	X	X
HIRUNDINIDAE	**SWALLOWS**		
Hirundo pyrrhonota	cliff swallow	X	X
Stelgidopteryx serripennis	northern rough-winged swallow	X	X
Hirundo rustica	barn swallow	X	
CORVIDAE	**CROWS, JAYS**		
Corvus brachyrhynchos	American crow	X	X
Corvus corax	common raven	X	X
Aphelocoma californica	western scrub jay	X	X
AEGITHALIDAE	**BUSHTIT**		
Psaltriparus minimus	common bushtit	X	X
TROGLODYTIDAE	**WRENS**		
Troglodytes aedon	house wren		X
Thryomanes bewickii	Bewick's wren	X	X
Campylorhynchus brunneicapillus	cactus wren	X	X
MUSCICAPIDAE	**THRUSHES, OLD WORLD WARBLERS**		
Catharus ustulatus	Swainson's thrush		X*
Turdus migratorius	American robin	X	
Polioptila caerulea	blue-gray gnatcatcher		X*
Polioptila californica	California gnatcatcher	X	X
Chamaea fasciata	wrentit	X	X
MIMIDAE	**MOCKINGBIRDS & THRASHERS**		
Mimus poolyglottos	northern mockingbird	X	X
Toxostoma crissale	California thrasher	X	X
PTILOGONATIDAE	**SILKY-FLYCATCHERS**		
Phainopepla nitens	phainopepla	X	X

SCIENTIFIC NAME	COMMON NAME	DA	OS
STURNIDAE	**STARLINGS**		
Sturnus vulgaris	European starling	X	X
VIREONIDAE	**VIREOS**		
Vireo huttoni	Hutton's vireo		X*
Vireo gilvus	warbling vireo		X*
Vireo bellii pusillus	Least Bell's vireo	X	X
EMBERIZIDAE	**WOOD WARBLERS, SPARROWS, NEW WORLD FINCHES & BLACKBIRDS**		
Dendroica townsendi	Townsend's warbler		X*
Dendroica petechia	yellow warbler	X	X
Vermivora celata	orange-crowned warbler		X
Geothlypis trichas	common yellowthroat	X	X
Wilsonia pusilla	Wilson's warbler	X	X
Icteria virens	yellow-breasted chat	X	X
Piranga ludovicianus	western tanager		X*
Pheucticus melanocephalus	black-headed grosbeak		X
Guiraca caerulea	blue grosbeak	X	X
Passerina ciris	lazuli bunting	X	X
Chondestes grammacus	lark sparrow	X	
Aimophila ruficeps	rufous-crowned sparrow	X	X
Spizella atrogularis	black-chinned sparrow		X*
Ammodramus savannarum	grasshopper sparrow		X
Melospiza melodia	song sparrow	X	X
Pipilo erythrophthalmus	spotted towhee	X	X
Pipilo crissalis	California towhee	X	X
Euphagus cyanocephalus	brewer's blackbird	X	
Agelaius phoeniceus	red-winged blackbird	X	X
Sturnella neglecta	western meadowlark	X	X
Molothrus ater	brown headed cowbird	X	X
Icterus galbula bullocki	bullocks oriole	X	X
Icterus cucullatus	hooded oriole	X	X
FRINGILLIDAE	**OLD WORLD FINCHES**		
Carpodacus mexicanus	house finch	X	X
Carduelis psaltria	lesser goldfinch	X	X
Carduelis tristis	American goldfinch		X
DIDELPHIIDAE	**OPOSSUMS**		
Didelphis marsupialis	opossum		X*
PROCYONIDAE	**RACOONS & COATIS**		
Procyon lotor	raccoon	X	X
MUSTELIDAE	**WEASELS, SKUNKS**		

SCIENTIFIC NAME	**COMMON NAME**	**DA**	**OS**
Taxidea taxus	badger		X*
Mephitis mephitis	striped skunk		X*
CANIDAE	**DOGS, WOLVES, FOXES**		
Canis latrans	coyote	X	X
Urocyon cinereoargenteus	gray fox	X	X
FELIDAE	**CATS**		
Felis concolor	mountain lion		X*
Lynx rufus	bobcat		X
SCIURIDAE	**SQUIRRELS**		
Citellus beecheyi	California ground squirrel	X	X
CRICETIDAE	**MICE, RATS, LEMMINGS, VOLES**		
Peromyscus maniculatus	deer mouse	X	X
Neotoma lepida intermedia	San Diego desert woodrat	X	X
LEPORIDAE	**HARES, RABBITS**		
Sylvilagus audubonii	desert cottontail	X	X
Sylvilagus bachmani	brush rabbit	X	X
CERVIDAE	**DEER**		
Odocoileus hemionus	mule deer	X	X

7.4 APPENDIX D: CALIFORNIA NATIVE PLANT SOCIETY CATEGORIES

CNPS Status based on California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California (Skinner and Pavilk 1994):

List 1A: Plants Presumed Extinct in California

The plants of List 1A are presumed extinct because they have not been seen or collected in the wild for many years. Although most of them are restricted to California, a few are found in other states as well. There is a difference between "extinct" and "extirpated." A plant is extirpated if it has been locally eliminated. It may be doing quite nicely elsewhere in its range. All of the plants constituting List 1A meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection) of the California Department of Fish and Game Code and are eligible for state listing.

List 1B: Plants Rare, Threatened or Endangered in California and Elsewhere

The plants of List 1B are rare throughout their range. All but a few are endemic to California. All of them are judged to be vulnerable under present circumstances or to have a high potential for becoming so because of their limited or vulnerable habitat, their low numbers of individuals per population (even through they may be wide ranging), or their limited number of populations. All of the plants constituting List 1B meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection) of the California Department of Fish and Game Code and are eligible for state listing.

List 2: Plants Rare, Threatened or Endangered in California, But More Common Elsewhere

Except for being common beyond the boundaries of California, the plants of List 2 would have appeared on List 1B. Based on the "Native Plant Protection Act," plants are considered without regard to their distribution outside the state. All of the plants constituting List 2 meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection) of the California Department of Fish and Game Code and are eligible for state listing.

List 3: Plants About Which We Need More Information—A Review List

The plants that comprise List 3 are an assemblage of taxa that have been transferred from other lists or that have been suggested for consideration. The necessary information that would assign most to a sensitivity category is missing.

List 4: Plants of Limited Distribution—A Watch List

The plants in this category are of limited distribution in California and their vulnerability or susceptibility to threat appears low at this time. While these plants cannot be called "rare" from a statewide perspective, they are uncommon enough that their status should be monitored regularly. Many of them may be significant locally. Should the degree of endangerment or rarity of a plant change, they will be transferred to a more appropriate list.

R-E-D Code

R (Rarity)

1. Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction or extirpation is low at this time.
2. Occurrence confined to several populations or to one extended population.
3. Occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported.

E (Endangerment)

1. Not endangered
2. Endangered in a portion of its range
3. Endangered throughout its range

D (Distribution)

1. More or less widespread outside of California
2. Rare outside California
3. Endemic to California

1.0 INTRODUCTION

This report (Volume 3 of the Protocol Area report) summarizes the results of biological surveys conducted in 2000 and 2001 in Implementation Area P, which is within the northeastern sphere of influence of the city of Irvine. The surveys involved:

- Vegetation mapping throughout Implementation Area P,
- Rare plant surveys throughout Implementation Area P,
- General wildlife inventories and habitat assessments throughout Implementation Area P,
- Focused least Bell's vireo (*Vireo bellii pusillus*) and willow flycatcher (*Empidonax trailli*) surveys in that part of Implementation Area P containing potential habitat for those specialized species.

Given the absence of habitat in Implementation Area P suitable for the Pacific pocket mouse (*Perognathus longimembris pacificus*), southwestern arroyo toad (*Bufo microscaphus californicus*), Riverside and San Diego fairy shrimps (*Streptocephalus woottoni* and *Branchinecta sandiegonesis*), golden eagle (*Aquila chrysaetos*), and prairie falcon (*Falco mexicanus*), focused surveys were not conducted for these species. Nonetheless, those species were considered in the general wildlife inventory survey efforts.

Implementation Area P will ultimately be dedicated to the city of Irvine or its designee, consistent with the city General Plan and the NCCP[1]. The dedication will be in accordance with the requirements of the Protocol Agreement, Irvine Code Section 2-21 and the NCCP Facilitation Agreement and NCCP Implementing Agreement. No development is proposed for Implementation Area P.

[1] In July 1996, a Natural Communities Conservation Plan/Habitat Conservation Plan (NCCP/HCP) was approved, and an Implementing Agreement (IA) was executed, between U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG), and participating entities. Participants included the City of Irvine, the County of Orange, The Irvine Company and other public and private entities. As a result of the IA the participants funded and developed the "The Nature Reserve of Orange County" (Reserve). The Reserve consists of 38,000 acres of habitat that is protected under the IA. Reserve Open Space in this report refers to parts of the Reserve located within Implementation Area P.

2.0 LOCAL SETTING AND SITE DESCRIPTION

Implementation Area P is located south of Lomas de Santiago, in the northeastern sphere of influence of the City of Irvine, Orange County, California (Exhibit 1). Implementation Area P lies within the city of Irvine's the Planning Area 2. It is within the unincorporated area of Orange County and lies within the El Toro and Black Star Canyon U.S. Geological Survey 7.5 minute quadrangles. All of Implementation Area P is proposed for inclusion in the NCCP Reserve (Exhibit 2).

The entire Implementation Area P consists of approximately 748 acres of mostly undeveloped and agricultural land. The extensive stands of native vegetation occurred mostly in the higher elevations while the agricultural land (mostly avocado orchards) generally occurred in the lower elevation portions of Implementation Area P.

Site topography varies and includes canyons, hillsides and low lying land, with elevations ranging from approximately 440 feet at the northern end of Rattlesnake Reservoir to approximately 900 feet along the northeastern boundary with the 241-tollroad (Exhibit 3). The climate is typically Mediterranean, with warm dry summers and cool wet winters. Early morning coastal fog frequently clouds the hillsides during spring.

Figure 1Exhibit 1: Implementation Area P vicinity map.

Figure 2Exhibit 2: Implementation Area P showing the NCCP Reserve.

Figure 3Exhibit 3: Implementation Area P topography.

3.0 SURVEY METHODOLOGY AND RESULTS

3.1 INFORMATION SOURCES

Focused surveys were conducted for all federal and state listed endangered/threatened species with potential to occur in Implementation Area P, except the California gnatcatcher (*Polioptila californica californica*). Focused surveys were also conducted for all special status plant species with potential to occur in Implementation Area P. Information on other sensitive wildlife and plant species and NCCP Identified species was collected during the focused surveys, during habitat assessments and during general wildlife surveys conducted specifically for this project, in addition to existing available information. Focused surveys, habitat assessments and general wildlife surveys were conducted by Dudek and Associates.

In addition to field surveys, vegetation mapping, wildlife inventories, and habitat assessments, information on the biological resources of Implementation Area P was obtained by reviewing existing available data. Databases such as the baseline NCCP database, records of the California Natural Diversity Database (CNDDB 2000) and California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California (Skinner 1994) were reviewed regarding the potential occurrence of any federal or state listed or proposed endangered, threatened or candidate species, or otherwise sensitive species or habitat within or in close proximity of the project site. In addition, reports from biological surveys conducted in the project area and relevant published literature were reviewed for occurrences of sensitive biological resources.

Existing and ongoing studies being conducted as part of the Nature Reserve of Orange County monitoring program were particularly useful in providing information on Identified Species within Reserve Open Space.

The resources used in this thorough archival review included the following;

- Baseline database from the Natural Communities Conservation Plan & Habitat Conservation Plan – County of Orange Central & Coastal,
- California Natural Diversity Data Base (CNDDB) for the USGS 7.5' quadrangle which comprised the study area: El Toro, Black Star Canyon and neighboring quads for pertinent data,
- California Native Plant Society Inventory of rare and endangered vascular plants of California (Skinner and Pavlik 1994; 6th Edition of CNPS Inventory),
- Review of various biological assessment reports and species lists for the region and neighboring areas such as biological assessment reports conducted for the

Irvine Company (Harmsworth Associates 2001a; 1999a,b; 1998a-d; and Bloom 1999),

- Existing and ongoing biological survey reports conducted for the Nature Reserve of Orange County (Fisher 2000, Smith Pers. Comm.),
- Published literature (Roberts 1990, Hamilton and Willick 1996, Gallagher 1997).

3.2 METHODS

3.2.1 Vegetation mapping

Field surveys for mapping vegetation were conducted in June through November 2000 by Dudek and Associates (see Appendix A for survey dates). The surveys were conducted by walking meandering transects throughout the study area. Meandering transects stress high elevation vista points, potential sensitive species habitat, boundaries of rapid vegetation change, riparian habitat, roadways, animal paths, and easy access points.

The vegetation classification system used in this report is the system adopted for Orange County (Jones & Stokes 1993), which, is roughly equivalent to mapping at the association level and consists of using the common name of the two most common species in the designation along with the vegetation type. A general plant species list was compiled concurrently with the vegetation mapping (Appendix C). Scientific nomenclature in Hickman (1993) was used as the taxonomic resource; common names according to Roberts (1998).

3.2.2 Special status plant surveys

Focused surveys for special status taxa were conducted between April and June, 2001. by Dudek and Associates (see Appendix A for survey dates). Field surveys were conducted using a floristic approach in order to address the composition of the flora, and to identify the presence of special status taxa. The locations of sensitive botanical resources were mapped in the field on topographic maps provided by Tetra Tech, Inc., and later transferred to a GIS database for data presentation.

Initial reconnaissance surveys of existing habitats within the study area were conducted to qualify potential sensitive plant habitats, and establish the accuracy of the data generated from the literature, maps, and aerial photographs. Aerial photographs and topographic vegetation maps were used to determine the community types, and other physical habitat features that may support sensitive and uncommon taxa or communities within the study area.

The focused field studies concentrated on habitats with the highest potential for yielding special status species and were performed during the peak of the blooming period when possible. Fieldwork was focused within specific areas and habitats, specifically open barrens, rock outcrops and heavy clays where non-native species were limited. Each of the habitats within the study area was traversed on foot, examining the areas for particular features such as seeps, unique geologic types, exposures, etc., that would indicate the presence of a preferred habitat for each special status plant species.

Field notes recorded included the date, location, time searched, habitat characteristics, and other information pertinent to the CNDDB field survey data form. This information was completed whether or not special status species were located. If a species was located, the following information was collected: plant phenology, relative abundance, estimated number of individuals, micro-site conditions and general habitat type. The exact location was also mapped. Native and non-native species that occur almost exclusively in the vicinity of special status plant species, soil, geologic, and topographic features were noted and used as visual cues for locating additional sensitive plant populations during the focused surveys.

3.2.3 Wildlife surveys

The reconnaissance level wildlife surveys were conducted between June and November 2000 by Dudek and Associates (see Appendix A for survey dates). The site was traversed on foot to survey each vegetation community and look for evidence of wildlife presence. All wildlife and wildlife sign, including tracks, fecal material, nests and vocalizations were noted. Information on the distribution and status of sensitive species, including San Diego horned lizard (*Phrynosoma coronatum blainvillei*), orange-throated whiptail (*Cnemidophorus hyperthrus*), white-tailed kite (*Elanus caeruleus*), burrowing owl (*Speotyto cunicularia*), California horned lark (*Eremophila alpestris actia*), loggerhead shrike (*Lanius ludovicianus*), southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*), grasshopper sparrow (*Ammodramus savannarum*), San Diego black-tailed jackrabbit (*Lepus californicus*), San Diego desert woodrat (*Neotoma lepida intermedi*), coyote (*Canis latrans*) and American badger (*Taxidea taxus*), was collected during the general wildlife surveys. Potential habitat for federal/state listed or proposed endangered, threatened or candidate species, or otherwise sensitive species was also documented during the reconnaissance surveys.

3.2.4 Least Bell's vireo and willow flycatcher surveys

To determine the status of least Bell's vireo and willow flycatcher in Implementation Area P focused presence/absence surveys were conducted by Dudek and Associates (see Appendix A for survey dates). All potentially suitable vireo/flycatcher habitat in Implementation Area P was surveyed eight times. Although the surveys were conducted concurrently on some days, the methods used were slightly different.

During the focused vireo and flycatcher surveys information on the distribution and status of other sensitive species that utilize riparian habitats, including coast range newt, Cooper's hawk (*Accipiter cooperi*), red-shouldered hawk (*Buteo lineatus*), yellow warbler (*Dendroica petechia brewsteri*), and yellow-breasted chat (*Icteria virens*), was collected.

The methodology used in the vireo surveys followed the least Bell's vireo Working Group and most recent USFWS survey guidelines (USFWS 2001). The use of tape-playback is no longer recommended for vireo surveys. The survey protocol used was as follows:

- Surveys were conducted at all potentially suitable vireo habitat in Implementation Area P a total of eight times.
- Surveys were conducted in the morning hours. No surveys were conducted during periods of excessive heat, wind, rain or other inclement weather.
- The project biologist walked through, or adjacent to all suitable habitat, searching each area thoroughly. Where vegetation was too dense to walk through, surveys were conducted from the periphery. The project biologist stopped frequently in each area for spontaneous singing by nearby male vireos.
- All located birds were observed long enough to determine their breeding status (whether paired or unpaired).
- All located birds were observed long enough to determine if they were banded.
- All brown-headed cowbirds detected during the surveys were recorded.
- All data were recorded on standardized data sheets and male/pair locations were plotted on topographic maps of the project site.

The methodology used in the flycatcher surveys followed the most recent USFWS survey protocol (USFWS 2000, Sogge *et al.* 1997). This protocol is primarily a tape-playback survey. The survey protocol used was as follows:

- Surveys were conducted at all potentially suitable flycatcher habitat in Implementation Area P a total of eight times.
- Surveys were conducted between first light and 1130 hours. No surveys were conducted during periods of excessive heat, wind, rain or other inclement weather.
- The project biologist walked through, or adjacent to all suitable habitat, searching each area thoroughly. Where vegetation was too dense to walk through, surveys were conducted from the periphery. The project biologist stopped frequently in each area and, initially listened for approximately 3 minutes for spontaneous singing by nearby flycatchers. When no birds were detected, the project biologist broadcast taped calls of flycatchers to elicit a response from any birds present.
- All located birds were observed long enough to determine their breeding status (whether paired or unpaired).
- All located birds were observed long enough to determine if they were banded.
- All brown-headed cowbirds detected during the surveys were recorded.
- All data were recorded on standardized data sheets and male/pair locations were plotted on topographic maps of the project site.

3.3 VEGETATION COMMUNITIES

A total of seven vegetation/habitat communities were identified during the field surveys (Table 1, Exhibit 4). They consisted of coastal sage scrub, grassland, marsh, riparian, agriculture, developed, and disturbed.

Table 1: Vegetation types (in acres) within Implementation Area P based on habitat mapping conducted in 2000 by Dudek and Associates.

Vegetation type	Implementation Area P Total
Coastal sage scrub	456.5
Grassland	21.6
Marsh	0.1
Riparian	25.7
Agriculture	224.2
Developed[1]	1.2
Disturbed	19.0
TOTAL	**748.3**

Vegetation communities according to Jones & Stokes (1993), acreages provided by RBF. [1] Does not include the 10 acres at the American Asphalt plant. Although the plant is not part of Implementation Area P it is shown on Exhibit 4 as developed.

3.3.1 Coastal Sage Scrub

Coastal Sage Scrub is a covered habitat[2] under the NCCP/HCP. Coastal Sage Scrub is a diverse community forming many associations determined by soil factors, fire, and topography. It is a community of low growing, soft, woody, drought-deciduous subshrubs and herbaceous plants that grow in thin rocky soils. Scrub vegetation generally occurred in xeric habitats on ridges and south-facing slopes. The scrub habitats were comprised of various proportions of California sagebrush (*Artemisia californica*), bush buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*) and white sage (*Salvia apiana*). Vegetation such as lemonadeberry (*Rhus integrifolia*) and toyon (*Heteromeles arbutifolia*) occurred in more mesic areas. Coastal cactus scrub (a sub-association of coastal sage scrub) occurred on the south and southeastern facing slopes and was dominated by dense patches of coast prickly pear cactus (*Opuntia littoralis*) and coastal cholla (*Opuntia prolifera*). Our lord's candle (*Yucca whipplei*) was common in the coastal cactus scrub. A total of 456.5 acres of coastal sage scrub was recorded in Implementation Area P (Table 1, Exhibit 4).

[2] Covered habitat means those habitat types protected by the NCCP/HCP in a manner comparable to the protection of CSS.

3.3.2 Grassland

The majority of the grasslands in Implementation Area P were characterized by low herbaceous vegetation dominated by annual, ruderal and perennial grass species, which typically occur in deep, well-developed, well-drained soils on gentle slopes and valleys (Jones & Stokes 1993). The assemblage of species within the grasslands were influenced by several environmental, climatic and edaphic factors including soil structure, texture, parent material and chemistry, slope, aspect and angle, and level of disturbance. All grasslands in Implementation Area P were small, in total only 25.7 acres of grassland occurred (Table 1, Exhibit 4). During the mapping exercise, grassland sub-associations were assigned as follows: annual, ruderal, and needlegrass. The characteristic components of each sub-association are described below:

Annual grassland was the most common grassland sub-association within Implementation Area P and was dominated by non-native annual species of Mediterranean origin including genera such as brome (*Bromus* spp.) and oats (*Avena* spp.). Ruderal non-native forb species were invariably scattered in heavily disturbed areas of this community, including filaree (*Erodium* spp.), mustards (*Brassica* spp. and *Hirschfeldia incana*), and Russian thistle (*Salsola tragus*).

Ruderal grasslands are dominated by tall, early successional forb species that colonize recently disturbed areas. In Implementation Area P ruderal areas were dominated by mustards (*Brassica nigra*), filaree (*Erodium botrys* and *E. cicutarium*), star thistle (*Centaurea melitensis*) and sweet-fennel (*Foeniculum vulgare*). Over time, and in the absence of further disturbances, these areas generally succeed to non-native annual grasslands.

Native perennial grasslands occurred on clay or clay loam soils, and in areas where grazing and past agricultural uses were less intensive. These native grasslands persist as mosaic patches within and adjacent to nonnative annual grassland and coastal sage scrub. These small isolated patches occurred on hilltops, slopes or on rocky soils. The native grassland community is dominated by 10 percent or more cover of perennial bunchgrasses from genera such as needlegrass (*Nassella* spp.) and melic grass (*Melica* spp.) (Jones & Stokes 1993). In Implementation Area P, these grasslands were dominated by non-native grasses including red brome (*Bromus madritensis*), ripgut grass (*Bromus diandrus*) and soft chess (*Bromus hordeaceus*). Needlegrass (*Nassella pulchra* and *N. lepida*) occurred as irregular tussocks among the non-native grasses.

3.3.3 Marsh

Marsh habitats consist of permanently or seasonally flooded or saturated sites dominated by persistent herbaceous plants. The only marsh vegetation in Implementation Area P occurred within the south fork of Rattlesnake Canyon wash south of the asphalt plant. This freshwater marsh covered 0.1 acres (Table 1, Exhibit 4). The marsh was dominated by southern cattail (*Typha domingensis*).

3.3.4 Riparian

Riparian habitats consist of trees, shrubs, or herbs that occur along watercourses and water bodies. The vegetation is adapted to flooding and soil saturation during at least a portion of the growing season[3]. Jones and Stokes define a number of different riparian sub-associations including;

- Herbaceous – an early success ional stage of riparian scrub and forest,
- Willow riparian scrub – dominated by willow species,
- Mulefat scrub – dense stands of mulefat with lesser amounts of willows,
- Sycamore riparian woodland – woodland dominated by western sycamore with coast live oak, understory of mulefat or willow scrub,
- Coast live oak riparian forest - woodland dominated by coast live oak with western sycamore, Mexican elderberry and California walnut,
- Arroyo willow riparian forest – forest with closed canopy of arroyo willows,
- Black willow riparian forest – multilayered forest with canopy dominated by black willow,
- Cottonwood-willow riparian forest - multilayered forest dominated by cottonwoods and willows.

Riparian habitats occurred in several locations within Implementation Area P, including the northern end of Rattlesnake Reservoir, the north and south forks of Rattlesnake Canyon Wash and within basins between the north and south forks of Rattlesnake Canyon Wash (Table 1, Exhibit 4). A total of 25.7 acres of riparian habitat occurred in the project area.

Herbaceous riparian habitat comprised pioneering early successional species and was located within drainages and channels. Herbaceous species occurring in these areas included, water cress (*Rorippa nasturtium-aquaticum*), dense-flowered sprangletop (*Leptochloa uninervia*), Bermuda grass (*Cynodon dactylon*), dallies grass (*Paspalum dilatatum*), wild beet (*Beta vulgaris*), willow smartweed (*Polygonum lapathifolium*), rabbit's-foot beardgrass (*Polygonum monspeliensis*), slender aster (*Aster subulatus* var. *ligulatus*), bristly ox-tongue (*Picris echioides*), salt marsh flebane (*Pluchea odorata*), yellow umbrella sedge (*Cyperus esculentus*), barnyard grass (*Echinochloa crus-galli*), Italian ryegrass (*Lolium multiflorum*) and green willow herb (*Epilobium ciliatum*).

Willow riparian scrub was the most common riparian habitat in Implementation Area P. The willow scrub was dominated by arroyo willow (*Salix lasiolepis*) and black willow (*Salix gooddingii*) with lesser amounts of mulefat (*Baccharis salicifolius*) and contained a sparse understory of California mugwort (*Artemisia douglasiana*). Willow riparian scrub occurred at the northern end of Rattlesnake Reservoir, in the south fork of Rattlesnake Canyon Wash and within basins between the north and south forks of Rattlesnake Canyon Wash.

[3] Areas defined as riparian by Jones and Stokes are not always subjection to CDFG or ACOE jurisdiction.

A small area of southern sycamore riparian woodland occurred in the south fork of Rattlesnake Canyon Wash upstream of the asphalt plant. The woodland was dominated by western sycamore (*Platanus racemosa*), arroyo and black willows were also present.

Mulefat scrub occurred in drainages and channels and was dominated by mulefat, Mexican elderberry (*Sambucus mexicana*) and Emory's baccharis (*Baccharis emoryi*). Mulefat also occurred in small patches among coastal sage scrub in low depressions and in areas that were disturbed or along dirt roads.

3.3.5 Agriculture

Agriculture lands in Implementation Area P totaled 224.2 acres and consisted primarily of avocado orchards (Table 1, Exhibit 4). Eucalyptus trees, which lined many of the orchards, were not mapped as a unique habitat type since they provided windbreaks and thus were also treated as a feature of the agricultural land use.

3.3.6 Developed

The only developed site within Implementation Area P consisted of the access road between Jeffery Road and the American Aspalt plant, which totaled 1.2 acres. The asphalt plant itself is located in the south fork of Rattlesnake Canyon but is not part of Implementation Area P, although it is shown on Exhibit 4 as developed (Table 1, Exhibit 4).

3.3.7 Disturbed

Disturbed areas were characterized as cleared areas lacking vegetation and included dirt roads. Within Implementation Area P disturbed sites totaled 19.0 acres (Table 1, Exhibit 4).

3.4 JURISDICTIONAL WATERS AND WETLANDS

ACOE or CDFG jurisdiction are not addressed in this report as all of Implementation Area P is proposed for inclusion in the Reserve and no development will occur.

Figure 4Exhibit 4: Implementation Area P vegetation types.

3.5 SPECIAL STATUS PLANT SPECIES

Based on a review of the CNDDB and the County GIS database, suitable habitat existed within Implementation Area P for 21 special status plant species (Table 2). Special status plant species (and their respective federal, state and California Native Plant Society [CNPS] status) detected onsite are tabulated in (Table 2). Of the 21, three special status species were known to occur in Implementation Area P, namely;

- Intermediate/Foothill mariposa lily (*Calochortus weedii* var. *intermedius*),
- Catalina mariposa lily (*Calochortus catalinae*) and,
- many-stemmed dudleya (*Dudleya multicaulis*).

Other special status plants that have moderate potential to occur within Implementation Area P, but were not detected during the surveys include;

- prostrate spineflower (*Chorizanthe procumbens*, CNPS List 4),
- Palmer's grapplinghook (*Harpagonella palmeri*, CNPS List 2),
- small-flowered morning glory (*Convolvulus simulans*, CNPS List 4),
- Coulter's matilija poppy (*Romneya coulteri*, CNPS List 4),
- golden flowered pentachaeta (*Pentachaeta aurea*, List 1B),
- rayless ragwort (*Senecio aphanactis*, CNPS List 2),
- Cooper's rein orchid (*Piperia cooperi*, CNPS proposed List 4),
- Robinson's peppergrass (*Lepidium virginicum* var. *robinsonii*, CNPS List 1B),
- small-flowered microseris (*Microseris douglasii* ssp. *platycarpha*, CNPS List 4),
- San Diego tarweed (*Deinandra paniculata*, CNPS List 4),
- California chocolate lily (*Fritillaria biflora*, local concern in Orange County).

Other special status species that were not found during the surveys and for which suitable habitat is limited within Implementation Area P are addressed in Table 2.

3.6.1 Intermediate/Foothill mariposa lily (*Calochortus weedii* var. *intermedius*)

Intermediate/Foothill mariposa lily is a federal species of concern, a conditionally covered species[4] under the NCCP and CNPS List 1B species. It is a near Orange County endemic (Roberts 1999) and occurs in the coastal ranges and Northern Peninsula Ranges and is known from Chino Hills, San Joaquin Hills, Santa Ana Mountains, Starr Ranch and Gypsum Canyon. Riverside populations include Vail Lake north to Winchester (Bramlet, pers. comm.). The geophyte is found in chaparral, coastal sage scrub, and valley & foothill grassland primarily on dry rocky open slopes and hills in sandstone outcrops.

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[4] Conditionally covered species means those species which the NCCP/HCP addresses as if they were listed as endangered species under FESA and CESA, and whose conservation and management is provided for in the NCCP/HCP, under the specific conditions listed for that species.

Not all bulbs flower in any given year and plants are more conspicuous after fires and other disturbances. Typically, more plants are present than can be detected above ground. Salvage operations have found between three and ten times more bulbs in the ground than were detected during above ground surveys (Bomkamp Pers. Comm.).

Fifty-nine locations, totaling 2,662 individuals, of Foothill mariposa lily were located in Implementation Area P (Table 2, Exhibit 5). Most of the locations supported a small number of individual plants (only eight locations supported more than 20 individuals) but one location consisted of 2,000 individuals.

3.6.2 Catalina Mariposa lily species (*Calochortus catalinae.*)

Catalina mariposa lily was not recorded during the current surveys but was recorded onsite in 1998, when a location 0.5 km west of the asphalt plant supported 20 individuals (Harmsworth Associates 1999a).

3.6.3 Mariposa lily species (*Calochortus* spp.)

At twenty-six locations, totaling 624 individuals, plants were mapped as *Calochortus* spp. since they could not be identified to species with certainty (Table 2, Exhibit 5). These plants were likely either Foothill mariposa lily or Catalina mariposa lily. Most of the locations supported a small number of individual plants (only five locations supported more than 20 individuals) but one location consisted of 415 individuals.

3.6.4 Many-stemmed Dudleya (*Dudleya multicaulis*)

Many-stemmed dudleya (*Dudleya multicaulis*) is a drought deciduous leaf-succulent perennial that remains dormant below ground throughout late summer and fall. It is listed as rare by the CNPS (List 1B) but is not federally or state listed as endangered or threatened nor is it a NCCP covered species. The species ranges from Los Angeles County south to northern San Diego County and east to western Riverside and San Bernardino Counties

The many-stemmed dudleya is a distinctive succulent with terete leaves and evident but non-showy flowers. This species primary habitat is thin well-drained soils on slopes, ridge tops, rock outcrops, cliff faces, and hillside grasslands. This dudleya species has also suffered from loss of habitat due to urbanization and direct loss of plants and habitat to cattle grazing. The cattle eat the succulent dudleyas and trample the shallow soils on rock ledges leading to erosion and sloughing off of soil to form bare rock.

Two locations, totaling between 1,250 individuals, of many-stemmed dudleya occurred in Implementation Area P (Table 2, Exhibit 5). The two locations consisted of 250 and 1,000 individuals.

Table 2: Federal and state endangered, threatened and special status plant species that occurred or have the potential to occur in Implementation Area P. NCCP status as a covered species (C), conditionally covered species (CC) or non-covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2000/2001 surveys and/or during other recent surveys in Implementation Area P.

Scientific Name **FAMILY**	**Common name**	**Status**	**NCCP**	**POTENTIAL TO OCCUR**	**Comments/Habitat**
Astragalus brauntonii FABACEAE	Braunton's rattleweed	Fed: endangered State: none CNPS: 1B	NC	Low	Limited habitat onsite. Occurs only on limestone outcrops in disturbed chaparral, short-lived perennial flowering after fires in February through June.
Abronia villosa var *aurita* NYCTAGINACEAE	Chaparral sand-verbena	Fed: none State: none CNPS: 1B	NC	Low	Occurs on sandy soils in coastal sage scrub and chaparral, below 1600 feet. Considered extripated in Orange County. Blooms January through August.
Brodiaeae filifolia LILIACEAE	Thread-leaved Brodiaea	Fed: threatened State: endangered CNPS: 1B	NC	Low	Limited habitat onsite. Occurs on clays, or silty alkaline substrates on edges of vernal pools, valley and foothill grasslands, coastal sage scrub, chaparral, and cismontane woodlands, below 2000 feet. Blooms March through June.
Calochortus catalinae LILIACEAE	Catalina Mariposa Lily	Fed: none State: none CNPS: 4[3]	C	Occurs	Perennial herb; blooms February to May; occurring in heavy soils, open grassy slopes and opening in brush in chaparral, coastal sage scrub, and valley and foothill grassland. Recorded onsite in 1998
Calochortus weedii var. intermedius LILIACEAE	Intermediate Mariposa Lily	Fed: FSC State: none CNPS: 1B	CC	Occurs	Detected onsite, Perennial herb; in bloom from May-July; habitat is dry rocky open slopes and hills in chaparral, coastal sage scrub, valley & foothill grassland.
Chorizanthe procumbens POLYGONACEAE	Prostrate Spineflower	Fed: none State: none CNPS: 4	NC	Medium	Annual herb, blooms April through June, occurs in chaparral, coastal sage scrub, pinyon juniper woodlands, valley foothill grasslands in gabbroic clay/granitic (Skinner 1994)

[1] California Native Plant Society: (CNPS) List 1B indicates species rare, threatened, or endangered in California and elsewhere); [2]: CNPS List 2 denotes plants rare, threatened, or endangered in California, but more common elsewhere, [3]:CNPS List 4 denotes plants of limited distribution (a watch list); FSC = federal species of concern.

Table 2, continued: Federal and state endangered, threatened and special status plant species that occurred or have the potential to occur in Implementation Area P. NCCP status as a covered species (C), conditionally covered species (CC) or non-covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2000/2001 surveys and/or during other recent surveys in Implementation Area P.

Scientific Name FAMILY	Common name	Status	NCCP	POTENTIAL TO OCCUR	Comments/Habitat
Convolvulus simulans CONVOLVULACEAE	Small-flowered morning-glory	Fed: none State: none CNPS: 4	NC	Medium	Occurs from Baja north to San Luis Obispo County and inland to Riverside and Kern Counties, on wet clay, serpentine seeps and ridges, near rock outcrops, south-facing slopes in shallow or clay soils on edges of coastal sage scrub and perennial grasslands. Blooms March through June.
Deinandra paniculata ASTERACEAE	San Diego tarweed	Fed: none State: none CNPS: 4	NC	Medium	Often confused with *D.conjugens* and *D. fasciculata*, occurs in dry hills, mesas, grasslands below 300 feet. Blooms May through November.
Dichondra occidentalis CRASSULACEAE	Western dichondra	Fed: none State: none CNPS: 4	NC	Low	Limited habitat onsite. Occurs on channel islands and south from Santa Barbara County to northern Baja, California. Fire follower, occurs in rock outcrops, under shrubs in loamy alluvium, Huerhuerco complex, Hambright gravely clay loam in southern mixed chaparral, Diegan sage scrub, oak woodland and grasslands. Blooms January through July.
Dudleya multicaulis CRASSULACEAE	Many Stemmed Dudleya	Fed: FSC State: none CNPS: 4	NC	Occurs	Detected onsite, perennial herb; flowering in May-July; microhabitat is rocky outcrops, clay soil in chaparral, coastal sage scrub, valley & foothill grassland.
Fritillaria biflora var. *biflora* LILIACEAE	California Chocolate Lily	Fed: none State: none CNPS: none Local concern	NC	Medium	Occurs on mesic native bunchgrass grasslands on north-facing slopes on clay soils, mesas and serpentine barrens in Southern coastal needlegrass grasslands. Flowers usually early in February but may extend until June.

[1] California Native Plant Society: (CNPS) List 1B indicates species rare, threatened, or endangered in California and elsewhere); [2]: CNPS List 2 denotes plants rare, threatened, or endangered in California, but more common elsewhere, [3]:CNPS List 4 denotes plants of limited distribution (a watch list); FSC = federal species of concern.

Table 2, continued: Federal and state endangered, threatened and special status plant species that occurred or have the potential to occur in Implementation Area P. NCCP status as a covered species (C), conditionally covered species (CC) or non-covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2000/2001 surveys and/or during other recent surveys in Implementation Area P.

Scientific Name FAMILY	Common name	Status	NCCP	POTENTIAL TO OCCUR	Comments/Habitat
Harpagonella palmeri BORAGINACEAE	Palmer's grapplinghook	Fed: FSC State: none CNPS: 2[2]	NC	Medium	Moderate potential to occur. Occurs on clay soils, dry slopes and mesas in coastal sage scrub openings and grasslands. Flowers March to April. More readily found after fires.
Holocrpha virgata ssp. *elongata* ASTERACEAE	Graceful tarplant	Fed: none State: none CNPS: 4	NC	Low	Limited habitat onsite. Occurs in annual and perennial grasslands; blooms June to November.
Lepidium virginicum var. *robinsonii* BRASSICACEAE	Robinson's peppergrass	Fed: none State: none CNPS: 1B	NC	Medium	Grows in openings of coastal sage and chaparral, typically away from the coast. Few recent collections of these species from cismontane southern California. Blooms January through July.
Microseris douglasii ssp. *platycarpha* ASTERACEAE	Small-flowered Microseris	Fed: none State: none CNPS: 4	NC	Medium	Annual herb; blooms March to May; occurs on clay soils in coastal sage scrub, valley and foothill grasslands, and cismontane woodland habitats.
Nolina cismontana LILIACEAE	Chaparral beargrass	Fed: none State: none CNPS: none Local concern	NC	Low	Limited habitat onsite. Distributed from western Ventura County south through Simi Hills, Santa Ana Mountains to the foothills of Palomar and Cuyamaca Mountains in San Diego County. Populations known from Limestone Canyon and North Ranch Policy Plan Area. Blooms from April through June.
Pentachaeta aurea ASTERACEAE	Golden-flowered Pentachaeta	Fed: none State: none CNPS: 4	NC	Medium	Occurs in Los Angeles, Orange, Riverside, San Bernardino, San Diego Counties, Baja California. Habitat includes cismontane woodland, coastal scrub, lower montane coniferous forest, valley and foothill grassland. Blooms March through July.

[1] California Native Plant Society: (CNPS) List 1B indicates species rare, threatened, or endangered in California and elsewhere); [2]: CNPS List 2 denotes plants rare, threatened, or endangered in California, but more common elsewhere, [3]:CNPS List 4 denotes plants of limited distribution (a watch list); FSC = federal species of concern.

Table 2, continued: Federal and state endangered, threatened and special status plant species that occurred or have the potential to occur in Implementation Area P. NCCP status as a covered species (C), conditionally covered species (CC) or non-covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2000/2001 surveys and/or during other recent surveys in Implementation Area P.

Scientific Name FAMILY	Common name	Status	NCCP	POTENTIAL TO OCCUR	Comments/Habitat
Piperia cooperi ORCHIDACEAE	Chaparral rein orchid	Fed: none State: none CNPS: 4	NC	Medium	Occurs in chaparral, cismontane woodland, valley and foothill grassland Blooms March through April.
Quercus engelmanii FAGACEAE	Engelmann oak	Fed: none State: none CNPS: 4	NC	Low	Limited habitat onsite. Occurs from Pasadena inland region to San Dimas to east San Diego Co., and one tree left on Santa Catalina Island (Skinner 1994). Dry fans, foothills, and slopes in Chaparral, valley and foothill grassland, riparian woodland, and cismontane woodland. Deciduous tree, which blooms from April to May.
Romneya coulteri PAPAVERACEAE	Coulter's Matilija Poppy	Fed: none State: none CNPS: 4	NC	Medium	Occurs in Los Angeles, Orange, Riverside, San Diego in chaparral, coastal scrub / often in burns. Blooms March through July
Senecio aphanactis ASTERACEAE	*Senecio aphanactis* ASTERACEAE	Fed: none State: none CNPS: 2	NC	Medium	Occurs in coastal sage scrub and extends from Contra Costa County to Baja California and on the Channel Islands. Known from lower Hicks Canyon and UCI ecological preserve. Blooms January through April, and easily overlooked.

[1] California Native Plant Society: (CNPS) List 1B indicates species rare, threatened, or endangered in California and elsewhere); [2]: CNPS List 2 denotes plants rare, threatened, or endangered in California, but more common elsewhere, [3]:CNPS List 4 denotes plants of limited distribution (a watch list); FSC = federal species of concern.

Figure 5Exhibit 5: Rare plant locations in Implementation Area P.

3.6 WILDLIFE

Endangered/Threatened Wildlife

Three Federal and/or State endangered/threatened wildlife species occur or have the potential to occur in Implementation Area P: the California gnatcatcher, least Bell's vireo and willow flycatcher. Focused presence/absence surveys were designed and conducted for the least Bell's vireo and willow flycatcher.

3.6.1 Coastal California Gnatcatcher

The California gnatcatcher was listed as a "threatened" species by the United States Fish and Wildlife Service (USFWS) in 1993, pursuant to Section 4(d) of the Federal Endangered Species Act ("FESA"), and it is a covered and target species under the NCCP/HCP. It is an obligate resident of coastal sage scrub ("CSS") habitat, and the rapid conversion of occupiable CSS to developed area was the basis for the listing.

Locations of California gnatcatchers in Implementation Area P are from the NCCP/HCP baseline data (County of Orange Environmental Management Agency 1995). Gnatcatchers were sighted at 14 locations (5 pairs and 9 singles; County of Orange Environmental Management Agency 1995; Exhibit 6). Gnatcatchers were recorded during the general wildlife surveys conducted in Implementation Area P.

Cactus wren

The cactus wren is not a listed species but it is discussed here because it is a NCCP covered species and it is shown on the same exhibit as the gnatcatcher and is also an obligate resident of coastal sage scrub.

Locations of cactus wrens in Implementation Area P are from the NCCP/HCP baseline data (County of Orange Environmental Management Agency 1995). Cactus wrens were sighted at 11 locations (6 pairs and 5 singles; County of Orange Environmental Management Agency 1995; Exhibit 6). Cactus wrens were recorded during the general wildlife surveys conducted in Implementation Area P.

3.6.2 Least Bell's vireo

The least Bell's vireo is a federal and state endangered species and is a conditionally covered species under the NCCP. This vireo is an obligate resident of willow dominated riparian woodland. In Implementation Area P one pair of least Bell's vireo was recorded in 2001 (Exhibit 7). This vireo pair occurred in willow riparian scrub at the northeastern end of Rattlesnake Reservoir. Two additional vireos (one pair and one unpaired territorial male vireo) were recorded in the willow woodland at the northeastern end of Rattlesnake Reservoir but these were outside Implementation Area P. Vireos have been nesting in this part of Rattlesnake Reservoir since 1997 (Harmsworth Associates 1998a).

3.6.3 Willow flycatcher

The willow flycatcher is a state endangered species and is a conditionally covered species under the NCCP. One subspecies, the southwestern willow flycatcher (*Empidonax trallii exttimus*) is also a federal endangered species. Only the southwestern subspecies breeds in southern California but northern subspecies (*E. t. brewsteri* and *E. t. adastus*) do pass through southern California during migration. The willow flycatcher is an obligate resident of willow dominated riparian woodland. No willow flycatcher was recorded in Implementation Area P during the 2001 focused surveys. During the 1997 focused surveys five willow flycatchers were recorded at Rattlesnake Reservoir, none were within Implementation Area P (Harmsworth Associates 1998a). All the recorded flycatchers were migrants, none nested at Rattlesnake Reservoir.

3.6.4 Other listed species

Four federal endangered species that do not have potential to occur in Implementation Area P are also addressed here since they are all conditionally covered species under the NCCP.

Two federal endangered fairy shrimps, the San Diego fairy shrimp and the Riverside fairy shrimp occur exclusively in vernal pools. No vernal pools exist within Implementation Area P and therefore no suitable habitat for either fairy shrimp species exists.

The quino checkerspot butterfly (*Euphydryas editha quino*) is a federally listed endangered species and is also conditionally covered under the NCCP. Surveys to locate the quino checkerspot's larval host plants were conducted in Implementation Area P in 1998 as part of a more extensive survey within the Coastal/Central NCCP Subregion. Three locations, all north of Rattlesnake Reservoir supported host plant species (Exhibit 8). Patch size varied from 25 to 1000 square meters, densities ranged from 3 to 300 plants per square meter, and percent cover estimated from 5 to 25 percent. Two of the three patches contained only owl's clover (*Orthocarpus purpurascens* [= *Castilleja exserta*]) in openings within coastal sage scrub with dwarf plantain (*Plantago erecta*) absent. Smooth cat's ear (*Hypochoeris glabra*), rattail fescue (*Vulpia myuros*), and red brome (*Bromus madritensis*) dominated the clearings. In one location plantain occurred along gravel roads that traversed the coastal sage scrub north of the reservoir. Yellow pincushion (*Chaenactis glabriuscula)*, bluedicks (*Dichelostemma capitatum*), popcorn flower (*Cryptantha* sp.), ground pink (*Linanthus dianthiflorus*), and sanicle (*Sanicula crassicaulis*) were present in low numbers in the vicinity of the larval host species. These three locations have the potential to support quino butterflies. However, the 1998

Figure 6Exhibit 6: California gnatcatcher and coastal cactus wren locations in Implementation Area P.

Figure 7Exhibit 7: Least Bell's vireo and southwestern willow flycatcher locations in Implementation Area P.

Figure 8: Exhibit 8: Quino checkerspot butterfly habitat.

surveys found that the quino butterfly was absent from all Irvine Company lands (Harmsworth Associates 1998b) and no quino butterfly adults or larvae were recorded during the 2000 or 2001 surveys in Implementation Area P. The quino checkerspot butterfly was last observed in Orange County in 1967 (Orsak 1978, Mattoni *et al.* 1997) and currently has a low probability of occurring in Implemenrtation Area P.

The arroyo toad is also a conditionally covered endangered species. Implementation Area P was assessed for arroyo toad habitat in 1998 as part of a more extensive survey within the Coastal/Central NCCP Subregion (Harmsworth Associates 1998c) and again during the 2001 surveys. No suitable arroyo toad habitats existed within Implementation Area P.

3.6.5 Unlisted sensitive wildlife

A number of California Department of Fish and Game "species of special concern" (CSC) occur or have the potential to occur in the project area (Table 4, Appendix B). These species are considered sensitive due to declining populations, partially as a result of habitat destruction.

<u>Amphibians</u>

The western spadefoot toad was not recorded in Implementation Area P during the 2000 or 2001 surveys, however populations of western spadefoot toads are known from nearby areas such as Hicks Canyon Haul Road, Bee Canyon and Agua Chinon, all within Reserve Open Space (Harmsworth Associates 1998c, Fisher 2000, CNDDB 2001). Suitable breeding and foraging habitat does exist for this species in Implementation Area P. Due to the presence of suitable habitat and the close proximity of known populations the spadefoot toad is presumed to occur in Implementation Area P. The western spadefoot toad is a NCCP covered species in the coastal subarea only. Other amphibians with a lower potential to occur in Implementation Area P are addressed in Table 4 and Appendix B.

<u>Reptiles</u>

Three sensitive reptile species occurred in Implementation Area P (Table 4, Appendix B). The San Diego horned lizard, the orange-throated whiptail, and the northern red-diamond rattlesnake (*Crotalus ruber ruber*) were recorded during the 2000 surveys in Implementation Area P, all are NCCP covered species.

The Coronado skink (*Eumeces skiltonianus interparietalis*) was not recorded in Implementation Area P during the 2000 or 2001 surveys but is known to occur in nearby Reserve Open Space. It probably also occurs in Implementation Area P. The skink is a NCCP covered species.

The southwestern pond turtle (*Clemmys marmorata pallida*) is also a sensitive species but is not covered under the NCCP. Surveys for the pond turtle were conducted throughout the Central/Coastal NCCP Subregion in 1998. No turtles were recorded from Implementation Area P. No potential turtle habitat occurs in Implementation Area P. However, Rattlesnake Reservoir which lies adjacent Implementation Area P was categorized as moderate turtle habitat (Harmsworth Associates 1998d). No turtles were recorded in 1998 but it was discovered that the Irvine Ranch Water District had released two or three turtles into the reservoir around 1995. One turtle was recorded in the reservoir in 2001 during the vireo and flycatcher surveys. Other reptiles with a lower potential to occur in Implementation Area P are addressed in Table 4 and Appendix B.

<u>Birds</u>
Several sensitive raptor species are known to use Implementation Area P (Table 4, Appendix B). The white-tailed kite was recorded foraging in Implementation Area P during the 2000 surveys. Oak or sycamore woodlands (kites favored nest sites) were virtually absent from Implementation Area P but the kites could nest off-site in the willow trees at Rattlesnake Reservoir. However, no nest sites were recorded during the 2000 or 2001 surveys or during surveys conducted in 1998 (Bloom 1999).

The sharp-shinned hawk (*Accipiter striatus*) does not breed in Orange County but is a common migrant and winter resident. It is presumed to forage in Implementation Area P during migration and winter. It is a NCCP covered species.

The Cooper’s hawk was recorded foraging in Implementation Area P during the 2000 and 2001 surveys. The majority of Cooper’s hawk nests are located in small groves of oak trees but dense stands of mature willows are also used. Suitable nesting sites exist in the willow woodland at Rattlesnake Reservoir. However, no nest sites were recorded during the 2000/2001 surveys or during surveys conducted in 1998 (Bloom 1999).

Red-shouldered hawks were recorded foraging in Implementation Area P during the 2000 and 2001 surveys. Although suitable breeding exists in the project area, no red-shouldered hawks were recorded breeding onsite during the 200/2001 surveys or during surveys conducted in 1998 (Bloom 1999). The red-shouldered hawk is a NCCP covered species.

The golden eagle is a conditionally covered species under the NCCP. It was recorded foraging in Implementation Area P during the 2001 surveys. Nesting opportunities do not exist in Implementation Area P for the eagle. The nearest current or historic golden eagle nest site is in Black Star Canyon (Gallagher 1997) which is approximately four miles from the site.

The peregrine falcon (*Falco mexicanus*) was formerly a state endangered species but was recently delisted as the population has recovered. The peregrine is also a NCCP covered species. This species was not recorded during the 2000/2001 surveys but may occasionally forage within the project area. Peregrines forage over open country in a variety of habitats, including grassland, marsh and scrub. They nest on cliffs, rock outcroppings or on the tops of buildings, usually near water. The only current nesting site in Orange County is in Newport Beach, on the top of a building (Hamilton and Willick 1996, Gallagher 1997). There are no potential nest sites within the project vicinity.

Another sensitive raptor is the burrowing owl. Burrowing owls require flat ground or rolling hills with short grass. Over grazed areas seem to be preferred. They nest in holes in the ground, which are usually made by California ground squirrels (*Citellus beecheyi*). Suitable habitat is limited in Implementation Area P and where grasslands do occur they generally do not consist of short grass due to the lack of grazing. There was no evidence from the surveys conducted in 2001 that burrowing owls occurred in Implementation Area P. Their potential for occurring in Implementation Area P is low.

Five sensitive passerine species, cactus wren (already discussed), yellow warbler, yellow-breasted chat, southern California rufous-crowned sparrow and grasshopper sparrow were recorded in Implementation Area P during the 2000/2001 surveys. Yellow-breasted chats nested in the willows at Rattlesnake Reservoir, yellow warblers also used the willow woodlands but only during migration. Rufous-crowned sparrows and grasshopper sparrows both nested onsite, the rufous-crowns occurred in coastal sage scrub and the grasshopper sparrows occurred in grassland areas.

Two additional sensitive passerine species, loggerhead shrike and Bell's sage sparrow (*Amphispiza belli belli*) were not recorded onsite in 2000/2001 but are presumed to occur (Table 4). Loggerhead shrike was recorded just offsite in 2000 and a small breeding population of Bell's sage sparrow was recorded within Implementation Area P in 1997 (Keane Biological Consulting 1997).

<u>Mammals</u>

A single sensitive mammalian species, the San Diego black-tailed jackrabbit was recorded in Implementation Area P (Table 4, Appendix B). This species occurs in grassland and openings in coastal sage scrub.

Focused mammal surveys were not conducted for this project and there is little specific data available on the usage of Implementation Area P by mammals. Therefore mammals, such as bats, pocket mouse and American badger, are not discussed here. Mammalian species whose habitat requirements coincide with those present in Implementation Area P are listed in Table 4.

A number of additional sensitive wildlife species have a medium or low potential to occur in Implementation Area P. These species are addressed in Table 4 but are not addressed in the text unless specific information on these species is available from the project vicinity. Although the habitat requirements of these species generally coincide with the existing native habitats located in Implementation Area P they have a low or medium potential to occur due to the size and nature of the existing habitat, the fact that they have not been recorded in the project vicinity in recent years and since there is no evidence to indicate they occur onsite currently.

3.6.6 Other wildlife

In total 102 wildlife species, including 3 amphibian, 14 reptile, 74 bird and 11 mammal species, were recorded in Implementation Area P during the current surveys and/or recent surveys conducted as part of the Nature Reserve of Orange County monitoring program (Appendix D). This is not an exhaustive list of the species that occur onsite as no surveys were conducted in winter, or at night and, no trapping or other special techniques were used.

In addition to the threatened/endangered and sensitive species, the following NCCP covered species were recorded in Implementation Area P:

- coastal western whiptail lizard (*Cnemidophorus tigris multiscutatus*)
- coyote
- gray fox (*Urocyon cinereoargenteus*).

3.6.7 Wildlife corridors and habitat linkages

Implementation Area P is contiguous with more Reserve Open Space at Loma Ridge to the north and west and with Hicks Canyon and Siphon Reservoir to the east. These areas provide a linkage with Open Space further to the north and east including Limestone Canyon, upper Borrego Canyon, the North Ranch Policy Plan Area and the Cleveland National Forest. Due to this corridor and the contiguous nature of the habitat, wildlife can move freely throughout this entire area.

Table 3: Federal and state endangered, threatened and sensitive wildlife species that occurred or have the potential to occur in Implementation Area P. NCCP status as a covered species (C), conditionally covered species (CC) or non-covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2000/2001 surveys and/or during other recent surveys in Implementation Area P, FE = Federal endangered, FT = Federal threatened, SE = State endangered, CSC = California species of special concern, none = no federal or state listing.

Scientific Name	Common Name	Status	NCCP	Potential to occur	Habitat
Euphydryas editha quino	quino checkerspot butterfly	FE	CC	low	scrub and chaparral habitats with openings containing host plant and nectar species
Taricha torosa torosa	coast range newt	CSC	NC	medium	scrub, chaparral, woodland; ponds, reservoirs and slow moving streams for breeding
Scaphiophis hammondi	western spadefoot toad	CSC	C	high	grassland, open habitats with sandy or gravelly soil; temporary rainpools for breeding
Clemmys marmorata pallida	southwestern pond turtle	CSC	NC	low	slow-water aquatic habitats, ponds, marshes, rivers, streams and irrigation ditches
Phrynosoma coronatum blainvillei	San Diego horned lizard	CSC	C	occurs	sandy washes and open sandy areas within coastal sage scrub, grassland, chaparral, oak and riparian woodland
Eumeces skiltonianus interparietalis	Coronado skink	CSC	C	high	mesic areas of coastal sage scrub, chaparral, grasslands and woodlands; heavily forested areas and dense brush avoided
Cnemidophorus hyperthrus beldingi	orange-throated whiptail	CSC	C	occurs	open, sparsely covered land, often with well-drained sandy or loose soils in coastal sage scrub, grassland, chaparral, oak woodland and riparian habitats
Anniella pulchra pulchra	silvery legless lizard	CSC	NC	medium	chaparral, oak woodland, coastal sage scrub
Thammophis hammondii	two-striped garter snake	CSC	NC	low	associated with freshwater wetlands
Salvadora hexalepis virgultea	coast patch-nosed snake	CSC	NC	medium	associated with brushy or shrubby vegetation
Crotalus ruber ruber	northern red-diamond rattlesnake	CSC	C	occurs	chamise, coastal sage scrub, desert slope scrub and other habitats with heavy brush associated large rocks or boulders
Circus cyaneus	northern harrier	CSC	C	medium	grassland, marshes, agricultural land, open areas in scrub and chaparral; ground or shrub nesting
Elanus caeruleus	white-tailed kite	CSC	NC	occurs	forages in grasslands; nests and roosts in oak and riparian woodland
Accipter striatus	sharp-shinned hawk	CSC	C	high	wide variety of habitats used by wintering and migrating birds, but mostly associated with woodland and scrubland; breeds in mountains
Accipiter cooperi	Cooper's hawk	CSC	NC	occurs	mature forests, open woodlands, wood edges, river groves, riparian woodland

Table 4, continued: Federal and state endangered, threatened and sensitive wildlife species which occurred or have the potential to occur in Implementation Area P. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2000/2001 surveys and/or during other recent surveys in Implementation Area P, FE = Federal endangered, FT = Federal threatened, SE = State endangered, CSC = California species of special concern, none = no federal or state listing.

Scientific Name	Common Name	Status	NCCP	Potential to occur	Habitat
Buteo lineatus	red-shouldered hawk	none	C	occurs	riparian woodland specialist, oak and sycamore woodlands
Buteo regalis	ferruginous hawk	CSC	NC	medium	plains, prairies, grasslands
Aquila chrysaetos.	golden eagle	CSC	CC	occurs	open mountains, foothills, plains, open country
Falco peregrinus	peregrine falcon	delisted	C	medium	nest on cliffs or rock outcroppings, usually near water; forages over open country (grassland, scrub, marshes)
Speotyto cunicularia	burrowing owl	CSC	NC	low	grasslands, farmland and other open habitats
Asio flammeus	short-eared owl	CSC	NC	low	Grasslands
Asio otus	long-eared owl	CSC	NC	low	widespread forager; nests in dense woodlands
Eremophila alpestris actia	California horned lark	CSC	NC	medium	Open areas with little or no ground cover, such as grassland or ruderal vegetation
Campylorhynchus brunneicapillus	cactus wren	CSC	C	occurs	cactus patches and yucca within coastal sage scrub and chaparral habitats
Polioptila californica californica	California gnatcatcher	FT, CSC	C	occurs	coastal sage scrub
Empidonax trallii	willow flycatcher	FE[1], SE	CC	occurs	dense riparian habitats, especially willow dominated woodland
Lanius ludovicianus	loggerhead shrike	CSC	NC	high	grassland, scrub and other open habitats with perching structures; nests in trees and shrubs
Vireo belli pusillus	least Bell's vireo	FE, SE	CC	occurs	dense riparian habitats, especially willow dominated woodland
Dendroica petechia brewsteri	yellow warbler	CSC	NC	occurs	riparian habitats, streams, wet thickets
Icteria virens	yellow-breasted chat	CSC	NC	occurs	riparian habitats, streams, wet thickets, marshes
Amphispiza belli belli	Bell's sage sparrow	CSC	NC	occurs	primarily chaparral, also coastal sage scrub
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	CSC	C	occurs	grass covered hillsides in coastal sage scrub and chaparral

Table 4, continued: Federal and state endangered, threatened and sensitive wildlife species which occurred or have the potential to occur in Implementation Area P. NCCP status as a covered species (C), conditionally covered species (CC) or non covered species (NC) is also listed. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2000/2001 surveys and/or during other recent surveys in Implementation Area P, FE = Federal endangered, FT = Federal threatened, SE = State endangered, CSC = California species of special concern, none = no federal or state listing.

Scientific Name	Common Name	Status	NCCP	Potential to occur	Habitat
Ammodramus savannarum	grasshopper sparrow	none	NC	occurs	grasslands
Macrotus californicus	California leaf-nosed bat	CSC	NC	low	roosts in caves or old mines
Antrozous pallidus	pallid bat	CSC	NC	high	coastal sage scrub, oak woodland and chaparral; roosts in caves, mines, rock crevices, trees and buildings
Eumops perotis californicus	California mastif bat	CSC	NC	medium	widespread forager; roosts in cliffs and buildings
Lepus californicus bennettii	San Diego black-tailed jackrabbit	CSC	NC	occurs	coastal sage scrub, grassland and chaparral
Chaetodipus californicus femoralis	Dulzura pocket mouse	CSC	NC	medium	Coastal sage scrub, chaparral, riparian-scrub ecotone
Chaetodipus fallax fallax	northwestern San Diego pocket mouse	CSC	NC	medium	coastal sage scrub, grassland and chaparral
Neotoma lepida intermedia	San Diego desert woodrat	CSC	C	high	cactus patches and rock outcroppings in coastal sage scrub
Onychomys torridus ramona	Ramona grasshopper mouse	CSC	NC	medium	annual grassland and coastal sage scrub
Canis latrans	Coyote	none	C	occurs	widespread, habitat generalist
Taxidea taxus	American badger	CSC	NC	high	widespread in natural habitats

4.0 POTENTIAL IMPACTS AND LEVELS OF SIGNIFICANCE

4.1 POTENTIAL IMPACTS

All of Implementation Area P is proposed for inclusion in The Nature Reserve of Orange County. No development will occur in Implementation Area P. There will be no direct impacts to Implementation Area P as a result of the proposed project in the Protocol Area.

Urban development adjacent to the NCCP Reserve creates certain potential indirect impacts to the biological resources in the Reserve. These potential impacts include; intrusion of humans and domestic pets into the Reserve, predation of sensitive wildlife by domestic animals, increase populations of species adapted to urban development (egg. raccoons, opossum, skunk) at the expense of more sensitive wildlife, increased fire risk and increased risk of invasion by exotic plant species.

Indirect impacts associated with construction activities include potential erosion on exposed slopes, sedimentation of watercourses, dust accumulation on native vegetation and increased dumping of trash and other pollutants.

4.2 SIGNIFICANCE OF POTENTIAL IMPACTS

Any indirect and offsite impacts to the Reserve are not likely to be significant. Any such impacts are mitigated by the NCCP/HCP (County of Orange, Environmental Management Agency 1996).

5.0 ACKNOWLEDGEMENTS

Surveys were conducted by Dudek and Associates, data provided by Megan S. Enright.

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7.0 APPENDICES

7.1 APPENDIX A: SUMMARY OF SURVEYS CONDUCTED IN IMPLEMENTATION AREA P.

Surveys conducted by Dudek and Associates biologists;
Brock A, Ortega (BAO)
Anita M. Hayworth (AMH)
Jeff D. Priest (JDP)
Megan S. Enright (MSE)
Vipul R. Joshi (VRJ)
Myloc K. Nguyen (MKN)
Darren S. Smith (DSS)
Julie M. Vanderwier (JMV)
Harold A. Wier (HAW)

7.2 APPENDIX B: EXPLANATION OF TABLE 3.

Explanation of how low, medium and high potential to occur assigned to wildlife species from Table 3. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2000/2001 surveys and/or during other recent surveys in Implementation Area P.

Scientific Name	Common Name	Potential to occur	Habitat
Euphydryas editha quino	quino checkerspot butterfly	low	Some suitable habitat in Implementation Area P but no larvae or adults recorded during focused surveys in 1998 and not recorded in Orange County since 1967
Taricha torosa torosa	coast range newt	medium	Breeding habitat limited, has not been recorded from project vicinity in recent years
Scaphiophis hammondi	western spadefoot toad	high	Suitable habitat present, recorded in nearby open space
Clemmys marmorata pallida	southwestern pond turtle	low	No suitable habitat onsite, recorded off-ste at nearby Rattlesnake Reservoir
Phrynosoma coronatum blainvillei	San Diego horned lizard	occurs	Recorded during current surveys
Eumeces skiltonianus interparietalis	Coronado skink	high	Suitable habitat present, recorded in nearby open space
Cnemidophorus hyperthrus beldingi	orange-throated whiptail	occurs	recorded during current surveys
Anniella pulchra pulchra	silvery legless lizard	medium	Suitable habitat present but species has not been recorded from project vicinity in recent years
Thammophis hammondii	two-striped garter snake	low	Suitable habitat limited
Salvadora hexalepis virgultea	coast patch-nosed snake	medium	Suitable habitat present but species has not been recorded from project vicinity in recent years
Crotalus ruber ruber	northern red-diamond rattlesnake	occurs	Recorded during current surveys
Circus cyaneus	northern harrier	medium	Suitable habitat present but species has not been recorded from project vicinity in recent years
Elanus caeruleus	white-tailed kite	occurs	Recorded foraging during current surveys
Accipter striatus	sharp-shinned hawk	high	Suitable habitat present, expected to forage onsite during migration and winter seasons
Accipiter cooperi	Cooper's hawk	occurs	Recorded during current surveys
Buteo lineatus	red-shouldered hawk	occurs	recorded during current surveys
Buteo regalis	ferruginous hawk	medium	Suitable foraging habitat present, small numbers winter in Orange County
Aquila chrysaetos.	golden eagle	occurs	Recorded foraging during current surveys
Falco peregrinus	peregrine falcon	medium	Suitable foraging habitat present, no historic or current nest sites nearby
Speotyto cunicularia	burrowing owl	low	Suitable habitat limited and species has not been recorded from project vicinity in recent years

Explanation of how low, medium and high potential to occur assigned to wildlife species from Table 3. Definitions: low = possible but unlikely to occur onsite; medium = could occur onsite; high = probably does occur onsite but not recorded during recent surveys; occurs = recorded onsite during 2000/2001 surveys and/or during other recent surveys in Implementation Area P.

Scientific Name	**Common Name**	**Potential to occur**	**Habitat**
Asio flammeus	short-eared owl	low	Suitable habitat limited and species has not been recorded from project vicinity in recent years
Asio otus	long-eared owl	low	Suitable habitat limited and species has not been recorded from project vicinity in recent years, also species now rare in Orange County
Eremophila alpestris actia	California horned lark	medium	Some suitable habitat present
Campylorhynchus brunneicapillus	cactus wren	occurs	Recorded during current surveys
Polioptila californica californica	California gnatcatcher	occurs	recorded during current surveys
Empidonax trallii	willow flycatcher	occurs	Recorded in 1998, sutiable habitat present
Lanius ludovicianus	loggerhead shrike	high	Suitable habitat present, recorded nearby during current surveys
Vireo belli pusillus	least Bell's vireo	occurs	recorded during current surveys
Dendroica petechia brewsteri	yellow warbler	occurs	recorded during current surveys
Icteria virens	yellow-breasted chat	occurs	recorded during current surveys
Amphispiza belli belli	Bell's sage sparrow	occurs	Recorded onsite in 1997
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	occurs	Recorded during current surveys
Ammodramus savannarum	grasshopper sparrow	occurs	Recorded during current surveys
Macrotus californicus	California leaf-nosed bat	low	Suitable habitat limited, no recent records
Antrozous pallidus	pallid bat	high	Suitable habitat present
Eumops perotis californicus	California mastif bat	medium	Suitable habitat present
Lepus californicus bennettii	San Diego black-tailed jackrabbit	occurs	Recorded during current surveys
Chaetodipus californicus femoralis	*Chaetodipus californicus femoralis*	medium	Suitable habitat present
Chaetodipus fallax fallax	northwestern San Diego pocket mouse	medium	Suitable habitat present
Neotoma lepida intermedia	San Diego desert woodrat	high	Suitable habitat present, recorded in nearby open space
Onychomys torridus ramona	Ramona grasshopper mouse	medium	Suitable habitat present
Canis latrans	Coyote	occurs	Detected during current surveys
Taxidea taxus	American badger	high	Suitable habitat present

7.3 APPENDIX C: Botanical inventory of Implementation Area P, June through November 2000, based on surveys conducted by Dudek and Associates throughout all of Planning Areas 1 and 2.

SCIENTIFIC NAME	COMMON NAME
ANGIOSPERMS-DICOTS	
AMARANTHACEAE	**AMARANTH FAMILY**
*Amaranthus albus**	Tumbleweed
ANACARDIACEAE	**SUMAC OR CASHEW FAMILY**
Malosma laurina	Laurel Sumac
Rhus integrifolia	Lemonadeberry
Toxicodendron diversilobum	Poison Oak
APIACEAE	**CARROT FAMILY**
*Conium maculatum**	Poison Hemlock
Foeniculum vulgare	Sweet Fennel
ASCLEPIADACEAE	**MILKWEED FAMILY**
Asclepias fascicularis	Narrow-leaf Milkweed
ASTERACEAE	**SUNFLOWER FAMILY**
Acourtia microcephala	Sacapellote
Artemisia californica	Coastal Sagebrush
Artemisia douglasiana	Mugwort
Artemisia dracunculus	Tarragon/ Dragon Sagewort
Aster subulatus	Slender Aster
Baccharis emoryi	Emory's Baccharis
Baccharis pilularis	Chaparral Broom/Coyote Brush
Baccharis salicifolia	Mulefat
Baccharis sarothroides	Chaparral Broom
*Centaurea melitensis**	Tocalote
*Cynara cardunculus**	Cardoon/ Artichoke Thistle
Encelia californica	California Encelia
Encelia farinosa	Incienso/ Brittlebush
Ericameria sp.	Goldenbush
Erigeron folisus var. *stenophyllus*	Leafy Daisy
Eriophyllum confertiflorum	Golden Yarrow
Gnaphalium californicum	California Everlasting
Gutierrezia californica	California Matchweed
Helianthus annuus	Common Sunflower
Isocoma menziesii ssp. venetus	Coastal Goldenbush
*Lactuca serriola**	Prickly Lettuce
Lepidospartum squamatum	Scale-broom
Lessingia filaginifolia	California Aster
*Picris echioides**	Bristly Ox Tongue
Senecio sp*	No common name
Stephanomeria virgata	Tall Stephanomeria

Xanthium strumarium	Cocklebur
BORAGINACEAE	**BORAGE FAMILY**
Heliotropium curassavicum	Salt Heliotrope
BRASSICACEAE	**MUSTARD FAMILY**
*Brassica nigra**	Black Mustard
*Raphanus sativus**	Radish
CACTACEAE	**CACTUS FAMILY**
Opuntia littoralis	Coastal Prickly Pear
CAPPARACEAE	**CAPER FAMILY**
Isomeris arborea	Bladderpod
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**
Sambucus mexicana	Mexican Elderberry
CHENOPODIACEAE	**GOOSEFOOT FAMILY**
Atriplex lentiformis	Big Saltbush
*Atriplex semibaccata**	Australian Saltbush
*Beta vulgaris**	Wild Beet
*Chenopodium ambrosioides**	Mexican Tea
*Salsola tragus**	Russian Thistle
CONVOLVUACEAE	**MORNING-GLORY FAMILY**
Calystegia macrostegia	Morning-glory
CUCURBITACEAE	**GOURD FAMILY**
Cucurbita foetidissima	Calabazilla
CUSCUTACEAE	**DODDER FAMILY**
Cuscuta californica var. *californica*	California Witch's Hair
EUPHORBIACEAE	**SPURGE FAMILY**
Chamaesyce micromeria	Prostrate Spurge
*Ricinus communis**	Castor Bean
FABACEAE	**LEGUME FAMILY**
Lotus purshianus	Spanish Lotus
Lotus scoparius	Deer Weed
Lupinus sp.	Arroyo Lupine
Melilotus sp*	Sweetclover
FAGACEAE	**OAK FAMILY**
Quercus agrifolia	Coast Live Oak
GERANIACEAE	**GERANIUM FAMILY**
*Erodium botrys**	Long-beaked Filaree
*Erodium cicutarium**	Red-stemmed Filaree
LAMIACEAE	**MINT FAMILY**
*Marrubium vulgare**	Horehound
Salvia apiana	White Sage
Salvia mellifera	Black Sage
Trichostema lanceolatum	Vinegar Weed
MALVACEAE	**MALLOW FAMILY**
Malacothamnus fasciculatus	Mesa Bushmallow
*Malva parviflora**	Cheeseweed/ Little Mallow
MYRTACEAE	**MYRTLE FAMILY**
Eucalyptus sp.*	Eucalyptus/ Gum Tree

ONAGRACEAE	**EVENING PRIMROSE FAMILY**
Epilobium canum	California Fucshia
Epilobium ciliatum	Green Willow Herb
PLATANACEAE	**PLANE TREE, SYCAMORE FAMILY**
Platanus racemosa	Western Sycamore
POLYGONACEAE	**BUCKWHEAT FAMILY**
Eriogonum fasciculatum	California Buckwheat
Eriogonum gracile	Slender Eriogonum
Polygonum lapathifolium	Pale Smartweed
PRIMULACEAE	**PRIMROSE FAMILY**
*Anagallis arvensis**	Scarlet Pimpernel
ROSACEAE	**ROSE FAMILY**
Heteromeles arbutifolia	Toyon/ Christmas Berry
RUBIACEAE	**MADDER FAMILY**
Galium angustifolium	Bedstraw
***Galium* sp.**	Bedstraw
SALICACEAE	**WILLOW FAMILY**
Salix gooddingii var. gooddingii	Black Willow
Salix lasiolepis var. *bracelinae*	Arroyo Willow
SCROPHULARIACEAE	**FIGWORT FAMILY**
Antirrhinum sp.	Snapdragon
Mimulus aurantiacus	San Diego Monkey Flower
Scrophularia californica	California Bee Plant
SOLANACEAE	**NIGHTSHADE FAMILY**
Lycium californicum	California box-thorn
*Nicotiana glauca**	Tree Tobacco
ANGIOSPERMS-MONOCOTS	
ARECACEAE	**PALM FAMILY**
Phoenix canariensis	Canary Island data Palm
CYPERACEAE	**SEDGE FAMILY**
Cyperus esculentus	Yellow Umbrella sedge
IRIDACEAE	**IRIS FAMILY**
Sisyrinchium bellum	Blue-eyed Grass
LILIACEAE	**LILY FAMILY**
Calochortus catalinae (sensitive)	Catalina Mariposa Lily
Calochortus weedii var. *intermedius* (sensitive)	Intermediate Mariposa Lily
Yucca whipplei	Our Lord's Candle
POACEAE	**GRASS FAMILY**
*Avena barbata**	Slender Oat
*Avena fatua**	Wild Oat
*Brachypodium distachyon**	Purple False Brome
Bromus carinatus	California Brome
*Bromus diandrus**	Ripgut Grass
*Bromus hordeaceus**	Soft Chess
Bromus madritensis ssp. *rubens**	Red Brome/ Foxtail Chess
*Cortaderia selloana**	Pampas Grass

*Cynodon dactylon**	Bermuda Grass
*Echinochloa crus-galli**	Barnyard Grass
*Hordeum murinum **	Barley
Leymus condensatus	Giant Wild Rye
Leymus glaucus	Blue Wild Rye
Leptochloa uninervia	Dense Flowered Sprangletop
*Lolium multiflorum**	Italian Ryegrass
Melica sp.	Melic Grass
Nassella sp.	Stipa/Needlegrass
*Paspalum diliatatum**	Dallis Grass
*Pennisetum setaceum**	African Fountaingrass
*Polypogon monspeliensis**	Rabbitfoot Grass
TYPHACEAE	**CATTAIL FAMILY**
Typha domingensis	Slender Cattail
** denotes non-native species*	

7.4 APPENDIX D: Wildlife species recorded in Implementation Area P during 2000/2001, based on surveys conducted by Dudek and Associates throughout all of Planning Areas 1 and 2. Species recorded during other recent surveys dented by *.

SCIENTIFIC NAME	COMMON NAME
SALAMANDRIDAE	**NEWTS AND SALAMANDERS**
Batrachoseps pacificus	Pacific slender salamender*
BUFONIDAE	**TRUE TOADS**
Bufo boreas	Western toad
HYLIDAE	**TREEFROGS**
Hyla regilla	Pacific treefrog
EMYDIDAE	**BOX TURTLES**
Clemmys marmorata pallida	Southwestern pond turtle
IGUANIDAE	**IGUANIDS**
Sceloporus occidentalis	Western fence lizard
Uta stansburiana	side-blotched lizard
Phrynosoma coronatum blainvillei	San Diego horned lizard
TEIIDAE	**WHIPTAILS**
Cnemidophorus hyperythrus	Orange-throated whiptail
Cnemidophorus tigris multiscutatus	coastal western whiptail
ANGUIDAE	**ALLIGATOR LIZARDS**
Elgaria multicarinatus	Southern alligator lizard
LEPTOTYPHLOPIDAE	**SLENDER BLIND SNAKES**
Leptotyphlops humilis	Western blind snake*
COLUBRIDAE	**COLUBRIDS**
Masticophis lateralis	striped racer*
Diadophis punctatus	ringneck snake
Pituophis melanoleucus	gopher snake*
Lampropeltis getula	California kingsnake*
VIPERIDAE	**VIPERS**
Crotalus viridis	Southern Pacific rattlesnake*
Crotalus ruber ruber	northern red-diamond rattlesnake*
ARDEIDAE	**HERONS & BITTERNS**
Ardea herodias	great blue heron
Egretta thula	snowy egret
ANATIDAE	**SWANS, GEESE & DUCKS**
Anas platyrhynchos	mallard
CATHARTIDAE	**AMERICAN VULTURES**
Cathartes aura	turkey vulture
ACCIPITRIDAE	**KITES, HAWKS, EAGLES & VULTURES**
Elanus caeruleus	white-tailed kite
Accipiter cooperii	Cooper’s hawk
Buteo jamaicensis	red-tailed hawk
Buteo lineatus	red-shouldered hawk
Aquila chrysaetos	golden eagle
FALCONIDAE	**FALCONS**
Falco sparverius	American kestrel

SCIENTIFIC NAME	**COMMON NAME**
PHASIANIDAE	**PHEASANTS, PARTRIDGES & QUAIL**
Callipepla californica	California quail
CHARADRIIDAE	**PLOVERS**
Charadrius vociferus	killdeer
COLUMBIDAE	**PIGEONS & DOVES**
Zenaida macroura	mourning dove
Colmbina passerina	common ground dove
CUCULIDAE	**CUCKOOS & ROADRUNNERS**
Geococcyx californianus	greater roadrunner
APODIDAE	**SWIFTS**
Aeronautes saxatalis	white-throated swift
TROCHILIDAE	**HUMMINGBIRDS**
Selasphorus rufus	rufous hummingbird
Calypte anna	Anna’s hummingbird
PICIDAE	**WOODPECKERS**
Picoides pubescens	downy woodpecker
Colaptes auratus	northern flicker
Picoides nuttallii	Nuttall’s woodpecker
TYRANNIDAE	**TYRANT FLYCATCHERS**
Tyrannus verticalis	western kingbird
Tyrannus vociferans	Cassin’s kingbird
Myiarchus cinerascens	ash-throated flycatcher
Sayornis nigricans	black phoebe
Sayornis saya	Say’s phoebe
Empidonax difficilis	Pacific-slope flycatcher
Empidonax trailli	willow flycatcher
HIRUNDINIDAE	**SWALLOWS**
Hirundo pyrrhonota	cliff swallow
Stelgidopteryx serripennis	northern rough-winged swallow
Tachycineta thalassina	violet-green swallow
CORVIDAE	**CROWS, JAYS**
Corvus brachyrhynchos	American crow
Corvus corax	common raven
Aphelocoma californica	western scrub jay
AEGITHALIDAE	**BUSHTIT**
Psaltriparus minimus	common bushtit
TROGLODYTIDAE	**WRENS**
Troglodytes aedon	house wren
Thryomanes bewickii	Bewick’s wren
Campylorhynchus brunneicapillus	cactus wren
Salpinctes obsoletus	rock wren
MUSCICAPIDAE	**THRUSHES, OLD WORLD WARBLERS**
Regulus calendula	ruby-crowned kinglet
Turdus migratorius	American robin
Polioptila caerulea	blue-gray gnatcatcher
Polioptila californica	California gnatcatcher
Chamaea fasciata	wrentit

SCIENTIFIC NAME	COMMON NAME
MIMIDAE	**MOCKINGBIRDS & THRASHERS**
Mimus poolyglottos	northern mockingbird
Toxostoma crissale	California thrasher
PTILOGONATIDAE	**SILKY-FLYCATCHERS**
Phainopepla nitens	phainopepla
STURNIDAE	**STARLINGS**
Sturnus vulgaris	European starling
VIREONIDAE	**VIREOS**
Vireo bellii pusillus	least Bell’s vireo
EMBERIZIDAE	**WOOD WARBLERS, SPARROWS, NEW WORLD FINCHES & BLACKBIRDS**
Dendroica petechia	yellow warbler
Vermivora celata	orange-crowned warbler
Geothlypis trichas	common yellowthroat
Icteria virens	yellow-breasted chat
Pheucticus melanocephalus	black-headed grosbeak
Guiraca caerulea	blue grosbeak
Passerina ciris	lazuli bunting
Chondestes grammacus	lark sparrow
Aimophila ruficeps	rufous-crowned sparrow
Ammodramus savannarum	grasshopper sparrow
Zonotrichia leucophrys	white-crowned sparrow
Spizella passerina	chipping sparrow
Amphispiza belli belli	Bell’s sage sparrow*
Melospiza melodia	song sparrow
Pipilo erythrophthalmus	spotted towhee
Pipilo crissalis	California towhee
Euphagus cyanocephalus	brewer’s blackbird
Agelaius phoeniceus	red-winged blackbird
Sturnella neglecta	western meadowlark
Molothrus ater	brown headed cowbird
Icterus galbula bullocki	Bullock’s oriole
Icterus cucullatus	hooded oriole
FRINGILLIDAE	**OLD WORLD FINCHES**
Carpodacus mexicanus	house finch
Carduelis psaltria	lesser goldfinch
Carduelis tristis	American goldfinch
DIDELPHIIDAE	**OPOSSUMS**
Didelphis marsupialis	opossum
PROCYONIDAE	**RACOONS & COATIS**
Procyon lotor	raccoon
CANIDAE	**DOGS, WOLVES, FOXES**
Canis latrans	coyote
Urocyon cinereoargenteus	gray fox
FELIDAE	**CATS**
Lynx rufus	bobcat

SCIENTIFIC NAME	COMMON NAME
SCIURIDAE	**SQUIRRELS**
Citellus beecheyi	California ground squirrel
GEOMYIDAE	**POCKET GOPHER**
Thomomys bottae	Botta's pocket gopher
CRICETIDAE	**MICE, RATS, LEMMINGS, VOLES**
Peromyscus maniculatus	deer mouse
LEPORIDAE	**HARES, RABBITS**
Lepus californicus	black-tailed jackrabbit
Sylvilagus bachmani	brush rabbit
CERVIDAE	**DEER**
Odocoileus hemionus	mule deer

7.5 APPENDIX E: CALIFORNIA NATIVE PLANT SOCIETY CATEGORIES

CNPS Status based on California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California (Skinner and Pavilk 1994):

List 1A: Plants Presumed Extinct in California
The plants of List 1A are presumed extinct because they have not been seen or collected in the wild for many years. Although most of them are restricted to California, a few are found in other states as well. There is a difference between "extinct" and "extirpated." A plant is extirpated if it has been locally eliminated. It may be doing quite nicely elsewhere in its range. All of the plants constituting List 1A meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection) of the California Department of Fish and Game Code and are eligible for state listing.

List 1B: Plants Rare, Threatened or Endangered in California and Elsewhere
The plants of List 1B are rare throughout their range. All but a few are endemic to California. All of them are judged to be vulnerable under present circumstances or to have a high potential for becoming so because of their limited or vulnerable habitat, their low numbers of individuals per population (even through they may be wide ranging), or their limited number of populations. All of the plants constituting List 1B meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection) of the California Department of Fish and Game Code and are eligible for state listing.

List 2: Plants Rare, Threatened or Endangered in California, But More Common Elsewhere
Except for being common beyond the boundaries of California, the plants of List 2 would have appeared on List 1B. Based on the "Native Plant Protection Act," plants are considered without regard to their distribution outside the state. All of the plants constituting List 2 meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection) of the California Department of Fish and Game Code and are eligible for state listing.

List 3: Plants About Which We Need More Information—A Review List
The plants that comprise List 3 are an assemblage of taxa that have been transferred from other lists or that have been suggested for consideration. The necessary information that would assign most to a sensitivity category is missing.

List 4: Plants of Limited Distribution—A Watch List

The plants in this category are of limited distribution in California and their vulnerability or susceptibility to threat appears low at this time. While these plants cannot be called "rare" from a statewide perspective, they are uncommon enough that their status should be monitored regularly. Many of them may be significant locally. Should the degree of endangerment or rarity of a plant change, they will be transferred to a more appropriate list.

R-E-D Code

R (Rarity)

1. Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction or extirpation is low at this time.
2. Occurrence confined to several populations or to one extended population.
3. Occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported.

E (Endangerment)

1. Not endangered
2. Endangered in a portion of its range
3. Endangered throughout its range

D (Distribution)

1. More or less widespread outside of California
2. Rare outside California
3. Endemic to California

VOLUME 3

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August 21, 2001

To Whom It May Concern,

In March 2001, the Irvine Community Development Company requested a Phase I Cultural Resources Inventory for Planning Area 5B, in Irvine, California. The planning area is slated for residential development. The property is being assessed to determine the status of on-site cultural resources. Additionally, the client requested an assessment of potential constraints regarding cultural resources, if any exist.

This report documents that effort in compliance with the California Environmental Quality Act. The 319 gross acre project is bounded by Hicks Canyon Wash to the north, Jeffrey Road to the east, Irvine Blvd. to the south and existing residential uses to the west. A USGS 7.5' topographical map depicting the survey boundaries was referenced for the fieldwork and is included in the report.

A search of the archaeological records indicates that the property has been formally surveyed and that no historic, archaeological, or historical archaeological sites are known to exist on the property. The Keith Companies (TKCI) Archaeological Division investigated the property. However, the property consists of agriculture, nurseries, buildings, and paved surfaces, which cover the native ground surface, making investigation difficult. TKCI further concluded that there was a possibility that buried or partially destroyed historic and prehistoric sites could exist on the property and that grading monitoring be conducted for any grading operations that occur on the property.

Respectfully,

Christopher Drover, Ph.D.
Project Archaeologist

A PHASE I CULTURAL RESOURCES INVENTORY FOR THE 319 ACRE PLANNING AREA 5B, IRVINE, CALIFORNIA

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August 21, 2001

USGS 7.5' Tustin Topographic Map

USGS 7.5' El Toro Topographic Map

Keywords: Orange County; Irvine Survey; Planning Area 5B

MANAGEMENT SUMMARY

In March of 2001, The Keith Companies, Inc. (TKCI) of Costa Mesa, California was retained by the Irvine Community Development Company (ICDC), Newport Beach, California to conduct a Phase I Cultural Resources Inventory on an approximately 319 gross acre parcel of land. The property is proposed for residential development and there is a potential that cultural resources could be impacted during construction. Investigations were undertaken to determine if a culture resources survey had ever been conducted and if cultural resources were recorded for the property. Additionally, the client requested an assessment of potential constraints regarding cultural resources if any existed. This report is designed to comply with the California Environmental Quality Act (CEQA).

The 319 gross acre survey boundary is located in Planning Area 5 and identified as “5B”. A composite USGS 7.5' Laguna Beach and Tustin topographical map was used as a reference map for this investigation. A USGS 7.5' topographical map showing the survey boundary has also been provided.

A search of the records on file at the South Central Coastal Information Center (SCCIC), Institute of Archaeology, California State University, Fullerton, California indicated that portions of the property had been formally surveyed and no historic or prehistoric sites were identified on the property by those investigations. TKCI resurveyed the property noting areas which were obscured by buildings, streets, or nursery related activities. Survey activities have resulted in the following recommendations

- A qualified archaeologist be present for the duration of mass grading to look for any historic or prehistoric sites that may be buried.

- Any cultural resources identified from either the reexamination of the property prior to general development, or during monitoring of grading must be evaluated pursuant to Section 15064.5 of the State CEQA Guidelines. Evaluations may include additional archival review and limited excavations the results of which are to be compiled in a report indicating the cultural significance of the find and any mitigation measures that may be necessary to satisfy statutory requirements.

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UNDERTAKING INFORMATION

The Irvine Community Development Company is considering residential development for a 319 gross acre parcel of land in Planning Area 5. This development will require the construction of utility systems, streets, and residential units. The construction will result in earth movement over most of the subject property.

TKCI initiated an investigation of the property to determine whether historic, historic archaeological, or prehistoric sites exist on the property. This investigation included an archival review of records to determine if any known cultural resources were recorded on the property. A pedestrian survey of the property, by two Keith Companies employees Catherine Bell and Craig Lambert, was conducted to identify new sites as well.

Figure 1. Composite USGS 7.5’ Tustin and El Toro Maps Indicating Planning Area 5B Boundaries

NATURAL SETTING

The property ranges from approximately 230 to 342 feet above sea level. It contains limited native vegetation especially prevalent in the southeastern corner of the property. Soils on the property range from clayey and fine-grained alluvium to bedded clays emanating from the Santa Ana Mountains immediately north of the property. Additional alluvium is likely to have resulted from the Hicks Canyon drainage, which, in recent historic times formed the northern boundary of the planning area. The Hicks Canyon drainage was piped underground during the construction of Portola Parkway.

Precipitation is mainly a result of winter dominant, frontal storms from the northwest, although occasional summer thundershowers result from damp air intruding from the southern (Gulf of Mexico--Sea of Cortez) monsoon season. The subject property is located in an area of the San Joaquin hills rich in ecological diversity. Depending on local climatic conditions, several plant communities have existed on and near the property in prehistoric times. Within a few miles radius of the property, southern oak woodland, coastal sage scrub, riparian woodland, saltmarsh, adventive grassland and native grasslands grow today and could have been exploited for sustenance by prehistoric inhabitants throughout the year (Klug and Popper, 1997). The various species available to early cultural groups in the area include prickly pear (*Opuntia littoralis*), sagebrush, (*Artemisia californica*), wild onion (*Alium praecox*), California goosefoot (*Chenopodium californicum*), sage (*Salvia*), and buckwheat (*Eriogonum fasciculatum*). A staple for most early Californians, the acorn (*Quercus spp.*) is common to the area and was likely to have been utilized extensively. During the course of the year numerous species of bulbs, seeds, and leaves from herbaceous plants such as tarweed, sunflower, grasses, saltbush, and clover as well as fruits from elderberry, cacti, and lemonade berry were collected and consumed.

Local precipitation and temperature conditions during the past would have altered the plant communities available to prehistoric groups. Pollen analysis and paleoenvironmental studies specific to known site locations on the subject property may facilitate a definitive understanding of ethnobotanical uses of indigenous plant life (see Klug and Popper, 1997).

CULTURAL SETTING

Prehistoric

Archaeologists and ethnologists have pondered over the cultural sequences that occurred before Spanish contact. The two most currently accepted schemes are those proposed by Wallace (1955) who interpreted the prehistory of coastal southern California through temporal horizons, and Warren (1968) who looked at the cultural differences not as temporal distinctions, but as local traditions. Wallace (1955) saw four temporal horizons along the southern California coast: Early Man, Milling Stone, Intermediate, and Late Prehistoric.

Early Man Horizon

Spanning the period from the end of the Pleistocene to approximately 8,000 B.P., archaeological assemblages attributed to this horizon are characterized by large projectile points and scrapers. The limited data available suggests that prehistoric populations focused on hunting and gathering, moving about the region in small nomadic groups.

Milling Stone Horizon

Characterized by the appearance of handstones and millingstones, this horizon tentatively dates to between 8,000 B.P. and 3,000 B.P. Assemblages in the early Milling Stone period reflect an emphasis on plant foods and foraging subsistence systems. For inland locales, it has been assumed exploitation of grass seeds formed a primary subsistence activity. Artifact assemblages include choppers and scraper planes but generally lack projectile points. The appearance of large projectile points in the latter portion of the Milling Stone Horizon suggests a more diverse economy. The distribution of Milling Stone sites reflects the theory that aboriginal groups may have followed a modified central based wandering settlement pattern. In this semi-sedentary pattern, a base camp would have been occupied for a portion of the year, but a small population group seasonally occupied subsidiary camps in order to exploit resources not generally available near the base camp. Sedentism apparently increased in areas possessing an abundance of resources, which were available for longer periods of time. More arid inland regions would have provided a seasonally and geographically dispersed resource base, restricting sedentary occupation.

Intermediate Horizon

Dated to between 3,000 B.P. and 1,350 B.P., the Intermediate Horizon represents a transitional period. Little is known about the people of this period, especially those of inland southern

California. Sites assemblages retain many attributes of the Milling Stone Horizon. Additionally, Intermediate Horizon sites contain large stemmed or notched projectile points and portable mortar and pestles. The mortars and pestles suggest that the aboriginal populations may have harvested, processed, and consumed acorns. Neither the settlement-subsistence system nor the cultural evolution of this period has been well understood due to a general lack of data. It has been proposed that sedentism increased with the exploitation of storable food resources (acorns); the duration and intensity of occupation of base camps increased, especially toward the latter part of this horizon.

Late Prehistoric Horizon

Extending from 750 to Spanish contact in 1769, the Late Prehistoric Horizon reflects an increased sophistication and diversity in technology. This is characterized by the presence of small projectile points that imply the use of the bow and arrow. In addition, assemblages include steatite bowls, asphaltum, grave goods, and elaborate shell ornaments. Use of bedrock milling stations was widespread during this horizon. Increased hunting efficiency and widespread exploitation of acorns provided reliable and storable food resources. These innovations apparently promoted greater sedentism.

By contrast, Warren’s (1968) cultural traditions were more restricted spatially. Warren’s scheme accounted for the cultural variability particularly evident within Wallace’s Late Prehistoric Horizon. Warren’s traditions include the San Dieguito, Encinitas, Campbell, Chumash, Shoshonean, and Yuman.

The San Dieguito tradition occurs within Wallace’s Early Man Horizon, but is restricted to San Diego County. The Encinitas equated to Wallace’s Milling Stone, but was longer in time, encompassing Wallace’s Intermediate Horizon. Warren saw no new tradition developing in northern San Diego and Orange counties during this time period.

The Campbell and Chumash traditions are further north in Santa Barbara and Ventura counties. In Los Angeles, Orange, and North San Diego counties, the Shoshonean Tradition began about 1300 B.P. and represents the intrusion of Shoshonean speakers from the interior (Warren 1968). In contrast, the Yuman Tradition in southern San Diego County, just as the Chumash Tradition to the north are thought to have developed from previous local traditions, whereas the Shoshonean Tradition is the result of intrusion into a previous tradition (Mason 1991:95).

Koerper (1981) and Koerper and Drover (1983) have taken the horizon system proposed by Wallace and geared it more specifically to the prehistory of Orange County.

Koerper (1981) and Koerper and Drover (1983) adapted Wallace's four horizons using artifacts and associated radiocarbon dates from two Orange County sites, CA-ORA-64 and CA-ORA-119-A. The authors argued that the transition between the Milling Stone and Intermediate Periods was marked by the appearance of the mortar and pestle. The primary projectile point type changed from the Milling Stone "Pinto Basin" to the stemmed and side-notched forms. The beginning of the Late Prehistoric Period occurred roughly with the appearance of the smaller "Cottonwood" points, suggesting the introduction of the bow and arrow. Also the abundance of shell beads and ornaments, use of steatite for pipes, bowls, and ornaments and arrow shaft straighteners marks the Late Prehistoric Period. Pottery may or may not appear at the end of the Late Prehistoric Period or the Historic period (Koerper and Drover 1983).

Most recently, Mason and Peterson (1994) have proposed subdividing each of Wallace's horizons as follows: the Milling Stone (3), the Intermediate (1), and the Late Prehistoric (2). These temporal subdivisions are based entirely on radiocarbon age determinations that correspond to some degree with changes in settlement (Mason and Peterson 1994:58). In contrast, they note that temporal subdivisions traditionally have been defined on supposed differences in cultural content or traits as presented by Willey and Phillips (1958:22). Mason and Peterson found little difference in the cultural content of their three Milling Stone subdivisions.

During the Newport Coast Archaeological Project (NCAP) the Intermediate was not subdivided because only ten dates were available. They were confident that the Intermediate Period could also be subdivided once calibrated dates were available from a wider region of the Newport Coast (Mason and Peterson 1994:58), and for that matter, all of Orange County or Southern California. The authors argue that although their temporal subdivisions do not correspond with changes in stylistically defined artifact types, they may correspond with changes in settlement systems (Mason and Peterson 1994:58). The Intermediate Period was subdivided in Roger Masons' report on CA-Ora-225 (Mason et al., 1997c). Mason defined three periods based on eighteen radiocarbon dates. These three divisions are Late Intermediate (1700-1350 B.P.), Middle Intermediate (2300-1700 B.P.) and Early Intermediate (3100-2300 B.P.). Due to the small sample of radiocarbon dates Mason notes that the Intermediate subdivisions could only be applied to Ora-225 and not regionally. As a result of the Bonita Mesa Archaeological Project

(BMAP) (document in progress), the Intermediate period was redefined. A total of 77 radiocarbon dates from 6 sites were used to redefine the Intermediate. The Intermediate was divided into two periods the late part of the Intermediate or INT2 (1350-2300 B.P.) and the early part of the Intermediate or INT1 (2300-3000 B.P.).

Figure 2. Cultural Sequence for Orange County (Mason and Peterson 1994 and Drover 2001 in progress)

CULTURAL PERIOD	RADIOCARBON DATES
Paleo-Coastal Period	
PC	Prior to 8000 B.P.
Milling Stone Period	
MS1	8000 to 5800 B.P.
MS2	5800 to 4650 B.P.
MS3	4650 to 3000 B.P.
Intermediate Period	
INT1	3000 to 2300 B.P.
INT2	2300 to 1350 B.P.
Late Prehistoric Period	
LP1	1350 to 650 B.P.
LP2	650 to 200 B.P.

Ethnohistory

At the time of European contact in 1769 the Gabrielino Native Americans, so called by the Spanish after the nearby mission San Gabriel Archangel, occupied the Santa Ana Plain. According to Bean and Smith (1978:538) the Gabrielino are, in many ways, one of the least known groups of California native inhabitants. In addition to much of the Los Angeles Basin, they occupied the offshore islands of Santa Catalina, San Nicolas, and San Clemente. Gabrielino populations are difficult to reconstruct. However, at any one time, as many as 50 to 100 villages were simultaneously occupied. Like the prehistoric culture before them, the Gabrielino were a hunter/gatherer group who lived in small sedentary or semi-sedentary groups of 50 to 100 persons, termed rancherias. These rancherias were occupied by at least some of the people all of the time. Water availability determined the location of. Within each village, houses were circular in form, and constructed of sticks covered with thatch or mats. Each village had a sweat lodge as well as a sacred enclosure (Bean and Smith 1978).

Gabrielino subsistence relied heavily on plant foods, but was supplemented with a variety of meat, especially from marine resources. Food procurement consisted of hunting and fishing carried out by men and gathering of plant foods and shellfish by women. Hunting technology included the use of bow and arrow for deer and smaller game, throwing sticks, snares, traps, and slings. Fishing was conducted with use of shell fishhooks, bone harpoons, and nets. Seeds were gathered with beaters and baskets. Food was stored in baskets. Manos and metates, and mortars and pestles were used in food processing. Food was cooked in baskets coated with asphaltum, in stone pots, on steatite frying pans, and by roasting in earthen ovens (Bean and Smith 1978).

Although the earliest description of the Gabrielino dates back to the Cabrillo expedition of 1542, the most important and extensive accounts were those written by Father Geronimo Boscana about 1822 and Hugo Reid in 1852. Major Gabrielino villages south of Long Beach apparently included Lukpa and Kengaa, also known as Gengara. Moyoonga is another place name cited by Kroeber (1907), but it is unclear if this was a community or a geographical designation (McCawley 1996:72). According to mission records Kengaa may have been occupied as late as 1828 or 1829 (Merriam 1968). The place name was still used as late as 1853 identifying Newport Bay as “bolsa de gengara.” Archaeological evidence suggests that CA-Ora-119A or CA-Ora-111 may be the remains of this important village. The other village, Lukpa, apparently was located in Huntington Beach according to one of Kroeber’s Native American informants.

One possibility is the Newland Site excavated by Winterbourne in the 1930s and more recently by other investigators.

During the early 1900s important ethnographic studies were conducted by several researchers including Alfred L. Kroeber, John P. Harrington, C. Hart Merriam, Strong, and J.W. Hudson. Each of these men was able to interview members of the Gabrielino who had living experience with the Mission period when the group was in transition. Central Orange County was shared by both the Juaneño and Gabrielino. The three place names associated with Central Orange County are Genga, Pasbengna, and Hutukngа . Genga was located at CA-Ora-58 in what today is Costa Mesa. Pasbengna was located along the Santa Ana River approximately where the City of Santa Ana is today and appears on the 1846 map drafted by Alexander Taylor. The third site, Hutukngа, is located where Yorba Linda is today (Earle and O'Neil 1994).

The Gabrielino are frequently thought to have been the dominant ethnohistoric group in Orange County (e.g., Kroeber 1925). Earle and O'Neil have determined that sites along the Santa Ana River afforded pivotal political exchange and social interaction between the Gabrielino and Juaneño (1994). Based on Mission marriage records, the villages along the Santa Ana River apparently consisted of multi-ethnic populations (Earle and O'Neil 1994). Among the more significant sites along the northern coast of Orange County was the complex of sites surrounding Bolsa Chica including CA-Ora-83, the "Cog Stone" site; CA-Ora-183, the "Newland Site;" CA-Ora-58, the "Fairview Site;" and CA-Ora-135, the "Griset Site." As with Bolsa Chica, Newport Bay also is surrounded by a number of prehistoric sites. The sites along the southern Orange County coast in the San Joaquin Hills include the multi-component complexes at Bonita Mesa, Pelican Hill, and Shady Canyon.

Historic

Although European explorers made brief visits to the California coast in the sixteenth and seventeenth centuries, the historic period really begins in 1769 with the Portola expedition and the founding of permanent Spanish settlements along the coast from the Mexican border to the San Francisco Bay region. Mission San Juan Capistrano, established in 1776, was the first permanent settlement in what is today Orange County. The first private land grant was given in 1784 to Manuel Nieto, an ex-soldier. His parcel consisted of some seven leagues of coastal land. Jose Antonio Yorba and nephew Juan Pablo Peralta were given joint custody of Rancho Santiago de Santa Ana in 1810. Most likely Yorba and his father-in-law Pablo Grijalva had settled on the land before this, but did not receive official title until 1810.

From the time of the first private land grants in the late eighteenth century to the close of Spanish rule in California, twenty private land concessions were made (Cleland 1941:19). Most were located in southern California and at least half were within one hundred miles of the pueblo of Los Angeles. After the overthrow of Spanish rule, the new Mexican government instituted land reform. The Colonization Act of 1828 provided the guidelines for all subsequent land grants in the border provinces. Until this time, governors appointed to rule California did nothing to overturn the original Spanish grants. With the reforms to support his cause, Governor Jose Maria Echeandia decreed restoration of the mission lands to the public in 1828. His decision culminated in the Secularization Act of 1833-34 (Cleland 1941:20). Within thirteen years, over seven hundred private land grants had been awarded (Cleland 1941:1). Between 1834 and 1844, no less than twenty were granted in what is today Orange County (Robinson 1963).

When California became a state of the Union, only one settlement, San Juan Capistrano, existed in what is today Orange County. A village had grown up around the largely abandoned mission compound. In 1857 a German colony called Anahiem was established on 1,200 acres purchased from Rancho San Juan Cajón de Santa Ana (Cleland 1941:157). History changed with the Great Drought of the 1860s, forcing many cattlemen to sell their land, which in turn encouraged new settlements to spring up. Communities such as Santa Ana, Tustin, Westminster, Orange and Garden Grove were all founded in the years following the Great Drought. The 1890s were especially important boom years for Southern California. A major cause of the boom years is the linking of Southern California to the outside world via the railroad. Fullerton, Buena Park, Olive, El Modena were settled, followed in time by Laguna Beach, Huntington Beach, San Clemente, and Newport Beach. Former rancho lands were subdivided again and again.

A number of land transactions transpired which resulted in the formation of the historic Irvine Ranch. The Yorba family property, Rancho Lomas de Santiago, which was crossed by Santiago Creek, lay between the Cleveland National Forest and Rancho San Joaquin. Governor Pio Pico originally granted this parcel to Teodocio Yorba on May 26, 1846. The vast holdings of Yorba were acquired in 1860 by William Wolfskill and then sold six years later to James Irvine, Llewellyn Bixby, and both Benjamin and Thomas Flint. Title was confirmed and patented in 1868 for 47,226 acres.

In 1862, the Irvine-Bixby-Flint group had purchased Rancho San Joaquin, a 50,000 acre parcel formerly owned by the Sepulveda family. Title was confirmed and a patent issued to 48,803 acres. Governor Alvarado originally granted Rancho San Joaquin, also known as La Cienega de las Ranas, to Jose Sepulveda on April 15, 1837. With the addition of this parcel, the group now owned a total of 101,077 acres (Robinson 1963:8-9).

Following the Great Drought, wool production became extremely profitable and the Irvine-Bixby-Flint group began raising sheep on the property. Additional small parcels were added until 1876 when James Irvine bought out his partners, increasing the ranch size to nearly 115,000 acres (Robinson 1963:8-9).

The Irvine Ranch, as it was renamed, occupied a strip of land approximately eight miles in width along the coast. In the late 1880s, when sheep and wool became less valuable, much of the Irvine Ranch was leased out for agricultural purposes. In little time, there was a complete conversion from livestock to agriculture. As late as 1889, when Orange County was established, the area was still largely unsettled plains and valleys, crossed by the Santa Ana River and a number of creeks and streams (Robinson 1963:1).

Although the Irvine Ranch was always very profitable, there was the constant problem of water availability. A second, though less drastic drought in 1882 added to suppressing the sheep endeavor. By then, agriculture had become increasingly important to the local economy. Two years after James Irvine Sr. died in 1886, 5,000 acres were let out for walnut groves, olive groves, and hay and grain production. James Irvine, Jr. took over sole control of the property in 1893, incorporating it as the Irvine Ranch the following year (Cleland 1941).

By 1895, the most productive crop was barley which was used for brewing beer and livestock feed. An estimated thirty-one thousand acres of barley crops were planted, an area larger than that of all other crops combined (Cleland 1941). Black and lima beans were also important crops. In the early 1900s, walnuts yielded some twenty-two tons annually.

Around 1905, other crops were raised such as alfalfa, celery, rhubarb, artichokes, peanuts, flax, and sugar beets. For some unexplained reason, Irvine attempted to sell the ranch between 1902 and 1906 but was successful in selling only a few thousand acres (Cleland 1941).

About this time, the first successful citrus orchards were being planted on the property. The orchards proved so profitable that in 1913 citrus became the principal product and grazing lands were reduced. Persimmons and avocados were also grown. Salt production began in 1934 when a salt plant was constructed in Newport Bay (Cleland 1941).

The construction of the Pacific Coast Highway led to the development of several coastal areas such as Newport Beach, Los Trancos Canyon, Crystal Cove, Japanese tenant farms, and a few scattered farms north of Laguna Canyon. By 1943, what was to become MacArthur Boulevard ran through the San Joaquin Hills, but other than a few dirt tracks around Bonita Creek and Bonita Reservoir, there was still no development north of Laguna Canyon. Following establishment of the California University of Irvine in 1965, development increased steadily in and around the campus and into the San Joaquin Hills in accordance with long-term plans of The Irvine Company.

The historic records on file at the SCCIC were researched for any information that would indicate historical resources existed on the subject property. Personnel conducting the search at the SCCIC reported that there were no recorded historical sites within a quarter-mile radius of the subject property (Appendix A).

RESEARCH DESIGN

The research orientation within the project constraints of this undertaking and any Phase I Archaeological Inventory is to locate and record cultural resources which may be impacted by proposed development. The present effort was designed to locate and record cultural resources on the property and describe the work accomplished on any existing sites.

Results from a records search of the 319 gross acre project area accomplished by personnel at the South Central Coast Information Center (SCCIC) is discussed in the Report of Findings section, which found that no sites are known to be located on the subject property or immediately adjacent to it. Although, research indicates that a number of sites have been discovered nearby suggesting that prehistoric sites may yet exist on the subject property.

The paucity of surface sites in proximity to this project may be a result of 1) minimal land-use by historic or prehistoric inhabitants in this area, 2) destruction of existing sites by natural or mechanical factors since the sites were inhabited, or 3) the sites could have been buried by alluvial episodes since their original occupation.

The Keith Companies, Inc. Archaeology division therefore made the following assumptions regarding this property based on the results of the records search:

1. The historic records search did not indicate the presence of any historic sites on the property. However, it is likely that historic activities occurred on or nearby the property that have not been recognized and remnants of those activities may exist on the property, either obscured by current land use or covered by fill or alluvium.
2. The prehistoric records search indicated that while no prehistoric sites have been identified on the property, the present land-use could be obscuring evidence of the sites. Furthermore, the incidence of buried and lost sites and isolate artifacts in the area, while low, is evidence that prehistoric peoples were nearby and may have traversed the property on occasion, particularly with respect to the Hicks Canyon drainage. Historic land use and natural forces could be obscuring the presence of prehistoric sites on the property.

METHODS

The locational relationship of historic or archaeological sites on the property to planned development is critical for evaluating the level to which a site may be impacted. Once the level of impact is understood, mitigation measures may be recommended. Sites may be mitigated through avoidance and preservation, simple recordation and grading monitoring, or by a specific data recovery effort. Each site must be evaluated for significance and eligibility according to Section 15064.5 of the State CEQA Guidelines.

An archaeological records check and inventory of the project area was undertaken in March, 2001 for the approximately 319-acre property located on the Tustin and El Toro 7.5' USGS Quadrangles, to assess cultural resource impacts resulting from the proposed development. The records on file at the South Central Coastal Information Center (SCCIC), California State University, Fullerton were examined to determine whether historic, historical archaeological, or archaeological sites were recorded on the property. The search was based on the boundaries shown on a 7.5’ topographical map supplied for fieldwork. The results of that search indicated that there have been eleven surveys conducted within a one-mile radius of the project area, three of which included some portion of the subject property. The records search also indicated that there are no historic sites recorded on the subject property or within a one-quarter mile radius of the project area (Invoice #PA-5A, Appendix A).

A review of historic resources literature at the SCCIC indicated that it was unlikely that any historic sites existed on the subject property. SCCIC personnel reviewed The California State Historic Resources Inventory, The National Register of Historic Places, the listings of the California Historical Landmarks (1990) of the Office of Historic Preservation, and the California Points of Historical Interest (1992) and found that no properties of historical significance are within a quarter mile radius of the project area.

REPORT OF FINDINGS

A records search of the 319 gross acre project area accomplished by personnel at the SCCIC indicated that eleven surveys (Manuscript #'s OR58, OR81, OR252, OR286, OR645, OR648, OR761,OR762, OR847, OR1394, and OR1844) have been conducted within a one mile radius of the project area (Appendix A). Those manuscripts document surveys related to specific areas both on and adjacent to the subject property. The exact total acreage of PA 5B surveyed by past projects was unclear, although it seems likely that approximately half of the entire project area had been formally surveyed by at least four of the eleven prior surveys.

Although no sites are known to be located on the subject property or immediately adjacent to it, research indicates that a number of sites have been discovered nearby suggesting that prehistoric sites may yet exist on the subject property.

The record search indicated four of the eleven Cultural Resource surveys, investigations, or assessments that were accomplished immediately adjacent to or on the subject property have encompassed portions of the subject property.

In 1978, Scientific Resource Surveys, Inc. (SRS), conducted a pedestrian survey of a large parcel of land to the north of PA 5B in conjunction with planning for the greater Hicks Canyon drainage system. That survey included the approximate northern half of PA 5B. No historic or prehistoric sites or artifacts were located on PA 5B during that investigation.

Another Cultural Resource Survey, conducted by LSA in 1982, traversed a small diagonal portion of the northeastern edge of the property. That project was being conducted as advance planning for the construction of the Foothill Transportation Corridor (Breece and Padon 1982). The survey did not locate any historic or prehistoric sites or artifacts on the subject property that was a part of that larger investigation.

Beth Padon conducted an archaeological resource inventory for the City of Irvine in 1985 (Padon 1985). That investigation included the approximate lower third of Planning Area 5B. The inventory did not result in the discovery of any historic or prehistoric sites or artifacts on that portion of Planning Area 5B.

The Keith Companies conducted a 400 acre survey for the Northwood Point Planned Community (5A) in 1994 to the north of the subject property (Chace). That survey included a narrow swath that ran diagonally through the northeast corner of Planning Area 5B. The survey did not result in the identification of any historic or prehistoric sites or artifacts on Planning Area 5B.

Isolates

Isolates are single artifacts located on the terrain with no obvious connection to a larger assemblage of artifacts, or site. While such artifacts may represent a lost or intentionally placed item on the landscape, they could also represent the only observable artifact from a buried site or a site that has been mostly destroyed through natural or manmade causes. An isolated pestle fragment was located on property near the intersection of Trabuco Road and Jeffrey Road one half-mile southwest of this project in 1988 by LSA (Padon and Jertberg 1988). Pestles are linked to acorn processing and typically associated with seasonal or semi-seasonal encampments.
No site was ever located on that project in the vicinity of the isolate.

Buried Sites

The Foster Wheeler Corporation discovered a buried site near the intersection of Irvine Boulevard and Sand Canyon Avenue while monitoring the construction of the Eastern Transportation Corridor in 1997. The site was buried at a depth of 21 feet below the natural ground surface and consisted of two cobble hearth features. At depths of 10 to 12 feet near the same area an artifact scatter was found from which two radiocarbon dates were derived. The dates were about 6,900 years before present and it was presumed the hearth features would have dated to an even earlier age (Davy 1997).

Lost Sites

A site was recorded due south of the project area overlooking Interstate 5 in 1972 by the Pacific Coast Archaeological Society (PCAS). The site was given the trinomial CA-Ora-341 and identified as a Milling Stone site containing Fire Affected Rock (F.A.R.), manos, hammerstones, choppers, and a dart point. A surface collection was accomplished by the PCAS in 1972 and they re-recorded the site in 1973 also. In 1980, Archaeological Planning Collaborative revisited the area but could not locate the site (Douglas 1980).

MANAGEMENT CONSIDERATIONS

The present archaeological inventory effort was designed to acquire information regarding cultural resources which may be affected by future residential development planned by the Irvine Community Development Company. Taking into consideration portions of the property which were obscured from observation, the following recommendations are made for Planning Area 5B:

- A qualified archaeologist be present for the duration of mass grading to look for any historic or prehistoric sites that may be buried.

- Any cultural resources identified from either the reexamination of the property prior to general development, or during monitoring of grading must be evaluated pursuant to Section 15064.5 of the State CEQA Guidelines. Evaluations may include additional archival review and limited excavations the results of which are to be compiled in a report indicating the cultural significance of the find and any mitigation measures that may be necessary to satisfy statutory requirements.

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APPENDIX A SCCIC RECORDS SEARCH DOCUMENTATION

APPENDIX B: RESUMES

A CULTURAL RESOURCES INVENTORY FOR PLANNING AREA 6, IRVINE, CALIFORNIA

August 23, 2001

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Keywords: CA-ORA-244 , Tomato Springs, Lambert Reservoir, USGS 7.5’ El Toro Quadrangle

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MANAGEMENT SUMMARY

In June of 2001, The Keith Companies, Inc. (TKCI) of Costa Mesa, California was retained by the Irvine Community Development Company (ICDC) of Newport Beach, California to conduct a Phase I Cultural Resources Inventory of an approximate 1,400-acre parcel of land in Orange County, California. The property is proposed for development and there is a potential that cultural resources could be impacted during construction. A cultural resources inventory, or survey, is conducted pursuant to Section 15064.5 of the State CEQA Guidelines (Guidelines) to locate any historical resources that may exist on the subject property.

The approximate 1,400-acre property is identified by the ICDC as Planning Area 6 (PA 6), Orange County, California. TKCI Engineering Division provided a 500-scale topographic map, depicting that portion of the property. That map was used in conjunction with the USGS 7.5' El Toro topographical map to reference the project area. A 7.5' El Toro topographical map indicating the survey boundary has been provided herein. Additionally, the survey crew and site recorders used a GPS unit to facilitate site location in the field, and subsequent site plotting on 7.5' topographic maps.

A search of the records on file at the South Central Coastal Information Center (SCCIC), Institute of Archaeology, California State University, Fullerton, California indicated that prior investigations have been conducted on the property and prehistoric archaeological sites are recorded with the SCCIC (Appendix A). Overall, there have been fifty-seven prehistoric archaeological sites recorded within a one-mile radius of the project area, twelve of which were recorded on the property. Additionally, the SCCIC indicated that one historic property existed just south of the project area, but was not located in PA 6. No other historic properties are recorded in or within one mile of PA 6.

The fourteen sites located by SCCIC include: CA-ORA-244, ORA-545, ORA-650, ORA-651, ORA-652, ORA-761, ORA-762, ORA-1246, ORA-1297, ORA-1298, ORA-1311, ORA-1347, ORA-1348, and ORA-1480. A later refinement of the property boundaries concluded that ORA-1246, ORA-1298, ORA-1347, and ORA-1348 were not located within the planning area. The refinement of boundaries also concluded that two other sites were included in the planning area, but not listed by the SCCIC. The additional sites are CA-ORA-649 and CA-ORA-1070. Therefore, of the fourteen sites originally listed by SCCIC as being within the planning area, four sites were taken out and two were added. With revisions, Planning Area 6 now has twelve sites within its boundaries.

The field inventory for PA 6 resulted in the discovery and re-recording of eleven of the twelve previously recorded sites and the discovery and recording of 14 previously unknown sites. Nine of these newly recorded sites are prehistoric, and five are historic, including historic scatters, a reservoir, and a residential structure. One of the twelve previously recorded sites not found or re-recorded is CA-ORA-1480, which is presumably under several meters of alluvium.

Numerous sections of the property could not be adequately surveyed and a constraints map (Appendix C) is included herein depicting the locations of those sections. Descriptions of each section surveyed on PA 6 are contained in this report under "Methods."

Previously Recorded Prehistoric Sites	New Prehistoric Sites	New Historic Sites[1]
CA-ORA-244		
CA-ORA-545	CA-Ora-1588 (TS-1)	TS-10
CA-ORA-649	CA-Ora-1589 (TS-2)	TS-11
CA-ORA-650	CA-Ora-1590 (TS-3)	TS-12
CA-ORA-651	CA-Ora-1591 (TS-4)	TS-13
CA-ORA-652	CA-Ora-1592 (TS-5)	TS-14
CA-ORA-761	CA-Ora-1593 (TS-6)	
CA-ORA-762	CA-Ora-1594 (TS-7)	
CA-ORA-1070	CA-Ora-1595 (TS-8)	
CA-ORA-1297	CA-Ora-1596 (TS-9)	
CA-ORA-1311		
CA-ORA-1480		

Figure 1. Summary of Historic and Prehistoric Sites Recorded on Planning Area 6.

The locational relationship of *historically significant* historic or archaeological resources on the property to planned development is critical for evaluating any adverse effects development may have on the resource. Once the effect is understood, measures can be recommended and implemented to mitigate the effects. Effects may be mitigated through avoidance and preservation, simple recordation and grading monitoring, or by a scientifically designed data recovery program. Monitoring of cultural resources during construction is always mandatory

[1] SCCIC issued trinomials for new sites TS-1 thru TS-9 prior to the production of this report. Site records for TS-10 thru TS-15 were not received by SCCIC until after the submission of this report. An addendum will be issued indicating the permanent trinomials for those additional sites.

regardless of the outcome of evaluative testing to ensure any previously unrecorded resources are managed properly. A land use plan for PA 6 was not available at the time of this investigation and therefore specific site by site recommendations relative to known impacts could not be determined.

TKC recommends that the following Cultural Resource Management procedures for Planning Area 6 be accomplished prior to the issuance of grading permits:

- Each historic site listed in Table 1 must be evaluated to determine the sites *historical significance*, or eligibility for listing on the California Register of Historic Resources pursuant to Criterion *"A"*, *"B"*, or *"C"*, as indicated under Section 15064.5 of the State CEQA Guidelines. Evaluations may include but are not limited to archival research, mapping and surface collection as warranted, photo-documentation, and subsurface excavation. The report should provide recommendations for any excavation and analyses where warranted and specify recommendations for the final disposition of the site, including, but not limited to preservation, partial or complete data recovery, and grading monitoring at and nearby the site during all phases of grading.

- Each prehistoric site listed in Table 1 must be tested and evaluated to determine its *historical significance*, or eligiblility for inclusion in the California Register of Historic Resources, pursuant to criterion "*D*" of Section 15064.5 of the State CEQA Guidelines: "*Has yielded, or may be likely to yield, information important in prehistory or history*." Testing and evaluation may consist of surface collection and mapping, limited subsurface excavations, and the appropriate analyses and research necessary to characterize the artifacts and deposits from which they originated. The report should provide recommendations for any further excavation and analyses warranted and specify recommendations for the final disposition of the site, including, but not limited to preservation, partial or complete data recovery, and grading monitoring at and nearby the site during all phases of grading.

- Monitoring must occur on PA 6 wherever grading activities are occurring. The high archaeological sensitivity of this property will require full time monitoring and, where necessary, additional monitors may be required to provide adequate coverage. If sensitive archaeological or historical resources are discovered during grading the area must be protected from further construction activities until a qualified archaeologist has evaluated the find and recommended the appropriate measures necessary to mitigate the effects development will have on the resources.

- In the event Native American remains are discovered during grading on the project all work within a 150' radius of the discovery shall be halted until the County of Orange Coroner's office has been notified. Subsequent measures for the disposition of the remains will be made through the Coroner's office in conjunction with a representative from a local Native American group deemed Most Likely Descendant by the Native American Heritage Commission.

INTRODUCTION

ICDC retained the services of TKCI Archaeological Division to conduct a Phase I Cultural Resources Inventory for property in Orange County, California. The property, identified as Planning Area 6, consists of approximately 1,400-acres of flat agricultural fields and ridge grove agriculture. The property is situated roughly between the Eastern Transportation Corridor to the northwest, Irvine Boulevard to the southwest and the Marine Corps Air Station El Toro to the southeast. The Foothill Transportation Corridor defines the northeastern boundary. The property is located in the greater Irvine Ranch Survey and consists of portions of blocks 119, 120, 142, 143, 152, and 153 of Irvine's subdivision, as per map recorded in Book 1, page 88 of miscellaneous records maps in the office of the county recorder of Orange County, California. The property is located on the western edge of the USGS El Toro 7.5' Quadrangle and is situated on gently sloping farmlands at the southernmost end, ranging into the foothills of the Santa Ana Mountains at the northern end.

This report contains an appendix with three appendices. Appendix A contains the SCCIC records search documentation, Appendix B has resumes of the principle investigators, and Appendix C consists of a survey methods and constraints map and is contained in a pocket in the inside back cover of the report. Appendices D and E, consisting of a 7.5' map indicating site locations, and site records, are bound under a separate cover and labeled confidential. The confidential appendices must not be released for public review.

TKCI personnel designated new sites temporarily as TS-1, TS-2, TS-3, and so on to TS-9 for the nine new prehistoric sites found during the investigation. The SCCIC subsequently issued permanent consecutive trinomials for the sites beginning with CA-Ora-1588 and ending with CA-Ora-1596. The five new historic sites were issued the temporary numbers TS-10 through TS-14. Those records were not submitted to the SCCIC prior to the production of this report and, therefore, trinomials were not issued for the sites. An addendum will be submitted by TKCI indicating the new trinomial numbers for the historic sites once they are issued by the SCCIC.

TKCI director of archaeology, Christopher Drover, oversaw survey methods for the project, while Edward Shickler participated with, and managed the survey crew. The survey crew consisted of Craig Lambert, Mark Deering, and Catherine Bell. Craig Lambert also completed the site records for new and previously recorded sites.

Figure 2. USGS 7.5 El Toro Quadrangle Depicting Project Survey Boundaries.

SETTING

Natural Setting

The elevation on the property ranges from 320 feet in the southwest corner of the property to 700 feet in the northeast corner of the property.

The water resources consist of Bee Canyon, Round Canyon, Agua Chinon Wash, and numerous unnamed seeps, springs, and intermittent drainages that feed onto the property from the Lomas De Santiago hills that form the northeastern physiography of the project. Tomato Springs, located near the center of the project, was a major water source for one of the largest prehistoric sites located on the property, CA-ORA-244. At least thirteen sites are located off the property immediately north of Tomato Springs and relied both on Tomato Springs, or either Bee or Round Canyon for water. The project area is located at the eastern edge of the Los Angeles basin between the San Joaquin Hills and the Lomas de Santiago in the Tustin Plain. The area is made up of alluvial and colluvial deposits emanating from the Santa Ana Mountains directly north of the project.

In PA 6, native vegetation and exotic plants are found mainly in the drainages surrounding the agricultural fields, and on steeper slopes. Most of the property is being utilized for nurseries and agriculture, consisting primarily of plowed fields and terraced avocado groves.

The natural vegetation in the area is predominately coastal sage/scrub with intrusions of non-indigenous plants. The subject property is located in an area of the Lomas de Santiago hills, which is rich in ecological diversity. Depending on local climatic conditions, several plant communities have existed on and near the property in prehistoric times. Within a few miles radius of the property, southern oak woodland, coastal sage scrub, riparian woodland, salt marsh, and native grasslands grow today and could have been exploited for sustenance by prehistoric inhabitants throughout the year (Klug and Popper, 1997). The various species available to early cultural groups in the area include prickly pear (*Opuntia littoralis*), sagebrush, (*Artemisia californica*), wild onion (*Alium praecox*), California goosefoot (*Chenopodium californicum*), sage (*Salvia*), and buckwheat (*Eriogonum fasciculatum*). A staple for most early Californians, the acorn (*Quercus spp*.), is common to the area and was likely to have been utilized extensively. During the course of the year, numerous species of bulbs, seeds and leaves from herbaceous plants such as tarweed, sunflower, grasses, saltbush, and clover, as well as fruits from elderberry, cacti, and lemonade berry, were collected and consumed. Local precipitation and temperature conditions during the past would have altered the plant communities available to prehistoric groups. Pollen analysis and paleoenvironmental studies specific to known site locations on the subject property may facilitate a definitive understanding of ethnobotanical uses of indigenous plant life (Klug and Popper, 1997).

Geological Setting

This entire project area is underlain by sedimentary deposits, most of which are marine in origin. The various sedimentary rock units encountered are typical of those that comprise much of the Santa Ana Mountains and their outlying foothills in the general vicinity (Raschke 1984; Raschke et al. 1988). The variety of different rock units that are represented at the site, and the numbers of faults present (Morton et al. 1976), combine to make this a very complex area from a geologic standpoint.

Williams Formation

The northwest part of the property, comprised of the hills and slopes between the private property section and the Toll Road, is underlain by the Late Cretaceous Williams Formation (Morton et al. 1976). This formation is a light brown-weathering, laminated to massive, fine sandstone, with localized concretions and other hard bedded sections. It is a marine deposit that is more than 65 million years old. The section of Williams Formation in this area has not been identified as representing any particular member of the Williams Formation, as it has been elsewhere in the Santa Ana Mountains, and so here it is mapped as undifferentiated Williams Formation.

Monterey Formation

The eastern part of the property, comprised of the north-south aligned hill that is southeast of the elongate valley which has a flood-control basin in it, is underlain by the Middle to Late Miocene Monterey Formation (Morton et al. 1976). This formation weathers white to yellow, and is comprised of laminated shale, sandy shales, with intervening sections of un-bedded fine sands, and some volcanic ash layers. It is a marine deposit that ranges in age from approximately 15 to 9 million years old (Raschke 1984).

Puente Formation

The Puente Formation is also present at the site. This marine rock unit is usually considered to be laterally equivalent, both stratigraphically and geochronologically to part or all of the Monterey Formation, and is Late Miocene in age, in the broad sense. The areas mapped as Puente Formation in the project area are in the northern part of the property (Morton et al. 1976), and are referred to the Soquel Member, which is the second oldest of four recognized members of the Puente Formation in this area, and thus is approximately 11 or 12 million years old. On the project site, the outcrops of the Soquel Member of the Puente Formation are coarse sandstone, yellow to yellowish red in color, with cobbles, and pebble stringers.

Capistrano Formation

The marine Capistrano Formation is widespread in the Capistrano Embayment, and has been shown to lie stratigraphically above both the Monterey and Puente formations (Raschke 1984). In the project site, the Oso Member of the Capistrano Formation, representing a near-shore marine environment, has been mapped in the northern and northeastern areas (Morton et al. 1976), between the outcrops of the Puente and Monterey formations. It contains a few scattered pebbles and pebble beds. It is latest Miocene in age, and to the east of the project site has been known to yield land mammals indicative of the Hemphillian North American Land Mammal Age (Barnes 1977).

Niguel Formation

The Niguel Formation is also widespread in the Capistrano Embayment (Raschke et al., 1988), and it is characteristically a cobbly to densely conglomeratic deposit that is typically found overlying the Capistrano Formation. It is a near-shore marine deposit of Pliocene age, and thus is approximately 5 to 3 million years old. In the project site it is mapped in the southern-central area of the property (Morton et al. 1976), characteristically overlying the Capistrano Formation. It is characteristically very cobbly, being comprised predominantly of rounded clasts of very hard metamorphic rocks, the clasts ranging in color from white to very dark.

Older Quaternary Alluvium

Capping the hills and slopes, this older Quaternary deposit is seen in the central and southern area of the project (Morton et al. 1976), and contains abundant cobbles and boulders in a sand matrix. This deposit is undoubtedly of fresh-water origin.

Younger Quaternary Alluvium

The valley bottoms have bedded, fine-grained silts and sands (noted in this survey) that are undoubtedly Late Pleistocene in age and are fresh-water in origin.

CULTURAL SETTING

Temporal Frameworks for Prehistoric Orange County

In the study of coastal Southern California prehistory, the quest for a "perfect" culture chronology scheme continues to challenge scholars. Temporal control is the first basic objective of archaeology, and advances in its development for any reason depend significantly on an expanding data base of past cultural manifestations (artifacts, ecofacts, and their associations), refinements in analyses of these remains, refinements in old dating techniques, and the application of new dating techniques. In Orange County, Cultural Resource Management (CRM) activities have provided a wealth of material remains, especially in the last two or three decades. Locally, prehistorians have actively scrutinized methods and techniques bearing especially on efforts at construction of cultural/temporal sequences. For instance, the utility of obsidian hydration analysis has received special attention (Koerper et al. 1986; Ericson et al. 1989). Many researchers in Orange County are running increasingly larger suites of radiometric assays, and there seems to be growing enthusiasm for the relatively new Accelerator Mass Spectrometry (AMS) ^{14}C technique. In fact, AMS was recently applied to beads from CA-ORA-378 to test the several types' purported time sensitivity (Gibson and Koerper 2000). Other recent Orange County efforts in chronology building include investigations into the time sensitivity of other kinds of artifacts, such as, circular abalone shell fishhooks (Koerper et al. 1988; Koerper et al. 1995), atlatl dart points (Koerper 1994), and arrow projectile points (Koerper 1996).

Presently in Orange County chronology building, these and other related intellectual activities unfold against frames of reference offered by established chronology schemes. These are the chronologies offered by William Wallace (1955, 1978), Claude Warren (1968), and Chester King (1981, 1990). King's scheme (1981, 1990) was developed for the Santa Barbara Channel area. It is referenced in the local literature mainly when time sensitive beads are being discussed (e.g., Gibson 1992; Gibson and King 1994). Such discussions usually involve notions of time sensitivity for certain bead types to the north applied to similar types recovered in Orange County middens. Little more will be said about King's chronology save to indicate how his categories translate into the chronology promoted in this report. The other two schemes, those of Wallace (1955) and Warren (1968) dominate discussions of chronology building in Orange County (Koerper 1981:118-179; Koerper and Drover 1983; Warren 1984; Koerper and Drover 1984). Wallace (1955) interpreted the prehistory of Southern California through temporal horizons. Warren (1968) considered the cultural differences less as temporal distinctions and more as local traditions. In our presentation of local chronology, the influences of Wallace and Warren will be obvious to anyone familiar with the subject matter. What is presented here closely follows chronological overviews offered in Koerper and Mason (2000) and in Koerper, Mason, and Peterson (2001).

In those overviews, there was incorporated into the framework the Holocene divisions formulated by Erlandson (1988, 1997; Erlandson and Colton 1991). Also, the overviews retained some of the nomenclature of Wallace (Milling Stone, Intermediate, and Late Prehistory), but replaced commonly employed terms, “horizon” and “tradition,” with the generic and neutral “period.” The Intermediate period and the Late Prehistoric period in Orange County fit into the Late Holocene, while the Milling Stone period runs through the entire Middle Holocene and part of the Early Holocene (Koerper, Mason, Peterson 2001; Koerper and Mason 2000). Koerper and Mason (2000) succinctly summarized their view of what preceded the Milling Stone period writing:

> The earliest cultural manifestations in Orange County recall what is termed San Dieguito culture in San Diego County and elsewhere. San Dieguito culture is a manifestation of the Paleo-Coastal Tradition (Moratto 1984:90-92, 104), which dates from 11,500 BP (Colton and Erlandson 1991; Erlandson and Moss 1994). Along the coast, the florescence of this complex wanes during the mid-seventh millennium BP (e.g. Haynes et al. 1967; Warren 1968), although San Dieguito-like components may continue for a millennium or more (Gallegos 1987:23). Thus, the San Dieguito begins at the terminal Pleistocene and continues well into the early Holocene. Some evidence from CA-ORA-64 at Newport Bay reflects San Dieguito culture.
>
> Since Malcolm Rogers first described (1929) and later renamed (1939) the San Dieguito, the concept has undergone considerable refinement (e.g., Warren 1967, 1968). Added to the artifact inventory are such things as manos and metates (True 1958:262; Ezell 1983), ornamentation (Kaldenberg 1982), and asphaltum-hafted tools (Ezell 1977). Chipped stone tools include large leaf-shaped points, a variety of leaf-shaped knives, large ovoid, domed and rectangular end or side scrapers, engraving tools, and crescentics (Warren 1967).

The early Holocene is dated from ca. 10,000 BP to 6,650 BP (Erlandson and Colton 1991:1). Mason and Peterson (1994) refer to all that goes before the following Milling Stone period as the Paleo-Coastal period (prior to 8,000 BP).

It is likely that the San Dieguito gave rise to the Milling Stone culture (see Koerper et al. 1991:60-61). As the name implies, there is an abundance of manos and metates associated with Milling Stone times. Other Milling equipment, specifically mortars and pestles, do appear during the period (Erlandson and Colton 1991:1; Glassow 1997:152; Wallace 1955: 220). Parenthetically, Erlandson and Colton (1991:1) note that their distinction between the Early and Middle Holocene is “not entirely arbitrary.” They note that the interface, roughly dated between 6,000 and 7,000 RYBP, is when mortars and pestles first widely appear in California.

There are few spear or dart points during this period. They tend to be large leaf-shaped points. There is a fair amount of ornamentation, mostly beads, in a variety of materials, such as, bone, stone, and shell. While it is often believed that food storage and cooking container evidence is absent, this is arguable. Since tarring pebbles are present and basketry impressions on fragments of asphalt have been recovered, it is reasonable to infer basketry. From ethnographic and ethnohistoric notes, it is clear that Late Prehistoric people used baskets for both storage and cooking. We suggest that it is probably the case that these utilitarian objects were present early in the Milling Stone period if not earlier.

Crude choppers, scrapers, cutting tools, and hammerstones are salient features of Milling Stone assemblages. Bone and antler tools such as awls and flakers are infrequent finds in Milling Stone sites. A wide variety of presumed magico-religious objects helps characterize the Milling Stone period. Cogged stones were manufactured as long ago as 7,000+ years BP. Piriform and plummet shaped charmstones were similarly fashioned, at least by the Middle Holocene. Spheres of granite, huge ceremonial blades, discoidals, and quartz crystals were all part of the superstructural inventory. Long distance trade, connecting Orange County with the Great Basin as far away as northeastern Oregon, was established at least by the middle of the Milling Stone period (Macko, Couch, and Koerper n.d.). Mason and Peterson (1994) subdivided the Milling Stone into three subperiods: MS1 (8,000-5,800 BP); MS2 (5,800-4,650 BP); and MS3 (4,650-3,000 BP). These temporal subdivisions are based entirely on radiocarbon age determinations that they believed corresponded to some degree with changes in settlement (Mason and Peterson 1994:58). In contrast, they note that temporal subdivisions traditionally have been defined on supposed differences in cultural content or traits as presented by Willey and Phillips (1958:22). Mason and Peterson found little difference in the cultural content of their three Milling Stone subdivisions. Data used to formulate these subdivisions was derived from extensive archaeological excavations conducted along the Orange County coast as part of the Newport Coast Archaeological Program (NCAP) (Mason 1990). Here we end the MS3 period at 3,350 BP, and would maintain that the Milling Stone period in Orange County begins minimally four millennia prior to this end date, maybe between 7,500 and 8,000 years ago. The 3,350 BP date coincides with the Middle to Late Holocene interface. Erlandson and Colton (1991:1-2) see the transition from Middle to Late Holocene (circa 1000-1500 BC) as not too arbitrary. They cite King (1981), whose Early and Middle periods in the Santa Barbara Channel area break at around 1400 BC for the reason that there is increased diversification in subsistence, technology, and adornment. Koerper, Mason, and Peterson (2001) note that around this time, between 2000 and 1000 BC, for whatever reasons, the number of ^{14}C dates diminishes for Newport Bay and for Orange County generally, although not for Bolsa Chica Bay. Milling Stone residential bases on the marine terraces of the Newport Coast (Mason, Koerper, and Langenwalter 1997) were no longer occupied after about 2000 BC. However, the number of ^{14}C dates for the Bolsa Chica Bay area indicates continued occupation at this time. Koerper, Mason, and Peterson (2001) write:

> We place the beginning of the Intermediate period within a 1,000 year span (2000 to 1000 BC) represented by fewer ^{14}C dates for the Newport Bay area and Newport Coast, choosing the slight upturn of dates at roughly 1400 BC in that area to partition the late Milling Stone period from the early Intermediate period, a time coinciding with the Middle to late Holocene interface. An almost continuous increase in the number of ^{14}C dates begins with the inception of the Intermediate period and continues through the middle of the Late Prehistoric period (2001).

The Intermediate sees increased utilization of mortar and pestle, while the mano-metate combination diminishes proportionately (see Koerper 1979:75, Table 2). The rate of increase continues into the Late Prehistoric. If mortars and pestles are to be primarily associated with acorn preparation, then the evidence of these maintenance tools reflects an increasing reliance on this plant resource from Milling Stone into Late Prehistoric times. If, however, the earliest use for mortars and pestles was to pulverize root foods (Glassow 1997: 154), acorn exploitation could turn out to be a time sensitive trait, although not one easily detected archaeologically. Yet, any definitive statement could only follow from accurate speciation of plant residues from a large diachronic sample of processing equipment (Koerper, Mason, and Peterson 2001). The basket hopper mortar was introduced during the Intermediate. Time sensitivity is undocumented with regard to atlatl-and-dart points unearthed from Intermediate period components in Orange County. Indeed, such sensitivity could not even be demonstrated in a large sample of Middle Holocene projectiles (Koerper, Schroth, and Mason 1994).

It is towards the beginning of the Intermediate period that the single piece circular shell fishhook first appears in Orange County (Koerper et al. 1988). With this development there is diminished use of fish gorges. Three hooks have been AMS dated, all falling within the Intermediate period (Koerper, Prior, et al. 1995). First use of circular hooks on San Clemente Island may begin about 1350 BC (Raab 1996, 1997; Raab, Procasi, et al. 1995). The Orange County Intermediate period (3,350 BP to 1,350 BP) covers most of King's (1990) Early Period Phase Z (Ez) and the first two-thirds of his Middle Period (Koerper et al. 1998). The Late Prehistoric period begins locally at around 1,350 BP terminating at the Historic period, the start of King's (1990) L3 Period. The Late Prehistoric period thus spans the latter third of King's (1990) Middle Period through his Late Period Phase 2b. The Late Prehistoric period divides into early (LP1) and late (LP2) at 650 B.P. (Mason and Peterson 1994), as will be discussed below.

With the introduction of the bow and arrow, which occurs between A.D. 400 and A.D. 600, small arrow points largely replace atlatl dart points in the archaeological record. It has been suggested that the replacement of atlatl and dart by bow and arrow marks the end of the

Intermediate period on the Orange County coast and the beginning of the Late Prehistoric period (Koerper, Schroth et al. 1996:277-288). No single arrow point type is identified as the earliest. The first arrow points may have been types downsized from dart points of similar forms. The earliest points in notable profusion were of the Cottonwood series. Leaf-shaped forms probably preceded the triangular styles. With advancing time, the ratio of Cottonwood Leaf-shaped to Cottonwood Triangular types decreased (Koerper, Schroth et al. 1996). The degree of basal notching on triangular points (see Waugh 1988) seems not to be time sensitive (Koerper, Schroth et al. 1996). Locally manufactured Sonoran arrow points appear almost exclusively during the second half of the Late Prehistoric period, after about A.D. 1300 (LP2) (Koerper, Schroth et al. 1996). Trade in culinary ware fashioned from Santa Catalina Island soapstone offers another hallmark of the Late Prehistoric period. Micaceous steatite provided the material for bowls and comals. This same material, as well as higher grades of talc schist from the island, was used to manufacture distinctive effigies that served as dimorphic sexual symbols in ritual contexts. So-called "birdstones," "pelican stones," and "hookstones" comprise a genre (Kroeber 1925:630) that may have been employed throughout the Late Holocene (Koerper, Labbé, et al. 1995) and into historic times (Koerper and Labbé 1987, 1989), but those sculptures made of soapstone are a Late Prehistoric event.

The beginning of the Late Prehistoric period at about 1,350 years BP coincides with the beginning of the expansion of residential settlement into the San Joaquin Hills. The Late Prehistoric period was originally divided into two subperiods, LP1 and LP2, based on a further expansion of major residential settlement in the San Joaquin Hills (Mason and Peterson 1994). LP2 begins at 650 years BP, a time coinciding with the beginning of a decrease in the numbers of radiocarbon dates. That decrease culminates in major Spanish contact circa 200 years BP. There is the possibility that at around beginning LP2 some people may have migrated through the northern half of Orange County into the San Juan Capistrano Valley area. Such population shifts, if they occurred, would likely have been related to droughts that occurred during the Medieval Climactic Anomaly, just preceding the Little Ice Age (LIA). It seems more certain, however, that an important migration occurred during the LIA, and the migrants may have come from around the area of Genga on the lower Santa Ana River to relocate at CA-ORA 855 and other places in San Juan Capistrano Valley (Koerper and Mason 2000).

Of what little Obsidian Butte volcanic glass passed into Orange County, the great majority arrived during LP2 (Ericson et al. 1989; Koerper et al. 1986). Nearly all obsidian arriving during the Intermediate and Milling Stone periods was quarried from northern sources, mostly the Coso volcanic field. Fired clay pipes traded from San Diego County are also a feature of LP2. Tizon Brown culinary ware was being manufactured in terminal LP2 or protohistoric times (Hurd, Miller, and Koerper 1990; Koerper et al. 1978). The LP2 period provides the first certain evidence of trade connections to the Lower Colorado River. Mohave people transported Hohokam *Glycymeris* shell bracelets, baked clay anthropomorphs, Sonoran-type projectiles, and textiles into Orange County to exchange for shell and shell beads, indirectly infusing some small amount of Hohokam culture elements onto the Pacific coast (Koerper 1996; Koerper and Hedges 1996).

History of Early Orange County

Although European explorers made brief visits to the California coast in the sixteenth and seventeenth centuries, the historic period really begins in 1769 with the Portolá expedition and the founding of permanent Spanish settlements along the coast from the Mexican border to the San Francisco Bay region. Mission San Juan Capistrano, established in 1776, was the first permanent settlement in what is today Orange County. The first private land grant was given in 1784 to Manuel Nieto, an ex-soldier, and consisted of nearly seven leagues of coastal land. Jose Antonio Yorba and nephew Juan Pablo Peralta were given joint custody of Rancho Santiago de Santa Ana in 1810. Most likely Yorba and his father-in-law Pablo Grijalva had settled on the land before this, but did not receive official ownership until 1810.

From the time of the first private land grants in the late Eighteenth Century to the close of the Spanish rule of California, less than twenty private concessions were made in California (Cleland 1941:19). Most were located in southern California and at least half were within one hundred miles of the pueblo of Los Angeles. After the overthrow of Spanish rule, the New Mexican government instituted land reform. The Colonization Act of 1828 provided the guidelines for all subsequent land grants in the border provinces. Until this time governors appointed to rule California did nothing to overturn the original Spanish grants. With the reforms to support his cause, Governor Jose Maria Echeandia decreed restoration of the mission lands to the public in 1828. His decision culminated in the Secularization Act of 1833-34 (Cleland 1941:20). Within thirteen years, over seven hundred private land grants had been awarded (Cleland 1941:1). No less than twenty were granted in what is today Orange County between 1834 and 1850 (Robinson 1963).

When California became a state, only one settlement, San Juan Capistrano, existed in what is today Orange County. A village had grown up around the mission compound, then largely abandoned. Anaheim was established in 1857 as a German colony on some 1,165 acres purchased from one of the ranchos. History changed with the Great Drought of the 1860s, forcing many cattlemen to sell their lands, allowing the opportunity for new settlements to spring up. Communities such as Santa Ana, Tustin, Westminster, Orange, and Garden Grove were all founded after the Great Drought. The 1890s were especially important boom years for Southern California. A major cause was the linking of Southern California to the outside world via the railroad. Fullerton, Buena Park, Olive, and El Modena were settled, followed in time by Laguna Beach, Huntington Beach, San Clemente and Newport Beach. Former ranch lands were subdivided again and again.

During the 1860s Rancho Lomas de Santiago, the vast holdings of the Yorba family, was sold. This parcel, crossed by Santiago Creek, lay between the Cleveland National Forest and Rancho San Joaquin. Originally granted to Teodocio Yorba by Governor Pio Pico May 26, 1846, title was confirmed and patented in 1868 for 47,226.61 acres. William Wolfskill acquired the rancho in 1860 then sold it six years later to James Irvine, Llewellyn Bixby, and Benjamin and Thomas Flint. (Robinson 1963:8-9). Four years earlier, the same group had purchased Rancho San Joaquin, a 50,000 acres parcel, formerly owned by the Sepulveda family.

Governor Alvarado originally granted rancho San Joaquin, also known as La Cienega de las Ranas, on April 15, 1837 and May 13, 1843 to Jose Sepulveda. Title was confirmed and a patent issued to 48,803.16 acres.

The Irvine-Bixby-Flint group also purchased this rancho and added it to those lands from Rancho de Lomas. Collectively, they owned 101,077 acres. Because of the then recent “Great Drought,” the men switched the emphasis of the land to sheep grazing. This became extremely profitable for the production of wool. Additional small parcels were added until 1876, when James Irvine bought out his partners. At this time the holdings amounted to nearly 115,000 acres.

The Irvine Ranch, as it was renamed, occupied a strip of land approximately eight miles in width along the coast. In the late 1880s, when sheep and wool became less valuable, much of the Irvine Ranch was leased out for agricultural purposes. Within a short period of time, there was a complete conversion from livestock to agriculture.

As late as 1889, when Orange County was established as a separate county, the area was still largely unsettled grazing plains and valleys, crossed by the Santa Ana River and a number of creeks and streams (Robinson 1963:1).

Although the Irvine Ranch has always been very profitable, there was always the problematic issue of water availability. A second, though less drastic, drought in 1882 helped to suppress the sheep endeavor. By then agriculture had become increasingly important to the local economy.
James Irvine Senior died in 1886. Two years later some 5,000 acres were let out for walnut groves, olive groves, and hay and grain production. James Irvine, Junior took over sole control of the property in 1893, incorporating it as the Irvine Ranch the following year (Cleland 1941).

By 1895, the most productive crop was barley, used for feed and brewing beer. An estimated thirty-one thousand acres of barley crops were planted, which covered more area than all other crops combined (Cleland 1941:101). Black and lima beans were also important crops. In the early 1900s walnuts yielded some twenty-two tons annually.

In about 1905 other crops were tried. They included alfalfa, celery, rhubarb, artichokes, peanuts, flax, and sugar beets. For some unexplained reason, Irvine attempted to sell the ranch between 1902 and 1906 but was successful in selling off only a few thousand acres (Cleland 1941).
At about this time, the first successful citrus orchards were being planted on the property. They proved so profitable that in 1913 citrus became the principal product, while grazing lands were reduced. Persimmons and avocados were also tried. Salt production began in 1934 when a salt plant was constructed in Newport Bay (Cleland 1941).

In 1887 the town of Irvine was founded near the modern intersection of Burt Road and Sand Canyon Avenue. The town was originally the site for centralized farming activities, supplies, and supply distribution. By 1895 the town had expanded to include a bean and grain storage warehouse, a blacksmith's shop, a hotel and general store, and employee housing. The core Old Town Irvine structures stand today and are still in use, either as functional domiciles or historic properties.

History of Tomato Springs

Seventeen sixty-nine stands as the "official" beginning of Orange County history. A special historical status for the Tomato Springs locale connects directly to that premier year, and accordingly, a bronze commemorative plaque has been erected near the springs. It reads:

SAN PANTALEÓN
or
AGUAGE DEL PADRE GÓMEZ
(THE SPRINGS OF FATHER GÓMEZ)
ON JULY 26, 1769 THE PORTOLÁ
EXPEDITION CAMPED AT THE
BASE OF THIS HILL AND USED
THE SPRINGS TO THE NORTHEAST.
COMMEMORATED BY EL VIAJE DE PORTOLÁ
APRIL 12, 1969

It is partly for the reason that four diarists on the expedition recorded their progress passing (1769) and returning (1770) through the county, that 1769 becomes the chronological division of convenience separating "history" from what went before. Also, 1769 may be taken to mark a turning point in the trajectory of Native cultural development. While there had previously been sporadic European contact along the southern California coast, with some of the foreigners providing posterity with useful historical and even ethnohistoric accounts (e.g., Cabrillo in Palou 126; Sebastian Vizcaino 1925; de la Ascension in Palou 1926) no formal program of forced acculturation had yet been set in motion. However, the mostly friendly Native peoples who received Portolá, curious and anxious to engage in gift exchanges, were unwitting witnesses to the genesis of a pacification and subjugation effort that would irreparably transform their traditional life-ways.

The 1769-1770 observers, Miguel Costansó (a cartographer), Fray Juan Crespi, the lieutenant Pedro Fages, and Portolá himself, all provided cursory observations of their 1769 stay at Tomato Springs (see also Meadows 1965:25).

Costansó wrote only:

> ...he halted [July 26, 1769] close to a very small watering place; it was scarcely sufficient for the people. We called it the Aguage del Padre Gómez as it was discovered by this missionary father who was of our company [Teggart 1911;15].

Crespi recorded that on the 26th the party entered a large plain at the beginning of which the expedition “pitched camp near a dry lagoon on a slope...” (Palou 1926:126-127; also Bolton 1975:139-140). Crespi continues

> Near the camp some verdure was to be seen, and when the father companion approached it he found two small springs of water, clear and good, for which reason the soldiers called this spot the Springs of Father Gómez and christened it with the name of San Pantaleón [Palou 1926:126-127; Bolton 1971:139-140].

Portolá’s July 26 entry notes “no water for the animals, though enough for the men” (Smith and Teggart 1909:21).

Fages (1937:13-14), who produced by far the skimpiest accounts had little to describe of Tomato Springs, which had been scouted on July 25 as a watering place, except to note that he judged it “no watering place save a very scanty one.”

On January 19, 1770, the party of explorers returned to Tomato Springs. They had begun their day’s trek from the Río de los Temblores (Santa Ana River) on the rainy Friday, and made approximately four leagues to the Aguage del Padre Gómez. (For the Spanish, in those times, a league measured 1/25th of a degree of latitude, or 5000 varas, about 2.4 statute miles [Simpson 1961:103]). The intrepid adventurers were obviously rushing through the county now, worn out, sick, hungry, and quite anxious to arrive back at San Diego. Costanso, Crespi (Palou 1926;257; Bolton 1971:270), and Portolá (Smith and Teggart 1908:49) have little report about January 19, but Costanso does provide some useful information for the archaeological study of Tomato Springs. “This place has little firewood” (Teggart 1911:161). What is immediately striking about the collective accounts is the absence of any mention of native people or any notice of an Indian campsite nearby. It is generally held in the study of Orange County archaeology that the Spaniards encamped at a location near the celebrated site of CA-ORA-244 (see Cottrell and Del Chario 1984). Cottrell and Del Chario described ORA-244, or the Tomato Springs site, as huge, covering 43 acres (1984:10), but later 40 acres (1984:70). The size of this “large permanent village which was occupied for at least the past 5000 years” is explained thus:

> The depositional characteristics of the site indicate that village movement occurred in a confined space, over much of the 40 acres now defined as Ora-244. As one area became too “messy” to live in, the community shifted to a new area of the site. This process continued until the area now defined as the site had been occupied [Cottrell and Del Chario 1984:70].

The "large" in "large permanent village" seems a reference to population numbers and not areal extent. Cottrell and Del Chario (1984:9) imply some numbers by citing an article of Helen Smith's (1965) entitled "The Portolá Camps Revisited." With regard to the Tomato Springs location, she writes:

> Ray Lambert, a longtime resident, and landowner of the area, states that some five years ago a Santa Ana man of about 65, whose name he does not remember, told him that his father had excavated the hillside site and removed many artifacts. This man's father had told him that when he was a boy, possibly one hundred years ago, he had seen about a hundred and fifty Indians occupying the area above the spring. [Smith 1965:30]

Cottrell and Del Chario write, "If true, the informant's statement, regarding the occupation of this site by Indians into the early 1860s, indicates that this was an important rancheria which was occupied from early in Orange County prehistory until well into the contact era" (1984:9). Laying aside the non sequitur, one questions the employment of such vague, hearsay anecdotal material. Apocryphal stories of late surviving indigenous cultural entities in California, no doubt given some life by the true account of Ishi (see Kroeber 1961), are a fixture of the state's rural folklore tradition.

The "permanent" in "large permanent village" reflects the view that, "The site was probably occupied year round, although portions of the population may have left the site for short periods of time to gather resources in other areas, or to visit other groups at other locations" (Cottrell and Del Chario 1984:70). It is unlikely for there to have been a mass exodus of people frightened by the approach of strange men and their animals. The Portolá diarists generally describe those Indians seen along their Southern California route as curious, hospitable, and eager to engage in gift exchanges. Also, had people retreated from the Spanish column, the party almost certainly would have taken notice of recent signs of people, as they did at Agua Hedionda Lagoon, probably the site of CA-SDi-5353 (Bolton 1971:128; Smith and Teggart 1909:51; Koerper, Schroth and Langenwalter 1992).

It is curious that Cottrell and Del Chario avoided any effort to reconcile the Portolá Expedition notes with the idea that, "The village was occupied year round, although it is expected that population levels would fluctuate on a seasonal basis as families would leave to take advantage of resources located in other areas or to visit friends and relatives in other villages" (1984:71). It seems that the diary entries reveal important seasonality and settlement evidence as well as important related environmental data. Why are the July 26, 1769/January 19, 1770 observations, including low summer water and lack of firewood, ignored?

The high profile for Tomato Springs in Orange County Indianology has had less to do with any historic record but much to do with a remarkable claim regarding a prehistoric role of ORA-244 in a monopolistic procurement of a supposed nonlocal resource, its trade, and its reduction to tools for trafficking with other groups, far and wide. Remarkable claims, however, require remarkable evidence.

RESEARCH DESIGN

The research orientation of this undertaking and any Phase I Cultural Resource Inventory is to locate and record cultural resources that exist on the subject property. While scientific interests are of utmost concern, the primary goal at this stage is compliance with CEQA statutes with respect to the identification and preservation of historic resources. Information learned from Cultural Resource Inventories is then used by lead agencies, planners, developers, and Cultural Resource Management (CRM) firms to ensure that appropriate measures are taken, as warranted, to mitigate the effects development will have on historic resources.

Initially, CRM firms research records to learn what information is available regarding historic resources on the property. While much of this effort is accomplished at regional information centers, other information may be gathered from county and municipal records departments where the subject property is located. Current landowners, tenants, and businesses located on or nearby the property may also be valuable sources of historical information pertaining to the property.

The next step in this process is to conduct a pedestrian survey of the property to 1) locate and rerecord any known sites on the property, and 2) conduct a new examination of the property to determine whether additional cultural resources exist that have never been recorded.

Historic Resource Considerations

PA 6 has been used almost exclusively for agriculture during the last century and, prior to that, very little activity related to historic European contact has occurred on the property. Although Portolá traversed the property during his journey, as almost certainly did other European travelers who came later, little else is known about the historic land use of the property until the early part of the 20th century. The locations of any early European campsites have never been identified although one anecdotal reference is made to a Portolá campsite near Tomato Springs. Early twentieth century maps reveal little European activity and it is not until the early twentieth century that historic structures begin to appear. The 1943 Santa Ana 15' quadrangle reveals several structures were in existence at that time. A search of existing residential addresses on MetroScan, a computer search program, reveals several houses constructed in 1916 and 1917 are located along Lambert Road which is outside the planning area towards the west. However, this information strongly suggests that other residences of similar age may have been constructed on the property, which were never formally recorded, and therefore, not found on any agency registries. While these structures may no longer exist, a ground-level or subsurface component may yet remain testifying to their existence. Evidence of these kinds of historic properties are commonly discovered as refuse deposits, concrete, brick, stone, or wooden foundations, fencelines, non-indigenous trees or shrubs, irrigation ditches, dams, power poles, and so on. Also, with few exceptions, most early European activities in the area would have been largely confined to the flat terrain and little evidence of historic activity would be anticipated in areas of high topographic relief. Therefore, TKC designed this Cultural Resource Inventory with two major themes in mind relevant to early European and historic presence on PA 6:

1. European travel through, and overnight camping on, PA 6 during the eighteenth century is historically documented but no physical evidence of it has ever been identified. It is possible that archaeological sites related to these events exist on the property. It is further anticipated that these sites, if present, represent ephemeral activities related to overland travel and camping and will not consist of intact, above ground structural elements.

2. Substantial evidence of 19th and 20th century occupation and landuse in PA 6 is documented and still in existence along Lambert Road, but not on the planning area. It is highly likely that historic and historic archaeological sites relevant to this period are present on the property. These may consist of standing or fallen structures, or merely the surface deposits that remain.

Prehistoric Resource Considerations

Cultural Resource Inventory research designs for properties located where there is a dearth of prehistoric archaeological data typically cite relevant anthropological theory to determine the appropriate regional settlement/subsistance model to guide the field research correctly. Such an understanding would suggest to investigators the likelihood that prehistoric peoples would have had a reason to inhabit or traverse the property, thereby, creating the possibility that archaeological data would be present.

However, this is not the case for PA 6 where there is an abundance of archeaological data. Numerous sites are known to exist on and nearby PA 6, several of which have been studied to some degree during the last 25 years.

The majority of PA 6 is located in an active alluvial area adjacent to and within the foothills of the Santa Ana Mountains and it is possible that archaeological sites have been covered by alluvium. Agricultural activities consisting of terracing, damming, trenching, road-building and plowing and grading have further disturbed topsoils, possibly obscuring all or portions of some sites. Lastly, investigators have conducted surface collections at several of the existing archaeological sites in recent years as part of the mitigation process for development that has encroached on the sites. That activity could hinder efforts to locate some sites for the purposes of rerecording.

Recognizing these factors, TKC devised the following strategy to accomplish the pedestrian survey of PA 6:

1. Transects would be accomplished over the entire property at an interval of 20 meters to provide the most uniform coverage possible to locate cultural resources and also identify obstructions that obscured ground surfaces. A constraints map would be developed to identify areas of the property where ground surfaces could not be adequately observed so that those areas might be investigated at a later date.

2. Areas where sites were known to exist were investigated at much narrower intervals to adequately define the site boundaries.

METHODS

PA-6 is currently used for a variety of agricultural activities. Avocado groves in the foothills, and tomato fields and nursery growth areas in the flatter southern alluvial fans, dominate the property. Many areas on steeper hills and hill slopes are covered with coastal sage scrub. Some of these sage scrub areas have been disturbed resulting in successive growth of coastal sage scrub mixed with non-indigenous plants consisting primarily of grasses and mustard. The southernmost portion of the property north of Irvine Blvd., and adjacent to N Street, is used for the manufacture of mulch, fertilizer, and for other commercial activities.

Because of the differential land uses, plant communities, and survey constraints, the survey area was subdivided into 33 sections. The survey methods and constraints map (See Appendix C) depicts this subdivision while individual descriptions of each section indicate the primary landuse of each section, and the general survey method employed for that section. This was done to facilitate a more controlled approach to examining the property, since the various landscapes presented unique transectional limitations.

The field reconnaissance survey of the approximate 1,400 acre project was accomplished primarily by using a paced 20-meter transect interval. Transects of the project area often included dirt access roads in proximity to the subsections, where available, and were included, and frequently served as boundaries for, the immediate survey area. Each survey section delineates survey methods utilized, as each section posed its own survey constraints. In all cases, except where indicated, the 20 meter transect was conducted to the maximum extent possible by the survey crew. Sections surveyed wholly, or in part, by intuitive or intensive surveys are also addressed individually. Sites were recorded following the general survey of the entire property. Except where indicated, no artifacts or other archaeological specimens were collected during the reconnaissance.

Section 1 lies southeast of, and is adjacent to, the 133 toll road both above and below Portolá. The main portions of this section consist of nurseries of tightly placed potted plants, with a ground cover of more than ninety-five percent gravel. The survey crew ran intuitive transects throughout the property, and along a graded channel that abuts the 133 toll road. The former transects yielded no artifactual materials, as the ground was so obstructed as to prevent any visibility of the soil whatsoever. The latter transect did yield a sparse scatter of lithic materials that may or may not be cultural, with no concentration of artifacts. Lithic materials included chert (2) and rhyolite (3), and one piece of quartz. All specimens were deemed isolates, and provenience was highly suspect, as this drainage contained plastic grocery bags several inches deep in the sidewall of an erosive channel. An unsuccessful attempt was made to locate CA-

ORA-1480. It has either been destroyed, or obscured with gravel and or earthen materials. The southeastern portion of this section is a knoll south of Portola Parkway surrounded by eucalyptus and other trees, with a drainage channel at its eastern border. The survey crew examined the dirt road to the northwest, and the channel to the southeast. Debitage in the form of black chert shatter (one piece), and a piece of red rhyolite was found in the drainage itself, with provenience suspect. No materials were collected from this section, and the area was not deemed a site. The survey crew collected no materials.

Section 2 is an avocado grove, the majority of which slopes up gently to the northeast. Transects were paced at 20 meters, and were run in north and south directions, following the rows between trees. Exact 20-meter intervals were not maintained in this section, as the paths between trees did not always lend themselves to a 20-meter transect. The survey crew made the adjustment to the row between trees that was closest to the 20-meter mark. This adjustment was considered for the next transect that required subjectivity, and a genuine attempt was made to compensate, and maintain an average of 20 meters. Severe limitations were encountered in this section. Ground coverage below and between trees was over 95 percent blanketed in avocado leaves that were up to eight inches deep. Occasional patches of soil were visible however, and visibility increased dramatically in the northern end of the grove. Here many trees were truncated, and leaf coverage was minimal. Grasses, weeds, and mulch continued to limit visibility, as did scrub brush in the northernmost portion. The eastern end of this section is made up of a steeply terraced hillside, where tree rows discontinued their clear north south orientation. Concrete water control channels are numerous in this end of section , as the slope is greater than in the western side. Here the survey crew continued to pace off 20-meter intervals, but followed the contours of the terraced slope. This allowed for greater control and visibility, as the rows between trees were not completely covered with leaves and mulch. Visibility, however, was still limited to less than ten percent. As with many sections that follow, this section was surveyed despite visual limitations to address patches of visibility where they did occur. In these areas of very dense groundcover, deviations from transects were often made to examine these patches. No artifacts were found in this section.

Section 3 is comprised of tomato fields divided by dirt roads into sections with varying row orientations. By necessity, the survey crew ran 20 meter transects that ran between the furrowed and stalked tomato plants. Visibility was limited to a width of one meter or less, as this was the approximate distance between plastic-sheet covered furrows. A further constraint was encountered due to the fact that the tomato plants were quite mature, and averaged four to five feet tall in height. This prevented the survey crew from seeing more than the one-meter wide path for each transect. The eastern end of this section is part of a steep slope leading up to the west side of the Lambert property. It is covered with dense coastal sage scrub. This area was surveyed intuitively up to a barbwire fence, which delineated the boundary of the property.

The survey crew found a siltstone “bowl” of unknown origin in the middle of this section, which was piled amongst numerous large and amorphous pieces of the same material. Provenience for this specimen is lacking, as it is likely to have been placed there while clearing the fields for agricultural use. TKCI personnel collected this bowl for examination, and concluded that it is not likely to be of cultural origin. It is currently stored in the archaeology division offices of TKCI. No other artifactual materials were discovered or collected.

Section 4 is comprised of two fairly steep hills densely covered on all slopes by sage scrub plant types. First, the southwestern knoll has been graded at its southeastern base to accommodate Portola Parkway, and a road or firebreak runs northwest to southeast over the hill. The survey crew followed this road from the southeast to the top of the hill, where it flattened out considerably. Here an intuitive survey was conducted, which resulted in the discovery of a previously unrecorded site, which is now designated as CA-Ora-1589. The western base of the hill also yielded artifactual materials. These included two cores, a white chert flake, and a perforator or awl of a dark gray chert. The survey crew collected no materials from this site.
Second, the upper knoll is a twin hill that sits to the northeast. The southern slopes were densely covered in paddle cactus and other brush, making a transect survey impractical. As in the lower knoll, the survey crew conducted an intuitive survey of all visible and accessible areas atop and around the hill. The hilltop was covered with rubble, concrete pieces, and other debris, and appears to have been graded. No historic or prehistoric artifactual materials were identified or collected.

Section 5 is a very steep incline on the northwest portion of PA 6, which abuts the Foothill Transportation Corridor. The slope is covered in grasses and weeds, with visibility fair to good. The survey crew conducted an intuitive survey of the section. No artifacts were found or collected.

Section 6 is a series of avocado groves separated by topography and dirt roads. Much of this section has very steep topography, and terraces are correspondingly deep. Transects were paced approximately at 20 meter intervals and run according to the directional orientations of tree rows. Intuitive surveys were also conducted on level hilltops in this section, as visibility was much improved in these areas. A portion of CA-ORA-649 lies within the boundaries of Section 6 and was rerecorded during this investigation. Schuster, Neitzel, Price, and Cottrell originally recorded CA-ORA-649 on July 31, 1977. In 1982, Archaeological Planning Collaborative (APC) surface collected the site (Breece and Padon 1982). RMW Paleo Associates updated the site on April 23, 1993 and no collection of artifacts was made. In September of 1995, CA-ORA-649 was tested by Foster Wheeler Environmental Corporation as part of a Phase II supplemental report for the Eastern Transportation Corridor. Noted constraints for this section include the steep terrain, and grass coverage of road paths between trees. Visibility is estimated at less than 25 percent. Much of the survey section has been heavily damaged due to terracing.

Section 7 is an avocado grove north of Portola Parkway, with a fairly level terrain. Transects were paced at approximate 20-meter intervals in northwest and southeast orientations, and coincided with tree rows. Visibility was obscured, at less than 10 percent, with a dense covering of mulch and leaves. Bare patches did allow for some visibility, and these were examined as they did occur. A new prehistoric site was recorded in this section as CA-Ora-1594. No materials were collected from this section.

Section 8 is a large nursery area used primarily for potted trees and plants. This section encircles section 9, which is kept separate due to its differential use as an avocado grove, and the nature in which the survey was conducted. The survey crew paced off transects at 20-meter intervals that were run southwest to northeast, as this corresponded with planter row orientations for the entire section, except for two plowed fields in the northwestern portion, where transects were run northeast to southwest on the eastern side of the drainage, and northwest to southeast on the western side. This portion is bisected by a deep drainage that runs north / south, and bordered to the northeast and southwest by rows of eucalyptus trees. The western end of this portion also has an occupied residence that appears to be greater than 50 years old, but lies outside the boundary for this survey.

The eastern side of the field yielded no artifactual materials. The western side however yielded one chalky thick *Chione* shell fragment, which may or may not be historic in nature, and one dark gray chert core. It is possible that neither of these specimens is within the survey area, as they are in close proximity to the boundary with the Lambert property.

The survey interval for the rest of the section was not difficult to maintain in most cases, given the accessible nature of numerous rows, especially in the southern portion of the section where potted trees were quite large. Visibility for this section ranged from very good to good, but with a limited view. Tightly placed smaller potted plants did obscure the ground significantly in some areas in the middle and northern portions of the section. Another potentially significant constraint for this section is that the northwest running boundary shows evidence of grading, possibly done in an effort to level out the area for more efficient agricultural land use. An alternative hypothesis is that the grading may have occurred during construction of the drainage that borders this section to the east from Bee Canyon, which once fed the Lambert Reservoir. Of note here is the fact that the southeastern portion of this section is just below Tomato Springs, in a location where water erosion has left exposed sidewalls of midden to depths of over seven feet. Artifacts including sizeable groundstone are visible in the sidewall. This midden is not visible in this portion of section 8, further demonstrating the probability of deep grading in this area.

Artifacts of note in this area include a gray chert core that was found right at the fence line abutting Portola Parkway, and a complete sandstone slab metate found at the southwestern boundary in the canal running northeast to southwest. Also, numerous prehistoric artifacts were discovered in section 9, but will be addressed separately. No artifacts were collected from this section.

Of historical consideration for this section is an unoccupied house that is located just east of section 9 (See map), which is depicted on a 1949 USGS EL Toro 7.5 minute map. The residence is greater than 50 years old, and should be examined for the potentiality of historical significance. A worker stated anecdotally that the house has been unoccupied since 1972. The temporary designation for this previously unrecorded historic site is TS-14.

Section 9 is comprised of a small grove of avocado trees. The bulk of the section is a terraced hill with trees on all slopes, and a level hilltop void of the avocado trees. The remainder of the grove lies to the southeast, and is gently sloped down to the southwest. The survey crew paced off transects at 20 meter intervals in a northeast to southwest direction, except for the hilltop, where transects were interrupted by an intuitive survey to discern the historical nature of multiple visible cultural materials. They included brick, glass fragments and bottle bases, plastic, cement pipe fragments, and other materials. These may have come from a house that sat atop the hill, which was constructed sometime before 1949, as per a 1949 El Toro quadrangle, and removed between 1968 and 1982, as per a 1982-revised USGS El Toro 7.5 minute map.

Artifactual materials were also found in this section, and are discussed in site descriptions. The historic and prehistoric sites in this section are designated TS-13 and CA-Ora 1588 respectively. The survey crew collected no material from this section.

Section 10 includes all of the loci for CA-ORA-244, including ORA-651 and -652, but does not include the new locus for ORA-244 to the northeast. A survey team of two crewmembers initially located all loci for this site, and then proceeded to define boundaries for each locus by starting with the most artifactually dense site areas, and running intuitive transects outward, deviating from a straight path to address bare areas. This survey method was continued until no artifacts could be found. Terminal boundaries were verified by surveying adjacent contours for negative findings. This process continued for the better part of two days, and current offered boundaries for ORA-244 are given with a high degree of confidence. Dirt roads were also instrumental in boundary definition, and often served as control references for survey areas.

Section 11 sits southeast of CA-ORA-244. It includes terraced avocado trees to the south, and a flatter grove to the northeast. Survey transects were paced at 20 meters, and adjusted for coincidence with tree rows (This averaged to be about every third row). A contour survey was conducted in the terraced grove, and northeast and southwest transects were run in the flatter southeastern portion. One chert flake was found at the very northern tip of the section, placing it just below the new locus for ORA-244. Visibility was relatively poor in most of the section, as grasses, weeds, and leaves obstructed the view of the ground. Visibility was estimated at less than 10 percent. No other artifacts were found, and none were collected.

Section 12 is an avocado grove northeast of CA-ORA-244, and just below the Foothill Transportation Corridor. An intensive survey was conducted in this section, as it was deemed a new locus for ORA-244. See site descriptions of ORA-244 for information.

Section 13 is an avocado grove, with a terraced southern portion. The survey crew paced off transects at approximate 20-meter intervals throughout the section, and ran transects that corresponded with the orientations of tree rows. Orientations varied from contoured to parallel, depending on topography. Ground visibility was fair to poor, with grasses and weeds the primary constraining factors. Isolated cores (3) were found in this section, but were not associated with any other visible artifacts, and displayed no identifiable concentrations. Of note is an area of very dark gray clay soil in an erosional rivulet at the northwestern portion of this section. No artifactual materials were collected, and no sites were identified in this section.

Section 14 is comprised of two avocado groves separated by a row of mature eucalyptus trees. In the northeastern half of this grove, transect intervals were paced at approximately 20 meters, and were run northwest to southeast, which corresponded to the rows of trees. Exact 20-meter interval transects were not possible to maintain, as they occasionally lined up with the trunks of the trees. In cases where the 20-meter pacings did not provide a reasonable path, the survey team alternated between navigable paths that fell short of 20 meters and those that fell beyond 20 meters. In addition, most of the ground was covered with vegetation or fallen avocado leaves, which made ground visibility limited, at less than ten percent. Where bare patches could be seen, the survey crew deviated up to three meters from the line of the transect to view the soil and check for the presence of artifactual materials. The survey crew found no archaeological or significant historic materials in this northern portion of section 16.

The southwestern half of section 16 is identical with respect to ground coverage, orientation of trees, and survey methods, the only notable difference being the presence of artifactual materials in the form of debitage and cores. The far northwestern end of this half, midway between the north and west corners, yielded a collection of lithic materials including three dark gray chert cores, one quartz core, and three pieces of red rhyolite debitage. A core of rhyolite also lies approximately four meters to the southwest of the main lithic scatter. A group of three amorphous quartz cores, which probably came originally from the same piece of material, sits on the very western corner of this section. Finally, an additional isolated flake of chert sits approximately equidistant between the east and south corners of the section. This previously unrecorded site is now designated as CA-Ora-1592. The survey crew collected no materials.

Section 15 is comprised of six plowed fields separated by dirt roads and or flood channels. The survey crew conducted 20-meter northeast survey transects at 40°, following furrows to aid in accuracy. Ground visibility was excellent at 100 percent. Previously recorded site CA-ORA-545 was located, and is currently defined as a lithic scatter of flakes and cores. An additional historic site, designated presently as TS-11, was also found in this section. It is comprised of an historic scatter of glass and ceramic fragments, which appear to be greater than 50 years old. A preliminary analysis of all materials in section 15 was not possible, as the entire section was replowed, then completely covered in plastic shortly after the survey, and before a site recordation could be made. Artifact scatters and isolates in both sites were recorded with the aid of a GPS device at the time of the survey. UTM coordinates obtained from this device were used to calculate site boundaries.

Section 16 is a small avocado grove with a dense ground cover of leaves and mulch. Northwest to southeast survey transects were paced at 20 meters, and adjusted for coincidence with tree rows. The survey crew encountered less than ten percent visibility, as imported mulch virtually blanketed the bulk of the section. Any visible patches of ground within 3 meters of the transect path were examined for the presence of artifactual materials. Nothing was discovered in this section.

Section 17 is defined as the Lambert reservoir, and an associated adjacent hill to the west. The reservoir is currently a plowed field of silty soil with a mulch of twigs, bark, and small broken branches. In the reservoir, the survey team ran transects at 20-meter intervals in northeast and southwest directions. The 20-meter intervals were paced, and followed plowed furrows to facilitate consistent coverage. The perimeters of the reservoir yielded ceramic, brick, glass, and metal materials, all of which did not appear to be historic in nature. A significant number of *Chione* were also present, but appeared again not to be historic, lacking the characteristic chalkiness of older specimens. Several structures are visible around the reservoir, and on the western hill, and appear to be associated with recreational use. They include a restroom, a barbecue area, a large balcony, and seating area with a view to the reservoir. The hilltop was surveyed intuitively by examining the materials and structures on the hill, and any visible materials on the hillsides. A pump structure sits atop the hill in close proximity to the recreational structures mentioned above. Two fiberglass boats and a transmission were also associated with the reservoir, as was other debris. The eastern side of the section contains potted plants on a cut, terraced, and scraped slope. The survey crew collected no materials from this section (See temporary site designation TS-10 for detailed background and usage of the Lambert Reservoir). Constraints for this section include grasses and weeds on the western hill, and the several feet of silt deposited in the reservoir in the 1990's.

Section 18 is an avocado grove bordered to the north by a steep drainage, and to the east by N Street. Survey transects were paced at approximately 20 meters, allowing for passage between rows of trees, and run northwest to southeast. Ground visibility was so poor as to make an adequate survey impossible. Almost complete coverage of bark mulch and avocado leaves predominated, with areas of visibility occurring only on or adjacent to dirt roads around the section. The westernmost point of this section yielded one small brown chert core, one rhyolite flake, and a pectin shell fragment. No materials were collected. The previously unrecorded site is now designated as CA-Ora-1592.

Section 19 is a small hill covered with small nursery potted plants and trees to the east and north, and native vegetation on the western side. The northeastern portion of this section is a knoll also covered with potted plants. The survey crew conducted an intuitive survey of the hill and slopes, taking advantage of visible ground areas. No distinct artifactual materials were found, but the hilltop was covered with numerous cobbles of various lithic materials. Constraints for this section include densely placed potted plants and native vegetation obscuring the ground. Visibility is estimated at less than 25 percent.

Section 20 is a heavily disturbed nursery and fertilizer manufacturing area. The hilltop has been truncated by extensive grading to accommodate a fertilizer company, and the western slopes have been heavily cut and graded for use as a potted plant area. The ground surface has been scraped, with soil and rock debris piled just south of Portola. The survey of the area was intuitive on the hill, where piles of industrial debris are scattered about. Old trucks and truck parts are also present. A combination of transects paced at 20 meters and intuitive transects was conducted to address the lower areas of the section. Visibility was good, at roughly 75 percent. No artifacts or midden deposits were observed.

Irvine Boulevard borders section 21 to the south, and military housing to the east. Surveys for this area were heavily constrained due to dense brush on hillsides, and the fact that the section is presently being used for mulch processing to the south, and industrial use in the central portion. Hillsides and hilltops have been heavily damaged by removal and scraping respectively. The survey crew conducted intuitive surveys of hilltops and accessible areas on slopes. Much of the survey area was not covered due to dense cactus, dangerous precipices, thick brush, and current use. Two sites were discovered in this survey area. One is a prehistoric lithic scatter (now designated as CA-Ora-1595), the other an historic trash dumpsite (TS-12). The prehistoric site, CA-Ora-1595, lies on what is left of a hill adjacent to N Street. It contains a lithic scatter area comprised of cores and flakes. One crescentic flake of good quality chert is included in the scatter. The historic site, TS-12, is located at the southwestern base of the southernmost hill on the section (See appendix for site map). Visible materials included evaporated milk cans, glass bottle fragments, a tobacco tin base, porcelain mentholatum jar fragments as well as other miscellaneous ceramic, brass, and steel pieces (See site description for greater detail). The survey crew disturbed the site to a limited extent to determine whether it should be considered historical in nature. The materials covered an area approximately ten by forty feet, and did not have much depth.

Section 22 was not surveyed due to extensive disturbance and ground cover of mulch and mulch piles. This section is currently an active facility with heavy machinery.

Section 23 is currently used as a nursery growing area for larger potted trees. The survey crew paced off transects at 20 meters, and surveyed from east to west, cooperating with the orientation of rows between potted trees. Exact 20-meter intervals were not maintained. Ground visibility was good. No obviously cultural artifacts were observed, and none were collected.

Section 24 is currently in use as a nursery potted plant growth area. The bulk of the section appears to have been heavily graded, with large terraced areas accommodating potted plants (This may be the result of the earthen diversion dam in the southern portion of this section, which was used at one time to provide water to the Lambert Reservoir, which was diverted from Round Canyon). The survey crew conducted a survey of the aisles between potted plants, as these were the only visible areas. Ground visibility was excellent here. Few artifacts were found, all in the central northern portion of this section. They included a cortical gray chert flake, and broken cobbles of quartz, carnelian chalcedony, and gray chert. Provenience of materials is questionable, as the immediate area has been heavily graded. The assemblage itself is of tenuous value, as no materials are conclusively cultural. TKCI personnel did not deem this a site. Shell fragments of *Argopectin* (1) and *Chione* (5) were also found in the northeastern portion of this section. No artifacts were collected from this section.

Section 25 is an avocado grove, most of which is terraced and in some places steeply. The southeastern portion of this section is relatively flat, with greater visibility due to the number of road cuts here. The survey crew paced off transects at approximately 20 meters, and followed rows between trees. Ground visibility was fair to poor on the slopes, depending on density of grasses and fallen leaves. The survey crew found many broken cobbles atop the hill in this section, which may be the result of the road cut and grading. One piece of reddish brown jasper shatter was also found here, suggesting the possibility of aboriginal presence. Despite an intensive survey by TKCI personnel, the area could not be conclusively designated as a site.

Section 26 is adjacent to the nursery area of section 28. The southeastern hilltop of this section is currently used as a dumping area for old and broken nursery planters. The remainder of the section is covered in native sage scrub vegetation and dense cactus. The survey crew accessed the southern portion via a dirt road from section 28. The hilltop and surrounding gently sloping sides were surveyed intuitively where accessible. The remainder of this portion was constrained and not surveyed due to the steep nature of the slopes and the dense cactus and brush. One core and one flake were found on the dirt access road. No other artifacts were found, and none were collected.

The northern portion of this section is a very steep hillside covered with dense coastal sage scrub and cactus. The survey crew examined the top of the hillside via a dirt road that separates section 26 and 27, and the west-facing slope at the base. A transect survey was not conducted due to the steep nature of the slope, and the dense brush. The survey crew found no artifacts in this section, but did locate a possible quarry site just to the east of the northern portion of this section, in section 27.

Section 27 is an avocado grove sloping down generally to the west. Survey transects were paced at approximately 20 meters, and followed the contours of the slope. Ground visibility was poor at less than 10 percent due to leaves, grasses, and weeds. The central western part of this section is an alluvial fan descending west from the terraced grove of avocado trees. Newly planted avocado trees occupy this portion, and are oriented roughly north to south. The survey crew paced off transects at 20 meters here as well, and followed rows between trees. Ground visibility was excellent here, at over 98 percent. The easternmost portion of this section contains bits of fossilized bone, and a piece of marine sedimentary rock that, when broken with a rock hammer, revealed a triangular cross section of a large bone. The consistency and state of preservation in the stone matched that of the fragments found nearby. Debitage of white chert was also observed, but with no apparent concentration. A new site, designated as CA-Ora-1590, was found in this section (See site descriptions). Portions of another new site, CA-Ora-1591, also lie within this section. No artifactual materials were collected.

Section 28 is currently a nursery area comprised primarily of larger potted trees and plants, on a relatively steep marine terrace. Agua Chinon Wash lies adjacent to the southeast. Survey transects were pace off at approximately 20 meters, and ran N/NW to S/SE, following roads and paths between trees and plants. When paced transects did not correspond with traversable paths, the survey crew alternated from a shorter transect to a longer one. An effort was made to average 20 meters. Ground visibility for this section ranged from more than ten feet wide to less than three feet wide, depending on the types and arrangements of potted plants. The great majority of the section allowed for good ground visibility, averaging approximately 50 percent (Visibility in the paths themselves was close to 100 percent). One new site was discovered just east of a steep ravine (See site map). The site, temporarily designated as CA-Ora-1596, consisted of a large chert core, many other siliceous flakes and cores, and several cobbles. Another location on top of the terrace yielded one chert core of poor quality, and one fragment of quartz, which may or may not have been cultural. Although these two specimens were within inches of each other, no other artifacts could be found in the immediate area. The survey crew collected no artifactual materials from this site.

Section 29 is comprised of a steep hill to the west, and a terraced avocado grove to the south and east. The hill has steep topography towards the north, west, and east, and moderately gentle sloping topography trending towards the south. On the north side of the knoll there is a microwave tower surrounded by a chain-linked fence. The survey crew conducted an intuitive survey of the hill, accessing the area via a dirt road leading up to the antenna tower, and descending the slope to the east. The remainder of the section was surveyed using approximate 20-meter transects coinciding with tree rows. These transects followed the contours of the slope, where visibility, estimated at less than 10 percent, was very limited due to leaves, grasses, and weeds. A new site was recorded in this section as CA-Ora-1591 (See site descriptions). Isolated artifacts of debitage and groundstone were also found in this section.

Section 30 is an avocado grove, which includes previously recorded sites ORA-761 and ORA-762. The survey crew paced off transects at 20 meters, and followed rows between avocado trees. Survey transects did not follow a single directional orientation, as rows tended to be oriented differentially depending on the nature of the slope. In general, differing row orientations in this section were divided clearly by dirt roads. The central portion of this section was surveyed intuitively, as it is comprised of sage scrub, and visibility was limited to bare patches within the area. TKCI personnel expanded the earlier boundaries for the ORA-762 loci, and re-recorded ORA-761 as a sparse lithic scatter. No artifacts were collected from this site.

Section 31 lies to the south and east of the Portola onramp to the Foothill Transportation Corridor, and is bordered to the south by Agua Chinon Wash. It includes previously recorded sites CA-ORA-1297 and CA-ORA-1311. The survey crew accessed site ORA-1311 from the north, where moderately dense brush was encountered to the top of the hill, where it leveled out to some degree, and brush thinned. Here many patches of clear ground were visible, allowing for approximately ten- percent visibility. An intuitive and opportunistic survey of the area was conducted, as a statistical sampling survey in the form of even transects was not possible. The crew found one red rhyolite flake and one dark gray chert core.

From the hilltop, the survey crew descended the knoll south, where more lithic materials were found on the gentle slope, approximately 120 meters south of the lithic scatter mentioned above. Very dense native scrub brush averaging four feet in height limited ground visibility between the two sub-sites, and a transect survey was not conducted. The brush gave way to knee-high native grasses on the gentler southern slope of the knoll, where the soil darkened to a medium gray with a clay content. Artifactual materials present confirmed the existence of site 1311.

Section 32 is Agua Chinon Wash. The northeastern half of this section, delineated to the south by a bridge, was surveyed intuitively in several east to west transects. Visibility was very poor throughout the wash as it was covered by vegetation including cattails. One brown jasper flake was found in this portion, but had no provenience, as it was resting on wet alluvial soil.

In the southern portion, the banks of the wash, and the adjacent nursery areas were surveyed intuitively, but are considered constrained to a great extent, the southern portion being much higher in elevation than the portion to the north (this may indicate a fill area). A final transect heading southwest along the southeastern edge of the Agua Chinon wash yielded a group of sandstone "blocks," complete with squared stones and a silty gray mortar. One side of the block assemblage appeared to have been burned, with reddish and dark gray soils giving the appearance of sandy adobe. This unusual assemblage may have resulted from a natural sedimentary phenomenon. The survey crew collected no artifacts from this section.

Section 33 lies on the far southeastern portion of the survey property adjacent to Agua Chinon Wash, and south of the Foothill Transportation Corridor. A barbwire and chain link fence, the other side of which is advertised as a demolition zone, demarcates the southwest to northeast running border of this section. The survey crew accessed the section by hiking up a scalable knoll in the midpoint of the section, beginning with the southeastern end of a bridge crossing Agua Chinon Wash. Ground visibility was highly limited due to very dense and tall brush. A transected survey of this section was not conducted due to the dense brush and steep terrain. Rather, the survey crew ran a ridgeline transect along the entire section via a dirt road. This intuitive approach provided the crew with access to gentler slopes on top of the ridge, where intensive surveys were conducted. Isolated artifacts of debitage were found in two locations along the ridge, with a concentration of lithic cores and flakes at the northern end of the section. Lithics at this site included materials of chert, quartzite, jasper, and rhyolite. In an effort to determine the boundaries of this site, the survey crew descended the northernmost knoll in a westerly direction, where an intuitive survey was conducted to Agua Chinon Wash. Visibility was again limited by cactus and brush, but bare spots did allow for a sampling survey of the knoll. Artifacts in the form of lithic debitage were found to approximately a third the way down the knoll, but lacked the concentration of the materials at the top of the ridge. It should be noted that the heaviest concentration of artifacts at this site lies near the property line, where the ground levels out considerably. The site continues beyond the property line, and is part of CA-ORA-1070.

The survey crew accessed the southern end of this section via the same dirt road from the south. Flakes of quartzite and chert were immediately visible at the base of the ridge. Ascending the slope, lithic materials of various siliceous stone types were abundant. Two very large pieces of brown, non-vitreous chert (Carnelian chalcedony) were also found. The raw materials are likely to be associated with the marine sedimentary layers of the ridge, as their cortical surfaces are similar to the indigenous silt/mudstone materials of which the ridge is comprised at this site. It is also of note that the chert was in an erosional rivulet in the road, amidst the native stone mentioned above. Flakes, cores, and cobbles were visible to the top of the ridge, where the slope descended rapidly to the west, and the artifactual materials diminished, with two isolated flakes noted 100 meters to the northwest (The survey crew could not locate any of the definitive flakes or cores when they returned to record the site. Therefore, there is no site recordation at this time). Following the ridgeline survey, a contour transect was done at the base of the ridge, from the southernmost end to the Chinon Wash bridge. Here the survey crew found two flakes of black quartzite, which were not similar in appearance to any of the noted materials atop the ridge. Severe constraints are noted for this section, as brush was so thick on the slopes as to be considered virtually impassible, with extremely limited ground visibility. Areas of gentler sloping knolls, while densely covered in brush and cacti, were intuitively surveyed in an attempt to expand boundaries of discovered sites.

REPORT OF FINDINGS

SCCIC Documentation

A search of the records on file at the SCCIC indicated that significant research has been conducted on the property, and prehistoric archaeological sites have been recorded. There have been forty-two scientific surveys, studies, or excavations conducted within a one-mile radius of the property. Of those, twenty-three were located within the current project area. There are currently fifty-seven prehistoric archaeological sites recorded within a one-mile proximity of the project area, fourteen of which were previously recorded on the property.

The fourteen sites located by SCCIC include: CA-ORA-244, ORA-545, ORA-650, ORA-651, ORA-652, ORA-761, ORA-762, ORA-1246, ORA-1297, ORA-1298, ORA-1311, ORA-1347, ORA-1348, and ORA-1480. A later refinement of the property boundaries concluded that ORA-1246, ORA-1298, ORA-1347, and ORA-1348 were not located within the planning area. The refinement of boundaries also concluded that two other sites were included in the planning area, but not listed by the SCCIC. The additional sites are CA-ORA-649 and CA-ORA-1070. Therefore, of the fourteen sites originally listed by SCCIC as being within the planning area, four sites were taken out and two were added. With revisions, Planning Area 6 now has twelve sites within it's boundaries.

TKCI personnel conducted a record search at the SCCIC. The record search included the California State Historic Resources Inventory (CSHRI), the National Register of Historic Places (NRHP), and the California Historical Landmarks of the Office of Historic Preservation (OHP). The SCCIC provided TKCI with a Historic Property Directory, which listed one historic property located immediately south of the project area, and contained on the California Historic Resource Inventory, but was not located in Planning Area 6. No other historic properties have been recorded in or within one mile of Planning Area 6.

SITE DESCRIPTIONS, PRIOR INVESTIGATIONS

Others have recorded numerous prehistoric sites on this property over the last 20 years or so. The descriptions of the 12 recorded sites and 14 previously unrecorded sites found within PA 6, as well as a description of one of the sites found to be outside the planning area (CA-ORA-1298) are as follows:

Prehistoric Sites

CA-ORA-244

Herman Strandt conducted limited excavations at this site in the 1920s and coined the name "Tomato Springs Site." In addition to prehistoric occupation, the site was thought to be one of Gaspar de Portola's campsites by Helen Smith, who visited the site with Don Meadows in 1965. Subsequently, McKinney and Smith re-recorded the site in 1965 (Smith 1965). Smith's site record states "Lambert said a Santa Ana Man's father excavated here also, this man reported @ 150 Indians around the spring about 100 yrs. ago." The site was recorded as consisting of "leaf points, notched points of chert & quartz, schist bowl sections, broken and reworked manos, hammerstones, metates, chipping waste of quartz, chert, jasper, basalt, and desert petrified palm, yellow, red, and blue jasper." Marie Cottrell of Archaeological Resource Management Corporation (ARMC) conducted excavations at the site again in 1978. Diverse assemblages of artifacts were recovered, and midden depths recorded to 65 centimeters (Cottrell and Del Chario 1981). Cottrell and Del Chario posited a 5,000-year span of fairly continuous occupation at the site in that report. Breece and Padon re-recorded the site in 1982 as part of a Foothill Corridor investigation. They concluded that this site was associated with ORA-651 and ORA-652 (Breece and Padon 1982). Kathleen Del Chario re-recorded this site during assessment work she conducted in the area in 1989 (Del Chario and Drummy-Chapel 1989). She reported the site to be obscured by dense vegetation, but noted several artifacts in the southerly dirt access road. She also reported that the site had been terraced for avocado trees, but had not been planted. These terraces have been cut into the gentle slopes of the site, and do not occur on the flatter loci tops, which are likely to remain undisturbed in places. The extent of damage due to this terracing needs to be addressed.

A proposed pipeline excavation was likely to impact Locus A of the site but Del Chario recommended no research in the area since it had been salvaged by ARMC in 1978 (Cottrell 1978).

Kenneth Becker (1997) also conducted limited archaeological excavations in 1997, and conducted archaeological fieldwork at sites CA-ORA-244, -651, and –652. His excavational units did not yield new data of consequence.

Edward Shickler and Craig Lambert of TKCI resurveyed this site in July of 2001, and found a dense assemblage of artifactual materials on loci CA-ORA-244a and 244b. They concurred with Breece and Padon's summation that ORA-651 and ORA-652 should be considered associated with ORA-244. Shickler and Lambert also discovered another site to the northeast of ORA-244, which they believe should also be included in the Tomato Springs Complex of sites (See site map). This new locus abuts the Foothill Transportation Corridor, which has very likely run right through the upper knoll of this site. It appears that this locus may have been a southern extension of CA-ORA-1348. During the course of this survey of -244, the survey crew found that the primary constituency of cultural materials included debitage and ground stone artifacts. Groundstone materials discovered included nine metate fragments, 12 complete bifacially ground manos, four unifacially ground manos, and 12 mano fragments. Hundreds of pieces of debitage were also observed and included materials of various cherts, rhyolite, opaque jasper, obsidian (one small tertiary flake), chalcedony, agate, basalt, quartz, quartzite, metavolcanic, and fine-grained sedimentary rock. Several stone tool artifacts were also noted. They consisted of one serrated scraper, four utilized flaked scrapers, two utilized blades, 14 cores/choppers, four hammerstones, and one brown chert projectile point.

The survey crew also noted naturally occurring siliceous materials in the study area, which they observed within the site's boundary at the time of this survey. These materials included, but were not limited to, Rhyolite, Chert, and Carnelian Chalcedony.

CA-ORA-244 also has an historic component in the form of a bronze plaque commemorating the Portola' expedition, which may have camped at this location and used the spring. This spring was active at the time of the present survey. This history is addressed in Cultural Setting: History of Tomato Springs.

CA-ORA-545

T. Cooley and A. Schilz of Archaeological Research, Inc. recorded this site northwest of Lambert Reservoir in 1976. They described the site as "A scatter of artifactual materials in and around the citrus trees." Artifacts noted included manos, metate fragments, hammerstones, choppers, and flake tools. Padon and Breece could not locate the site during their advance planning assessment work for the City of Irvine in 1985.

TKCI personnel resurveyed, and located, this site in July of 2001. The site presently consists of a sparse lithic scatter and is located 400' south of Portola Parkway and 400' northwest of the Lambert Reservoir. This site is within a plowed field, which has been disturbed extensively by agricultural activities occurring since the 1970's. The site lies upon the undifferentiated

Williams Land Formation and is situated in alluvial deposits. The topography of the site is very slight and trends towards the southwest. Artifacts observed included four chert flakes, two rhyolite cores, one hammerstone, one quartz core, one opaque jasper flake, and several rhyolite flakes. No groundstone artifacts were observed during this investigation.

CA-ORA-649

A small portion of CA-ORA-649 was rerecorded during this investigation. Schuster, Neitzel, Price, and Cottrell originally recorded CA-ORA-649 on July 31, 1977. In 1982, Archaeological Planning Collaborative (APC) surface collected the site (Breece and Padon 1982). RMW Paleo Associates updated the site on April 23, 1993 and no collection of artifacts was made. In September of 1995, CA-ORA-649 was tested by Foster Wheeler Environmental Corporation as part of a Phase II supplemental report for the Eastern Transportation Corridor. Apparently, most of the site was destroyed during the construction of the Eastern Transportation Corridor. The artifacts observed at the site consist of three mano fragments, several pieces of debitage, two cores, and a whole mano.

CA-ORA-650

N. Neitzel, M. Cottrell, R. Price, and T. Schuster recorded this site in 1977. They originally described it as a “Milling and flaking station along ridgeline overlooking Bee Canyon mouth and fan. Ground and chipped stone scattered throughout sagebrush.” The site consisted of two manos, a metate, two hammerstones, and quartzite, chert, jasper, and dacite debitage. They stated in the site record that the site might be associated with ORA-244. Roger Desautels re-recorded the site in 1978 during a survey of Bee and Round Canyons (Desautels 1978). Cottrell and Del Chario of ARMC conducted limited collections at the site later in 1978 to mitigate the effects of a pipeline running through the site. During that investigation 23 groundstone tools, three hammerstones, one chopper, seven scraper planes, and seven chipped stone implements were recovered. The site was impacted by agricultural activities in 1981, after which Ron Douglas coordinated a surface collection of the site. His crew recovered six groundstone tools, seven chipped stone tools, and one hammer stone (APC 1981, now LSA). Breece and Padon re-recorded the site again in 1982 as part of a Foothill Corridor investigation (Breece and Padon 1982).

TKCI personnel resurveyed this site in July of 2001, and noted that it had been extensively disturbed from terracing to accommodate avocado orchards, the terracing cuts in some areas as deep as five feet. The portions of the site that appear to remain intact are along the ridgeline and in the agricultural road cuts. The artifacts observed during this survey included one brown chert scraper, one granitic mano fragment, one rhyolite core, one opaque jasper flake, three chert flakes, and one chert core.

CA-ORA-651

N. Neitzel, M. Cottrell, R. Price, and T. Schuster recorded this site in 1977, which is located on a small finger ridge. The site consisted of manos, hammerstones, and scrapers of chert, jasper, and quartzite. Roger Desautels re-recorded the site in 1978 and associated it with ORA-244. Cottrell and Del Chario of ARMC conducted limited collections at the site later in 1978 to mitigate the effects of a pipeline running through the site. During that investigation they recovered 47 groundstone tools (Cottrell and Del Chario 1981). This site was also impacted by agricultural activities in 1981, after which Ron Douglas coordinated a surface collection of the site. His crew recovered 19 groundstone tools, nine chipped stone tools, and one biface, but did not observe a midden (APC 1981, now LSA). Breece and Padon also re-recorded the site in 1982 as part of a Foothill Corridor investigation. They too concluded that this site was associated with ORA-244 and ORA-652 (Breece and Padon 1982). Kathleen Del Chario conducted assessment work in the area in 1989, and reported this site as destroyed. Del Chario and Drummy also noted that, based upon the artifacts recovered during the surface collection, there is a likelihood that it may have served as an agave processing station (Del Chario and Drummy-Chapel 1989). A survey by TKCI personnel in July of 2001 resulted in this site being re-recorded as part of ORA-244.

CA-ORA-652

N. Neitzel, M. Cottrell, R. Price, and T. Schuster recorded this site in 1977. Site artifacts included a scraper, a hammerstone, cores, manos, a metate fragment, a sandstone tablet, and a dacite core/chopper. Darker midden appeared at the site and stone materials consisted of chert, quartzite, rhyolite, dacite, quartz, basalt, and granite. Roger Desautels re-recorded the site in 1978 and associated it with ORA-244. He recorded it as a part of the Tomato Springs Complex. In 1981, Cottrell and Del Chario also viewed the site as part of ORA 244 (Cottrell and Del Chario 1981). LSA concurred with those impressions and recorded both ORA-244 and this site as being the same in 1982 (Breece and Padon 1982). Breece and Padon re-recorded the site in 1982 as part of a Foothill Corridor investigation. Again it was associated with ORA-651 and ORA-244 (Breece and Padon 1982). TKCI recorded this site in July of 2001 as part of the Tomato Springs Complex (CA-ORA-244).

CA-ORA-761

Theo Mabry originally recorded this site in 1978, and described it as a "Surface lithic scatter – possible shallow sub-surface –activity site. On a flat area overlooking Agua Chinon Wash, just before road that curves uphill." Mabry and Beth Padon updated the site record in 1984, at which time they recorded no existing prehistoric remains at the recorded location. They indicated on the update that recent rains might have eroded the site resulting in its loss. TKCI personnel conducted an intensive survey of this site in July of 2001, and recorded one white chert core, three white chert flakes, two brown chert flakes, one rhyolite core, and 10 plus altered cobblestones. The site is currently on the edge of an avocado grove and extends towards a paved access road for the Agua Chinon Wash diversion dam. The site lies upon the Williams Land Formation and gently sloping topography trends toward the south and east.

CA-ORA-762

Theo Mabry recorded this site in 1978 as consisting of groundstone, cores, and numerous unmodified cobbles. William Breece updated the record in 1982 during an assessment of potential impacts for the Foothill Transportation Corridor. He observed a single white chert core during that visit. In 1984 Padon and Mabry revisited the site, and recorded significant numbers of artifacts compared to the prior survey. They recorded a discoidal, two manos, one core, and three mano fragments. TKCI personnel resurveyed this site in July of 2001, and recorded the following artifacts: one quartzite flaked scraper, two complete manos, one mano fragment, one quartz core, one chert core, two fire affected rocks, multiple chert flakes, two rhyolite cores, one hammerstone, two rhyolite scrapers, and other assorted flakes / debitage. This site is located within the Williams Land Formation on gently sloping topography that trends towards the south. Part of the site is situated in an avocado grove, and part lies in native scrub. Artifacts were highly visible in four agricultural access roads that run through the site.

CA-ORA-1070

This site consists of a lithic scatter and is a part of a larger site that could not be observed due to property boundary fencing. The site was originally described in the following manner: "Site is located on three adjacent knolls, connected by a saddle to SW and split by a small drainage to NE. The site sits above and east of Agua Chinon Wash. Road from Agua Chinon cuts main knoll of site." The portion of the site within the boundaries of this survey is located to the west of said road cut. The site is situated on the Niguel Land Formation. Its topography is generally flat on top of the knoll and trends down towards the northwest. The artifacts observed included four quartzite flakes, two red jasper flakes, five brown chert flakes, six rhyolite flakes, two rhyolite cores, and three amorphous cores.

CA-ORA-1297

Michael Macko recorded this site in 1991, and described it in this manner: "Site is located on top of a small knoll west of and overlooking Agua Chinon Wash. The north boundary of the site abuts the limit of grading for the Foothill Transportation Corridor between stations 2550+00 and 2552+00." The site consisted of one angular hammer, three cores, 12 burnt rocks, 13 flakes, one hammer, three manos, and one undifferentiated groundstone. The predominate artifactual materials were volcanic, and included metarhyolite (9), rhyolite (8), granite (600), andesite (2), and Santiago Peak volcanic (1). Other lithic materials included jasper (2), sandstone (2), chert (10), and cherty shale (1). This site was surface-collected and mapped prior to clearing and grubbing for the construction of the Foothill Transportation Corridor in 1992 (Macko 1992). Macko recommended no further mitigation for this site (Macko 1992). A recent survey by TKCI personnel in July of 2001 confirmed that evidence of this site still exists, although the density of artifacts described by Macko above was not evident at the time of the survey. Artifacts noted during this survey included six fire-affected rocks, one basalt flake, one quartzite core, and two chert flakes.

CA-ORA-1298

Deborah McLean, Ivan Strudwick, Douglas McIntosh, and Peter Carr originally recorded this site in February 1991. The cultural materials consisted of a sparse scatter of approximately five cores (three chert), two flakes, burnt groundstone, and fire-affected rocks (about 3 pieces). The non-artifactual items included small bone fragments (one bird), and pieces of shell. Michael Macko re-recorded the site in September 1991 as consisting sparsely of small, flaked stone, and milling stone scatter. The assemblage of artifacts was comprised of one chopper, six cores, two core scrapers, 27 burnt rocks, 16 flakes, two hammers, seven manos, and one shaped metate. Artifactual materials included metarhyolite (23), Santiago Peak volcanic (9), rhyolite (7), granite (6), tuff (1), basalt (1), quartzite (10), chert (6), jasper (1), and sandstone (2).

Macko Archaeological Consulting mitigated the site in 1992. During mitigation nine 20-centimeter wide postholes were excavated. The placement and subsequent excavation of 34 one-by-one meter excavation units were based upon the data gathered from the posthole program (CAPS). During the excavations two hearths and a house floor were encountered. Four radiocarbon samples were taken from both inside and outside the house. The two radiocarbon dates from inside the house are 2,300 +/- 60 years BP and 2,760 +/- 60 years BP, with corresponding dendro-calibration of +102 and +205 years. The two radiocarbon dates from outside the house are 3,360 +/- 80 years BP and 3,250 +/- 80 years BP, with corresponding dendro-calibration of +276 and +217 years. The prehistoric house floor at CA-ORA-1298 is the most intact in Orange County (Macko, Michael E. and Hurd, Gary S. 1992). The site was subsequently destroyed during the construction of the Foothill Transportation Corridor. No further work is necessary at this site. The TKCI survey crew confirmed the destruction of this site in July of 2001, and found that the knoll on which the site was situated is now gone, replaced by the Foothill Transportation Corridor. Being situated on the Foothill Transportation Corridor, CA-ORA-1298 is not within the planning area's boundaries.

CA-ORA-1311

Rod McLean, Ivan Strudwick, Douglas McIntosh, and Peter Carr of Chambers Group Inc. recorded this site in 1991. The site was described as two loci containing areas of midden with surface artifacts. The artifactual materials included flakes, groundstone, cores, and other artifacts. TKCI personnel re-recorded this site in August of 2001, and discovered a gray quartzite core and two pieces of fire affected rock at the hilltop just south of the Foothill Transportation Corridor. Descending the knoll to the south, the survey crew found one red quartzite core, three quartz flakes, two chert flakes, and one opaque jasper flake. Visibility was poor on the steeper slopes of the knoll, but improved on the hilltop and on the lower flatter southern knoll, where dense brush gave way to a more sparse plant community, allowing for visibility in the form of patches of bare ground. Soil is described as a medium to dark gray. The site does not appear to have been disturbed. The original site boundaries were kept for this update.

CA-ORA-1480

Douglas Davy, of Foster Wheeler Environmental Corporation, recorded this site in 1997 as being buried with three components. He described the first component as being comprised of a small mano, debitage, marine shells including abalone, a bone awl tip, and a small amount of mammal bones. The second component was a small hearth about 50 centimeters in diameter located 21 feet below the surface and consisting of stained sand, small bits of charcoal, and small cobbles. The third component was also a small hearth about 60 centimeters in diameter located 24 feet below the surface, "consisting of fine layers of charcoal, burnt earth, and clay in a fine sandy matrix" (Davy 1997). The area in which this site was located is presently a nursery, which is completely covered in gravel. The survey crew was unable to relocate the site, as it is buried under several meters of alluvium. TKCI recommends grading monitoring for this and other alluvial deposits that may blanket other subterranean cultural deposits. Excavations of CA-ORA-1480 were limited to a road cut for the Eastern Transportation Corridor; therefore, it is possible that the site's deposit could extend into Planning Area 6.

CA-Ora-1588

This site is situated on a relatively level-topped knoll, and on its southeast trending slope. The artifact assemblage observed consisted primarily of groundstone implements and stone-chipping debris (debitage). This site is situated entirely within an avocado grove, except for the hilltop, which is relatively bare. There is evidence of extensive agricultural and residential disturbances to an unknown depth, the result of the grading of the hilltop and terracing of its slopes. The site is contained within an 82,500 square feet area.

Artifacts observed on the hilltop include three rhyolite flakes, two cores, and several truncated cobbles. Lithic materials included cherts, rhyolite, chalcedony, basalt, metavolcanic, and some fine-grained sedimentary rock. The gently sloping adjacent knoll contained a metate fragment, a stone bowl fragment, two bifacially ground manos, and a lithic scatter of cores and flakes.

CA-Ora-1589

This site is situated on a knoll and its western slope. The knoll topography is generally steep on all sides, save for the western slope, which is relatively gentle. A road cut runs southeast and northwest through the site and the summit of the knoll. There is no apparent midden associated with the site. Artifacts consistent with a cobble-type quarry, and flaked stone tools, were apparent during this evaluation. The biota of this site is comprised mostly of native vegetation. The visible artifacts included several broken (truncated) cobbles, one retouched flaked scraper, two brown chert flakes, one basalt core, two rhyolite cores, one quartz core, one blade, three hammerstones, and several unmodified flakes.

CA-Ora-1590

This site is located on a north-facing slope with a moderately steep topography. It was discovered in part due to the presence of an agricultural road cut, where debitage and worked and truncated cobbles were visible. The immediate area in which the site is contained is a marine conglomerate of various sedimentary and metamorphic lithic materials. These have eroded out of the hillside, and are conspicuously scattered, densely in some places, in a somewhat confined area.

The artifact assemblage observed on this site includes one well-defined white chert core, two chalcedony core fragments, three chert flakes, one quartz core, and two rhyolite angular cores. Numerous truncated and broken cobbles were also present, but could not be positively identified as culturally procured materials, given the density of raw materials at the site locus.

CA-Ora-1591
This site is located on a hill with steep topography towards the north, west, and east. Moderately gentle sloping topography trends towards the south. The site encompasses an area that extends from the knoll summit southwards, into an avocado grove. Parts of the site appear to have been impacted. On the north side of the knoll there is a microwave tower surrounded by a chain-linked fence. The lower southern portion of the site as been agriculturally impacted, a result of terracing to accommodate the grove. An access road leading to the tower, and agricultural roads on the southern portion of the site, appear to have displaced some artifacts. The site has well defined midden areas and habitation debris. The artifacts observed during this survey included two bifacially ground manos, one uniface mano, one metate fragment, and flakes of chert, rhyolite, and chalcedony.

CA-Ora-1592
This site is located in relatively flat topography, approximately 1200' west southwest of the Lambert reservoir. It consists primarily of debitage and shellfish remains. Extensive agricultural grading and or plowing may have disrupted this site. Visibility of the surface is low. The cultural assemblage includes one piece *Argopecten* shellfish, one white chert core, and one rhyolite flake.

CA-Ora-1593
This prehistoric site includes a collection of lithic materials including three dark gray chert cores, one quartz core, and three pieces of red rhyolite debitage. A core of rhyolite also lies approximately four meters to the southwest of the main lithic scatter. A group of three quartz cores, which probably came originally from the same piece of material, sits approximately 75 meters (paced) southwest of the main scatter. Boundaries for this site were arbitrarily expanded to include the quartz material, and to account for the possibility that materials extend into the grove, where visibility was poor.

CA-Ora-1594
This prehistoric site is primarily a lithic scatter situated adjacent to an avocado grove in survey section 7, just north of Portola Parkway and immediately to the northwest of a canal running to the southwest from Bee Canyon (See site map). This site contains two black rhyolitic cores, one amorphous quartz core, one dark gray chert core, one dark gray chert cortical flake, and one dark gray microflake. Possibly associated with this lithic scatter is a four by four inch angular black chert core with multiple flake scars. The core appears to be spent, with multiple step fractures present. One dark gray chert cortical flake / scraper was also found. A very dense cover of

avocado leaves, grasses, and bark mulch in the avocado grove adjacent to the site may obscure site boundaries. A complete sandstone slab metate was also found in the canal below the site to the south. This may have eroded out of the canal in-situ, or it may have been hydro-transported down the canal from above. The former hypothesis could not be supported in the field, as the eroded slopes of the canal contain materials to a significant depth, which are clearly recent.

CA-Ora-1595

This site lies upon a small hill 150’ southeast of N Street. The site is comprised of a lithic scatter of flakes and stone tools. Metavolcanic cobbles were observed on this site, and were noted as containing multiple flake scars and ridges. This site appears to have been a quarry. The site also contains a conglomerate of cobblestones that have not been altered. Artifacts observed include one brown chert crescentic, two basalt secondary flakes, one rhyolite core, eight truncated metavolcanic cores, and two brown chert flakes.

CA-Ora-1596

This lithic scatter site sits just above and to the east of a steep drainage, and at the edge of a nursery growth area. The materials assemblage includes five quartzite cores, one large chert core, numerous broken and truncated cobbles, and one rhyolite flake. Other siliceous flakes and cores were also found just north of the main assemblage, but were scattered amongst an outcropping of unmodified raw lithic materials in a road cut. Provenience of the latter artifacts is therefore questionable.

Historic Sites

Several potentially historic structures, including the Lambert Reservoir, two earthen diversion dams, and residential buildings, lie within the survey area. These appear on a 1949 USGS El Toro 7.5' map. The Lambert reservoir is discussed in TS-10, under Historic Sites. The diversion dams are currently used to hold potted plants, with their integrity uncertain. These levees were originally used to divert waters from Bee and Round Canyons, the water channels themselves being altered for agricultural use sometime after 1903. One residence, which was constructed prior to 1949, is also discussed in the Historic Sites section under TS-14. Three houses constructed between 1916 and 1917, one of which is of the California Bungalow architectural style, sit adjacent to the survey boundary, but are not included in the survey area. These all have Lambert Road addresses and are not part of PA 6. Additional structures on N Street with Irvine Blvd. addresses do not appear on the 1949 map, as N Street did not exist in 1949. They do however show up on the 1968 USGS El Toro 7.5' map. Irvine Blvd. addresses considered are as follows: 7987, 7989, and 7993. According to the County Planning Office, these addresses did not appear on 1951 or 1955 parcel books, but did appear in 1963. They are not of any style deemed architecturally significant, and are unlikely to be of historic value. No further research was conducted into these properties as this researcher is satisfied that they are less than 50 years old, and are of no historical significance.

TS-10

The Lambert Reservoir was originally constructed in the early 1930's as an irrigation and water storage facility for the Irvine Ranch. Two earthen berm dams served to act as a retaining bowl, with an emergency spillway at the eastern end of the dam to channel waters in the event of a large storm. A 16-inch concrete pipe, which ran under the eastern dam, originally conveyed water to agricultural areas, and to a large grove of fruit trees. Aside from water flow exiting the reservoir from these storm events, the reservoir was intended as a closed system, with all water intake planned for irrigation use.

The Highline Canal, built in the 1930's to supply water from Irvine Lake to Irvine Ranch agricultural lands, was the primary water source for the Lambert Reservoir. Water from the canal was transported through a booster pump to the reservoir.

Seasonal major storm events also supplied water to the reservoir via two intake ditches. Waters diverted from Round and Bee Canyons via diversion dams supplied the first intake ditch, which was located at the northeastern side of the reservoir. The second ditch, at the south end, received waters channeled from Agua Chinon. To accommodate a sand mining operation in the early 1970's, the original course of the Agua Chinon sub watershed drainage was diverted back to its original course. In the mid 1990's the Bee Canyon Retarding Basin was built, capturing flows in the Bee Canyon Reservoir and diverting them to the Marshburn Retarding Basin via the Bee Canyon Channel, bypassing the Lambert Reservoir. Flows detained at the Round Canyon Retarding Basin similarly bypassed the reservoir and were diverted to the Marshburn Retarding Basin.

Initially, the Lambert Reservoir irrigated agricultural fields and orchards by way of a gravity system, later replaced in the 1970's by the Irvine Lake Pipeline, a more effective pressurized system. This system was in use until the early 1980's, at which time the Lambert Reservoir ceased to function as a source for agricultural irrigation. The Irvine Ranch filled the reservoir at this time with water from the Highline Canal, and redesignated the site as a recreational fishing facility for Irvine Ranch employees until the late 1980's, when the operation was terminated. At that time the primary water source for the Lambert Reservoir came from the Bee Canyon Drainage diversion. In the early 1990's, for a three to four year period, the Lambert Reservoir was repeatedly inundated from large storm flows that resulted from construction of the Bee Canyon landfill. One of these storm events deposited three to four feet of sediment in the reservoir, which resulted in the county later agreeing to remove the materials. Limited funding resulted in a 150 feet by 350 feet pit, approximately six to eight feet deep. In 1995 the Bee Canyon retarding Basin was constructed, channeling all water into the Bee Canyon Channel, and no longer into the Lambert Reservoir.

Historically the Lambert Reservoir irrigated several hundred acres of farmland owned by the Irvine Ranch. Some of these lands were sold to the Federal Government in the 1940's for what became the EL Toro Marine Corps Air Station, and more was sold in the 1960's to the University of California Regents for agricultural research. More land was sold to the Marine base in the 1970's for expansion purposes.

TKCI recommends that the Lambert Reservoir be further evaluated for historic significance prior to its being impacted.

TS-11

This site is comprised of an historic scatter of glass and ceramic fragments. A field analysis of the materials suggested a date greater than 50 years old. A preliminary analysis of all materials in section 18 was not possible, as the entire section was completely covered in plastic shortly after the survey, and before a site recordation could be made. A further evaluation for potential historic significance needs to be conducted for this scatter.

TS-12

This is an historic dumpsite comprised of a variety of temporally diagnostic debris, in at least three depositional episodes. A tobacco tin and a bottle top were used for a field temporal estimation, and a date range of 1935 to 1950 was extrapolated for that locus. Other materials included a several pieces of metal, remnants of a very large glass bottle, a decorative metal spice shaker top, china fragments, SCA glass fragments from a cut glass decorative bowl, various other glass pieces, meat cans, and evaporated milk cans with lead filler. Materials which may aid in the development of a temporal window for this site include the following materials: a "*GENUINE BOYD CAP FOR MASON JAR*" porcelain seal, still inside the lid; a large aqua bottle base with very small bubbles in glass, and with "11" encircled and embossed on base; a brass shaker top with lid, the inside of which reads "*OPEN CAP AS FAR AS IT WILL GO*"; a glass screw top rim with few visible small bubbles in glass (inside diameter measures approximately 2 7/8"; a rectangular clear bottle base with "9" encircled on base. Embossed on the side of the bottle reads "…*MORE*' (partial "m") with a full "…*N*" below and slightly to the right of, the "*O*" Very small bubbles were visible in the glass. Photos were taken of several of the artifacts (See Confidential Appendices). TKCI recommends that this site be evaluated further for more accurate dating, and for any potentially valuable historic information that it may provide.

TS-13

This site is comprised of a debris scatter of potentially historic materials. The materials observed included brick, glass fragments and bottle bases, plastic pieces, a washing machine top piece, cement pipe and cement pipe fragments, and various pieces of metal. As per 1949 and 1982-revised USGS El Toro 7.5 minute maps, a house at that location was constructed before 1949, and removed between 1968 and 1982. While much of the debris could not be field-identified as greater than 50 years in age, it is possible that at least some of the debris was associated with this structure. No materials were collected from this site.

TS-14

This residence stands unoccupied in a dilapidated state. It consists of a main house with a raised foundation, an originally detached garage of similar construction, and an addition of later date with a cinder block foundation that bridges the house and garage. The shingles on the house appear to be of an asbestos type that was popular in the 1930's. A 1949 USGS El Toro 7.5 minute map confirms that the residence is at least 52 years old. The potential historic significance for this structure needs to be evaluated before any adverse impact occurs.

DISCUSSION

Considerable archaeology exists on PA 6 and various forms of dense ground cover may obscure more. Presently, there are 21 prehistoric archaeological sites and 5 historic sites identified on the property.

While the historic sites may prove to be of some historic significance through testing and evaluation, the most salient cultural resource for PA 6 is the prehistoric presence as indicated in this report.

Prehistory of PA 6

The most important site to date, for this property, and, in many respects for Orange County, is the much publicized “Tomato Springs” site, CA-Ora-244, and its purported immediate constituent loci, CA-Ora-650 and CA-Ora-651.

While the function of the sites surrounding Tomato Springs remains unclear, the overall distribution of prehistoric sites in the greater Tomato Springs area, both on and off of PA 6, is striking. The function of so many sites through time as a settlement system, or systems will require rigorous field, laboratory, and analytical work to define. Answers to questions regarding trade and procurement, seasonality, settlement/subsistence, chronology, and trade and procurement will undoubtedly be forthcoming, as will new questions.

The occupation span at CA-ORA-244 is estimated at around 5,000 years duration, ending, it is suggested, possibly as late as the mid-1800’s (Cottrell 1985; Cottrell and Del Chario 1984). Many time sensitive artifacts from this site reflect a Late Prehistoric (LP) component. These include coastal Cottonwood projectile points, a three-groove steatite arrow shaft straightener, a steatite pendant, and a shaman’s stone-sucking tube. The projectile in Figure 10d of Cottrell and Del Charios PCAS Quarterly publication (1984:30), labeled a Cottonwood type, may be a Sonoran point (see Koerper and Drover 1983). If so, it bespeaks an LP2 presence (see Koerper et al 1996).

Other projectiles, dart points, reflect earlier than Late Prehistoric period occupation. Atlatl dart points in Orange County do not hold the kind of precise temporal resolution they were once believed to have had (see Koerper et al. 1994). Thus, it is uncertain whether the large points establish people at Tomato Springs as far back as the third millenium BC.

Four discoidals and two cogged stones were found at Tomato Springs. A problem with embracing certain presumed magico-religious items as indicators of periods of occupation that coincide with the known or estimated manufacture period of the sacred object, or the known or estimated florescence of employment of the artifact, is that power objects are prone to being recycled through evolving magical and religious systems of belief and behavior. They achieve heirloom status more readily than mundane objects. They are of unusual morphologies thus easily equated (in the minds of later populations) with the supernatural realm, coveted, and collected for their power potential. Centuries or even millennia after their manufacture, very durable objects such as cogged stones or discoidals may find their ways into burial contexts, ceremonial caches, shamans' bundles, etc. With that caveat, we tend to agree with Cottrell and Del Chario (1984; Cottrell 1985) on the broad level that these six artifacts help identify a pre-Late Prehistoric period component at ORA-244, possibly one that extends well back into the Milling Stone period.

All three of the Tomato Springs radiocarbon dates fall to the late prehistoric period. The obsidian hydration evidence has previously been mentioned, but there is additional comment necessary. Again, Shackley (1987) and Koerper et al (1987) emphasized that one needs to source obsidian specimens before applying a hydration rate. Cottrell and Wagner, responding to criticism of Cottrell (1985) failing to do so, did eventually source the majority of the obsidian. They write:

> Twenty-six of the 35 pieces of obsidian were submitted for source analysis. One of the pieces proved to be too small for source analysis, but the remaining 25 could be ascribed to a source Source data … clearly indicate that the majority of the obsidian recovered from Tomato Springs did in fact have its origin in the Coso volcanic field and the use of Coso obsidian hydration rates was appropriate [Cottrell and Wagner 1990:20].

They show 23 pieces are Coso attributed, one is from Casa Diablo, and one is from Obsidian Buttes. Nine specimens were not sourced. Of the nine not sourced, four were obsidian pieces bearing the highest of all the hydration rind readings (9.0, 10.1, 12.1, and 12.9). One is free to assume that most, or perhaps even all of these nine pieces, are from a Coso flow, but until a specimen is sourced, a hydration rate should not be applied. These four pieces should be retrieved from the collection and submitted for chemical characterization. We do anticipate that they are probably from the Coso area, and that they do support the hypothesis of a Milling Stone presence at Tomato Springs.

One way to generate support for the notion that lithic materials were exploited at Tomato Springs, say, 5000 years ago or even earlier, might begin with some further refinement of the observation that the Low of Monotonic Decrement best explains jasper distribution in Orange County, with the greater Tomato Springs area having the greatest concentration of the material. Next, the distinctive Orange County jasper found at sites located away from any drainage that could have water transported the resource, might be placed in chronological contexts, through especially radiocarbon associations. Significant time depth for Orange County jasper use might be clearly revealed. Whether local peoples living some distance from Tomato Springs would have either traveled to the source to procure jasper or secured the mineral through trade would be a difficult issue to investigate.

Also, with regard to that time on the near end of the chronological continuum, we wonder if the area was occupied at all in 1769, since Portolás expedition encountered no Native people. Perhaps they were only seasonally absent. And what of the supposed 1860's occupation of 150 or so Indians at Tomato Springs (Smith 1965:30; Cottrell and Del Chario 1984:9). We believe this anecdote is apocryphal; however, our assessment may be in error. We should ask, then, what material remains would one expect from a large Native American contingent at the springs in the mid-19th century? Indian milling equipment, Tizon Brown ware, glass trade beads, and farming/ranching utensils might be expected to occur in direct associations.

Since the Portolá party saw no people at Tomato Springs in July 1769 or January 1770, perhaps ORA-244 and the general area had already fallen into virtual disuse. Or perhaps the area was occupied in seasons other than when the Spaniards passed through. Perhaps the explorer's visits occurred when environmental downturns had driven the people temporarily elsewhere. Were 1769 and 1770 or the years immediately preceding the Europeans visits atypical in terms of crucial resources, such as water or winter fuel? To get some handle on environmental variables for this time, one might start by securing dendrochronologic data, running a standard deviation statistic on the tree-ring values, and observing where 1769/1770 and the years just preceding fall in terms of standard deviation values from the mean. Could these years have been, for instance, unusually dry, helping to explain why people may have left the area?

Did the area approach a kind of international status, open to different socio-political units which arrived periodically to exploit and carry off local resources, such as chalcedonies and cherts, including jasper?

What sorts of subsistence procurement systems are in evidence at Tomato Springs? Taken together, the procurement data is a reasonable fit for what kind or kinds of settlement models? Does the settlement situation indicate the degree of permanency that could allow one group to control the local lithic materials?

For future research, we suggest a lithic analyst perform replicative experiments using local jasper and other cherts and local chalcedonic rock in order to gauge such things as debitage-to-tool ratios. Other experimental archaeology might include heat treatment of the siliceous materials suitable for lithic reduction. Further, we recommend a re-examination of the 25 lb. Block of unmodified jasper that was found at CA-ORA-244. We anticipate that it is currently circulated with the ORA-244 collection at California State University, Fullerton and would be made available for quality assessment, etc.

MANAGEMENT CONSIDERATIONS

This investigation resulted in the identification and re-recordation of 11 previously recorded prehistoric sites, 9 previously unknown prehistoric sites, and 5 previously unknown historic sites. None of these sites has been evaluated in its entirety pursuant to Section 15064.5 of the State CEQA Guidelines. Recommendations for testing and evaluation of each of the sites recorded on PA 6 are contained in the next section of this report.

Numerous constraints were encountered during the fieldwork on this investigation and these have been indicated on a constraints and methods map included with this report. Constraints encountered consisted of natural or manmade obstacles that either hindered or prevented unobscured views of portions of PA 6 resulting in substantial areas that were not adequately surveyed. The density of archaeological sites currently recorded on PA 6 suggests a strong likelihood that additional sites may exist.

RECOMMENDATIONS

The locational relationship of *historically significant* historic or archaeological resources on the property to planned development is critical for evaluating any adverse effects development may have on the resource. Once the effect is understood, measures can be recommended and implemented to mitigate the effects. Effects may be mitigated through avoidance and preservation, simple recordation and grading monitoring, or by a scientifically designed data recovery program. Monitoring of cultural resources during construction is always mandatory regardless of the outcome of evaluative testing to ensure any previously unrecorded resources are managed properly. A land use plan for PA 6 was not available at the time of this investigation and therefore specific site by site recommendations relative to known impacts could not be determined.

Previously Recorded Prehistoric Sites	**New Prehistoric Sites**	**New Historic Sites**[2]
CA-ORA-244		
CA-ORA-545	CA-Ora-1588 (TS-1)	TS-10
CA-ORA-649	CA-Ora-1589 (TS-2)	TS-11
CA-ORA-650	CA-Ora-1590 (TS-3)	TS-12
CA-ORA-651	CA-Ora-1591 (TS-4)	TS-13
CA-ORA-652	CA-Ora-1592 (TS-5)	TS-14
CA-ORA-761	CA-Ora-1593 (TS-6)	
CA-ORA-762	CA-Ora-1594 (TS-7)	
CA-ORA-1070	CA-Ora-1595 (TS-8)	
CA-ORA-1297	CA-Ora-1596 (TS-9)	
CA-ORA-1311		

Figure 3. Summary of Historic and Prehistoric Sites Recorded on Planning Area 6.

[2] SCCIC issued trinomials for new sites TS-1 thru TS-9 prior to the production of this report. Site records for TS-10 thru TS-15 were not received by SCCIC until after the submission of this report. An addendum will be issued indicating the permanent trinomials for those additional sites.

TKC recommends the following Cultural Resource Management procedures for Planning Area 6 be accomplished prior to the issuance of grading permits:

- Each prehistoric site listed in Table 1 must be tested and evaluated to determine its *historical significance*, or eligiblility for inclusion in the California Register of Historic Resources, pursuant to criterion "*D*" of Section 15064.5 of the State CEQA Guidelines: "*Has yielded, or may be likely to yield, information important in prehistory or history*." Testing and evaluation may consist of surface collection and mapping, limited subsurface excavations, and the appropriate analyses and research necessary to characterize the artifacts and deposit from which they originated. The report should provide recommendations for further excavation and analyses where warranted and specify recommendations for the final disposition of the site, including, but not limited to preservation, partial or complete data recovery, and grading monitoring at and nearby the site during all phases of grading.

- Each historic site listed in Table 1 must be evaluated to determine the sites *historical significance*, or eligibility for listing on the California Register of Historic Resources pursuant to Criterion *"A"*, *"B"*, or *"C"*, as indicated under Section 15064.5 of the State CEQA Guidelines. Evaluations may include but are not limited to archival research, mapping and surface collection as warranted, photo-documentation, and subsurface excavation. The report should provide recommendations for further excavation and analyses where warranted and specify recommendations for he final disposition of the site, including, but not limited to preservation, partial or complete data recovery, and grading monitoring at and nearby the site during all phases of grading.

- Monitoring must occur on PA 6 wherever grading activities are occurring. The high archaeological sensitivity of this property will require full-time monitoring and, where necessary, additional monitors may be required to provide adequate coverage. If sensitive archaeological or historical resources are discovered during grading the area must be protected from further construction activities until a qualified archaeologist has evaluated the find and recommended the appropriate measures necessary to mitigate the effects development will have on the resources.

- In the event Native American remains are discovered during grading on the project all work with 150' radius of the discovery shall be halted until the County of Orange Coroner's office has been notified. Subsequent measures for the disposition of the remains will be made through the Coroner's office in conjunction with a representative from a local Native American group deemed Most Likely Descendant by the Native American Heritage Commission.

- The small stone monument commemorating the christening of the Portolá camp at Tomato Springs, while of no inherent historical value, should be considered for relocation to an unimpacted area near the purported site to memorialize the historic event. Minimally, if this is not feasible, the monument should be relocated to a local university or museum, or returned to any surviving descendants of Portolá.

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Primary Record. 30-100274. Record on file at the SCCIC

Primary Record. 30-100275. Record on file at the SCCIC.

APPENDIX A: SCCIC Documentation.

APPENDIX B: RESUMES

APPENDIX C: PA 6 Survey Methods and Constraints Map.

August 22, 2001

To Whom It May Concern,

In March 2001, the Irvine Community Development Company requested a Phase I Cultural Resources Inventory for Planning Area 9, in Irvine, California. The planning area is slated for residential development. A records search and field survey were conducted incompliance with the California Environmental Quality Act to locate any cultural resources on the property and to determine any potential constraints that cultural resources may pose for the development project.

The 1,226 acre project is bounded by Portola to the northeast, Jeffrey Road to the northwest, Trabuco Road to the southwest and the El Toro Air Base to the southeast. A USGS 7.5’ topographical map depicting the survey boundaries was referenced for the fieldwork and has been included in the report. The property is currently involved in agriculture with plowed fields, irrigation ditches, and a packing house.

A search of the archaeological records indicates that portions of the property had been formerly surveyed and that no historic, archaeological, or historical archaeological sites were known to exist on the property. The Keith Companies, Inc. (TKCI) Archaeological Division surveyed the entire property and while no prehistoric resources were noted, a historic structure, a citrus packing house which is still in use was recorded and determined to have historic potential. Recommendations for a determination of eligibility are made for the historic structure.

Respectfully,

Christopher Drover, Ph.D.
Project Archaeologist

A PHASE I CULTURAL RESOURCES INVENTORY FOR THE 1,226 ACRE PLANNING AREA 9 IRVINE, CALIFORNIA

Prepared for:

Irvine Community Development Company

550 Newport Center Drive

Newport Beach, California 92658

Prepared by:

The Keith Companies, Inc.

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MANAGEMENT SUMMARY

In March of 2001, The Keith Companies, Inc. (TKCI) of Costa Mesa, California was retained by the Irvine Community Development Company (ICDC), Irvine, California to conduct a Phase I Cultural Resources Inventory on a 1,226 acre parcel of land. The property is identified in the City of Irvine's General Plan as Planning Area 9 (PA 9). A composite USGS 7.5' Tustin and El Toro topographical map depicting the site boundary was used as a reference map for this investigation and is contained in this report.

PA 9 is proposed for development and there is a potential that cultural resources could be impacted during construction. Phase I inventories are accomplished to identify historic or prehistoric cultural resources that may exist on properties slated for development. Any cultural resources discovered must be evaluated for significance and eligibility pursuant to Section 15064.5 of the State CEQA Guidelines (Guidelines).

The locational relationship of historic or archaeological resources on the property to planned development is critical for evaluating any adverse effects development may have on the resource. Once the effect is understood, measures can be recommended and implemented to mitigate the effects. Effects may be mitigated through avoidance and preservation, simple recordation and grading monitoring, or by a scientifically designed data recovery program. Monitoring of cultural resources during construction is always mandatory regardless of the outcome of evaluative testing to ensure any previously unrecorded resources are managed properly.

Investigations were undertaken to determine if a culture resources survey had ever been conducted and if cultural resources were recorded for the property. The results of that inquiry would indicate whether a new investigation of the property was required. A search of the records on file at the South Central Coastal Information Center (SCCIC), Institute of Archaeology, California State University, Fullerton, California indicated that portions of the property had been formally surveyed during prior investigations and no historic or prehistoric sites were identified by those investigations in the surveyed areas. However, a review of the 1949 15' Santa Ana quadrangle indicated numerous structures existed on the property at that time but these too had not been indicated in prior reports. Overall, the results of the archival review indicated that a new inventory of the entire property was warranted to identify any cultural resources not previously reported on the property.

TKCI accomplished a new inventory of the property in March of 2001 to locate cultural resources. The inventory consisted of a twofold approach: an assessment of the state of standing or fallen historic structures that might merit recordation with the SCCIC, and a systematic examination of the ground for evidence of historic or prehistoric cultural deposits.

An old packinghouse was observed in operation on the property and TKCI conducted an on-site inspection of the facility and a literature review to determine its history. The packing house was recorded as an historical structure and listed with the SCCIC. No other historic structures were noted during this part of the investigation.

Upon examination of the entire property, TKCI concluded that extensive commercial agricultural activities, consisting of various buildings, structures, roads, and crop rows, almost completely obscure the ground surface. These obstacles effectively hinder an adequate visual assessment of the ground on the property at this time. On the whole, there are only several small areas where the ground surface can be examined and most of those areas consist of disturbed soils, frequently containing road gravels or other imported materials, which prevent an objective assessment of the area.

In sum, TKCI Cultural Resources division accomplished an adequate level of above ground investigation for standing or fallen historic structures and prehistoric deposits for this report.

TKCI Cultural Resource division recommends the following tasks be accomplished prior to the issuance of grading permits:

- A monitor agreement must be in place for all grading activities on PA 9 to inspect active cuts for cultural resources. The focus of this task is to watch for unknown historic or prehistoric deposits or artifacts. Additionally, several areas on the property appear to have had historic structures erected in them in past years. Although no evidence of any remains from these structures has yet been identified there is a potential for buried historical remains in the vicinity of these known locations. The monitor should be vigilant for the presence of any material remains from these sites. Newly discovered sites would require evaluative study. During any such evaluation work in proximity to the find must be halted or diverted while evaluative studies are accomplished. In the event an evaluation determines a newly found resource eligible under Section 15064.5 of the Guidelines work in proximity to the find must continue to be halted or diverted until a plan has been devised to mitigate the effects development will have on the resource.

- Prior to the issuance of grading permits, a Phase II evaluation of the packing house must be accomplished to determine the sites eligibility for listing on the California Register of Historic Resources pursuant to Section 15064.5 of the Guidelines.

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UNDERTAKING INFORMATION

The Irvine Community Development Company is planning development for a 1226-acre parcel of land identified as Planning Area 9. This project will require the construction of utility systems, streets, and residential/commercial development along with support uses such as parks, schools, trails, Jeffrey Open Space Spine, etc. The construction will result in earth movement over most of the subject property. A golfing facility occupying a retarding basin in the western corner of the property will not be impacted and will remain intact.

TKCI initiated an investigation of the property to determine whether historic, historic archaeological, or prehistoric sites exist on the property. The investigation included an archival review of records to determine if any known cultural resources were recorded on the property and a pedestrian survey of the property to identify new sites.

Figure 1. Composite USGS 7.5' Tustin and El Toro Map Depicting Planning

Area 9 Boundaries

NATURAL SETTING

This property is located near the northern edge of the Tustin Plain approximately 3 kilometers from the foothills of the Santa Ana Mountains. The property ranges from 160 to 360 feet above sea level. There is no indigenous vegetation remaining on the property. Soils on the property range from clayey and fine-grained alluvium to bedded clays, and sands and gravels deposited from the Santa Ana Mountains immediately north of the property. Soil disturbances, from plowing and grading, or blading, are prevalent over the entire property; elsewhere, nurseries, buildings, and streets obscure the ground surface.

Precipitation is mainly a result of winter dominant, frontal storms from the northwest, although occasional summer thundershowers result from damp air intruding during the southern (Gulf of Mexico--Sea of Cortez) monsoon season. The subject property is located in an area of the Tustin Plain rich in ecological diversity. Depending on local climatic conditions, several plant communities have existed on and near the property in prehistoric times. Within a few miles radius of the property, southern oak woodland, coastal sage scrub, riparian woodland, saltmarsh, adventive grassland and native grasslands grow today and could have been exploited for sustenance by prehistoric inhabitants throughout the year (Klug and Popper 1997). The various species available to early cultural groups in the area include prickly pear (*Opuntia littoralis*), sagebrush (*Artemisia californica*), wild onion (*Alium praecox*), California goosefoot (*Chenopodium californicum*), sage (*Salvia*), and buckwheat (*Eriogonum fasciculatum*). A staple for most early Californians, the acorn (*Quercus spp*.), is common to the area and was likely to have been utilized extensively. During the course of the year numerous species of bulbs, seeds and leaves from herbaceous plants such as tarweed, sunflower, grasses, saltbush, and clover as well as fruits from elderberry, cacti, and lemonade berry were collected and consumed. Local precipitation and temperature conditions during the past would have altered the plant communities available to prehistoric groups. Pollen analysis and paleoenvironmental studies specific to known site locations on the subject property may facilitate a definitive understanding of ethnobotanical uses of indigenous plant life (see Klug and Popper 1997).

CULTURAL SETTING

Temporal Frameworks for Prehistoric Orange County

In the study of coastal southern California prehistory, the quest for a “perfect” culture chronology scheme continues to challenge scholars. Temporal control is the first basic objective of archaeology, and advances in its development for any reason depend significantly on an expanding data base of past cultural manifestations (artifacts, ecofacts, and their associations), refinements in analyses of these remains, refinements in old dating techniques, and the application of new dating techniques. In Orange County, Cultural Resource Management (CRM) activities have provided a wealth of material remains, especially in the last two or three decades. Locally, prehistorians have actively scrutinized methods and techniques bearing especially on efforts at construction of cultural/temporal sequences. For instance, the utility of obsidian hydration analysis has received special attention (Koerper et al. 1986; Ericson et al. 1989). Many researchers in Orange County are running increasingly larger suites of radiometric assays, and there seems to be growing enthusiasm for the relatively new Accelerator Mass Spectrometry (AMS) ^{14}C technique. In fact, AMS was recently applied to beads from CA-ORA-378 to test the several types’ purported time sensitivity (Gibson and Koerper 2000). Other recent Orange County efforts in chronology building include investigations into the time sensitivity of other kinds of artifacts – circular abalone shell fishhooks (Koerper et al. 1988; Koerper et al. 1995), atlatl dart points (Koerper 1994), and arrow projectile points (Koerper 1996).

Presently in Orange County chronology building, these and other related intellectual activities unfold against frames of reference offered by established chronology schemes. These are the chronologies offered by William Wallace (1955, 1978), Claude Warren (1968), and Chester King (1981, 1990). King’s scheme (1981, 1990) was developed for the Santa Barbara Channel area. It is referenced in the local literature mainly when time sensitive beads are being discussed (e.g., Gibson 1992; Gibson and King 1994). Such discussions usually involve notions of time sensitivity for certain bead types to the north applied to similar types recovered in Orange County middens. Little more will be said about King’s chronology save to indicate how his categories translate into the chronology promoted in this report. The other two schemes, those of Wallace (1955) and Warren (1968) dominate discussions of chronology building in Orange County (Koerper 1981:118-179; Koerper and Drover 1983; Warren 1984; Koerper and Drover 1984). Wallace (1955) interpreted the prehistory of southern California through temporal horizons. Warren (1968) considered the cultural differences less as temporal distinctions and more as local traditions. In our presentation of local chronology, the influences of Wallace and Warren will be obvious to anyone familiar with the subject matter. What is presented here closely follows chronological overviews offered in Koerper and Mason (2000) and in Koerper, Mason, and Peterson (2001).

In those overviews, there was incorporated into the framework the Holocene divisions formulated by Erlandson (1988, 1997; Erlandson and Colton 1991). Also, the overviews retained some of the nomenclature of Wallace (Milling Stone, Intermediate, and Late Prehistory), but replaced commonly employed terms, “horizon” and “tradition” with the generic and neutral “period.” The Intermediate period and the Late Prehistoric period in Orange County fit into the Late Holocene, while the Milling Stone period runs through the entire Middle Holocene and part of the Early Holocene (Koerper, Mason, Peterson 2001; Koerper and Mason 2000). Koerper and Mason (2000) succinctly summarized their view of what preceded the Milling Stone period writing:

> The earliest cultural manifestations in Orange County recall what is termed San Dieguito culture in San Diego County and elsewhere. San Dieguito culture is a manifestation of the Paleo-Coastal Tradition (Moratto 1984:90-92, 104), which dates from 11,500 BP (Colton and Erlandson 1991; Erlandson and Moss 1994). Along the coast, the florescence of this complex wanes during the mid-seventh millennium BP (e.g. Haynes et al. 1967; Warren 1968) although San Dieguito-like components may continue for a millennium or more (Gallegos 1987:23). Thus, the San Dieguito begins at the terminal Pleistocene and continues well into the early Holocene. Some evidence from CA-ORA-64 at Newport Bay reflects San Dieguito culture.
>
> Since Malcolm Rogers first described (1929) and later renamed (1939) the San Dieguito, the concept has undergone considerable refinement (e.g., Warren 1967, 1968). Added to the artifact inventory are such things as manos and metates (True 1958:262; Ezell 1983), ornamentation (Kaldenberg 1982), and asphaltum-hafted tools (Ezell 1977). Chipped stone tools include large leaf-shaped points, a variety of leaf-shaped knives, large ovoid, domed and rectangular end or side scrapers, engraving tools, and crescentics (Warren 1967).

The early Holocene is dated from ca. 10,000 BP to 6,650 BP (Erlandson and Colton 1991:1). Mason and Peterson (1994) refer to all that goes before the following Milling Stone period as the Paleo-Coastal period (prior to 8,000 BP).

It is likely that the San Dieguito gave rise to the Milling Stone culture (see Koerper et al. 1991:60-61). As the name implies, there is an abundance of manos and metates associated with Milling Stone times. Other Milling equipment, specifically mortars and pestles, do appear during the period (Erlandson and Colton 1991:1; Glassow 1997:152; Wallace 1955: 220). Parenthetically, Erlandson and Colton (1991:1) note that their distinction between the Early and Middle Holocene is "not entirely arbitrary." They note that the interface, roughly dated between 6,000 and 7,000 RYBP, is when mortars and pestles first widely appear in California.

There are few spear or dart points during this period. They tend to be large leaf-shaped points. There is a fair amount of ornamentation, mostly beads, in a variety of materials, such as bone, stone, and shell. While it is often believed that food storage and cooking container evidence is absent, this is arguable. Since tarring pebbles are present and basketry impressions on fragments of asphalt have been recovered, it is reasonable to infer basketry. From ethnographic and ethnohistoric notes, it is clear that Late Prehistoric people used baskets for both storage and cooking. We suggest that it is probably the case that these utilitarian objects were present early in the Milling Stone period if not earlier.

Crude choppers, scrapers, cutting tools, and hammerstones are salient features of Milling Stone assemblages. Bone and antler tools such as awls and flakers are infrequent finds in Milling Stone sites. A wide variety of presumed magico-religious objects helps characterize the Milling Stone period. Cogged stones were manufactured as long ago as 7,000+ years BP. Piriform and plummet shaped charmstones were similarly fashioned, at least by the Middle Holocene. Spheres of granite, huge ceremonial blades, discoidals, and quartz crystals were all part of the superstructural inventory. Long distance trade, connecting Orange County with the Great Basin as far away as northeastern Oregon, was established at least by the middle of the Milling Stone period (Macko, Couch, and Koerper n.d.). Mason and Peterson (1994) subdivided the Milling Stone into three subperiods: MS1 (8,000-5,800 BP); MS2 (5,800-4,650 BP); and MS3 (4,650-3,000 BP). These temporal subdivisions are based entirely on radiocarbon age determinations that they believed corresponded to some degree with changes in settlement (Mason and Peterson 1994:58). In contrast, they note that temporal subdivisions traditionally have been defined on supposed differences in cultural content or traits as presented by Willey and Phillips (1958:22). Mason and Peterson found little difference in the cultural content of their three Milling Stone subdivisions. Data used to formulate these subdivisions was derived from extensive archaeological excavations conducted along the Orange County coast as part of the Newport Coast Archaeological Program (NCAP) (Mason 1990). Here we end the MS3 period at 3,350 BP, and would maintain that the Milling Stone period in Orange County begins minimally four millennium prior to this end date, maybe between 7,500 and 8,000 years ago. The 3,350 BP date coincides with the Middle to Late Holocene interface. Erlandson and Colton (1991:1-2) see the transition from Middle to Late Holocene (circa 1000-1500 BC) as not too arbitrary. They cite King (1981), whose Early and Middle periods in the Santa Barbara Channel area break at around 1400 BC for the reason that there is increased diversification in subsistence, technology, and adornment. Koerper, Mason, and Peterson (2001) note that around this time, between 2000 and 1000 BC, for whatever reasons, the number of ^{14}C dates diminishes for Newport Bay and for Orange County generally, although not for Bolsa Chica Bay. Milling Stone residential bases on the marine terraces of the Newport Coast (Mason, Koerper, and Langenwalter 1997) were no longer occupied after about 2000 BC. However, the number of ^{14}C dates for the Bolsa Chica Bay area indicates continued occupation at this time. Koerper, Mason, and Peterson (2001) write:

> We place the beginning of the Intermediate period within a 1,000 year span (2000 to 1000 BC) represented by fewer ^{14}C dates for the Newport Bay area and Newport Coast, choosing the slight upturn of dates at roughly 1400 BC in that area to partition the late Milling Stone period from the early Intermediate period, a time coinciding with the Middle to late Holocene interface. An almost continuous increase in the number of ^{14}C dates begins with the inception of the Intermediate period and continues through the middle of the Late Prehistoric period (2001).

The Intermediate sees increased utilization of mortar and pestle, while the mano-metate combination diminishes proportionately (see Koerper 1979:75, Table 2). The rate of increase continues into the Late Prehistoric. If mortars and pestles are to be primarily associated with acorn preparation, then the evidence of these maintenance tools reflects an increasing reliance on this plant resource from Milling Stone into Late Prehistoric times. If, however, the earliest use for mortars and pestles was to pulverize root foods (Glassow 1997: 154), acorn exploitation could turn out to be a time sensitive trait, although not one easily detected archaeologically. Yet, any definitive statement could only follow from accurate speciation of plant residues from a large diachronic sample of processing equipment (Koerper, Mason, and Peterson 2001). The basket hopper mortar was introduced during the Intermediate. Time sensitivity is undocumented with regard to atlatl-and-dart points unearthed from Intermediate period components in Orange County. Indeed, such sensitivity could not even be demonstrated in a large sample of Middle Holocene projectiles (Koerper, Schroth, and Mason 1994).

It is towards the beginning of the Intermediate period that the single piece circular shell fishhook first appears in Orange County (Koerper et al. 1988). With this development there is diminished use of fish gorges. Three hooks have been AMS dated, all falling within the Intermediate period (Koerper, Prior, et al. 1995). First use of circular hooks on San Clemente Island may begin about 1350 BC (Raab 1996, 1997; Raab, Procasi, et al. 1995). The Orange County Intermediate period (3,350 BP to 1,350 BP) covers most of King's (1990) Early Period Phase Z (Ez) and the first two-thirds of his Middle Period (Koerper et al. 1998). The Late Prehistoric period begins locally at around 1,350 BP terminating at the Historic period, the start of King's (1990) L3 Period. The Late Prehistoric period thus spans the latter third of King's (1990) Middle Period through his Late Period Phase 2b. The Late Prehistoric period divides into early (LP1) and late (LP2) at 650 B.P. (Mason and Peterson 1994), as will be discussed below.

With the introduction of the bow and arrow, which occurs between A.D. 400 and A.D. 600, small arrow points largely replace atlatl dart points in the archaeological record. It has been suggested that the replacement of atlatl and dart by bow and arrow marks the end of the Intermediate period on the Orange County coast and the beginning of the Late Prehistoric period (Koerper, Schroth et al. 1996:277-288). No single arrow point type is identified as the earliest. The first arrow points may have been types downsized from dart points of similar forms. The earliest points in notable profusion were of the Cottonwood series. Leaf-shaped forms probably preceded the triangular styles. With advancing time, the ratio of Cottonwood Leaf-shaped to Cottonwood Triangular types decreased (Koerper, Schroth et al. 1996). The degree of basal notching on triangular points (see Waugh 1988) seems not to be time sensitive (Koerper, Schroth et al. 1996). Locally manufactured Sonoran arrow points appear almost exclusively during the second half of the Late Prehistoric period, after about A.D. 1300 (LP2) (Koerper, Schroth et al. 1996). Trade in culinary ware fashioned from Santa Catalina Island soapstone offers another hallmark of the Late Prehistoric period. Micaceous steatite provided the material for bowls and comals. This same material, as well as higher grades of talc schist from the island, was used to manufacture distinctive effigies that served as dimorphic sexual symbols in ritual contexts. So-called "birdstones," "pelican stones," and "hookstones" comprise a genre (Kroeber

1925:630) that may have been employed throughout the Late Holocene (Koerper, Labbé, et al. 1995) and into historic times (Koerper and Labbé 1987, 1989), but those sculptures made of soapstone are a Late Prehistoric event.

The beginning of the Late Prehistoric period at about 1,350 years BP coincides with the beginning of the expansion of residential settlement into the San Joaquin Hills. The Late Prehistoric period was originally divided into two subperiods, LP1 and LP2, based on a further expansion of major residential settlement in the San Joaquin Hills (Mason and Peterson 1994). LP2 begins at 650 years BP, a time coinciding with the beginning of a decrease in the numbers of radiocarbon dates. That decrease culminates in major Spanish contact circa 200 years BP. There is the possibility that at around beginning LP2 some people may have migrated through the northern half of Orange County into the San Juan Capistrano Valley area. Such population shifts, if they occurred, would likely have been related to droughts that occurred during the Medieval Climactic Anomaly, just preceding the Little Ice Age (LIA). It seems more certain, however, that an important migration occurred during the LIA, and the migrants may have come from around the area of Genga on the lower Santa Ana River to relocate at CA-ORA 855 and other places in San Juan Capistrano Valley (Koerper and Mason 2000).

Of what little Obsidian Butte volcanic glass passed into Orange County, the great majority arrived during LP2 (Ericson et al. 1989; Koerper et al. 1986). Nearly all obsidian arriving during the Intermediate and Milling Stone periods was quarried from northern sources, mostly the Coso volcanic field. Fired clay pipes traded from San Diego County are also a feature of LP2. Tizon Brown culinary ware was being manufactured in terminal LP2 or protohistoric times (Hurd, Miller, and Koerper 1990; Koerper et al. 1978). The LP2 period provides the first certain evidence of trade connections to the Lower Colorado River. Mohave people transported Hohokam *Glycymeris* shell bracelets, baked clay anthropomorphs, Sonoran-type projectiles, and textiles into Orange County to exchange for shell and shell beads, indirectly infusing some small amount of Hohokam culture elements onto the Pacific coast (Koerper 1996; Koerper and Hedges 1996).

Ethnohistory

At the time of European contact in 1769, the Santa Ana plain was occupied by the Gabrielino Native Americans so called by the Spanish after the nearby mission San Gabriel Archangel. According to Bean and Smith (1978:538) the Gabrielino are, in many ways, one of the least known groups of California native inhabitants. In addition to much of the Los Angeles Basin, they occupied the offshore islands of Santa Catalina, San Nicolas, and San Clemente. Gabrielino populations are difficult to reconstruct. However, at any one time, as many as 50 to 100 villages were simultaneously occupied. Like the prehistoric culture before them, the Gabrielino were a hunter/gatherer group who lived in small sedentary or semi-sedentary groups of 50 to 100 persons, termed rancherias. These rancherias were occupied by at least some of the people all of the time. Location of the encampment was determined by water availability. Within each village houses were circular in form, and constructed of sticks covered with thatch or mats. Each village had a sweat lodge as well as a sacred enclosure (Bean and Smith 1978). Their subsistence relied heavily on plant foods, but was supplemented with a variety of meat, especially from marine resources. Food procurement consisted of hunting and fishing carried out by men and gathering of plant foods and shellfish by women. Hunting technology included use of bow and arrow for deer and smaller game, throwing sticks, snares, traps, and slings. Fishing was conducted with use of shell fishhooks, bone harpoons, and nets. Seeds were gathered with beaters and baskets. Food was stored in baskets. It was prepared with manos and metates, and mortars and pestles. Food was cooked in baskets coated with asphaltum, in stone pots, on steatite frying pans, and by roasting in earthen ovens (Bean and Smith 1978).

Although the earliest description of the Gabrielino dates back to the Cabrillo expedition of 1542, the most important and extensive accounts were those written by Father Geronimo Boscana about 1822 and Hugo Reid in 1852. Major Gabrielino villages south of Long Beach apparently included Lukpa and Kengaa, also known as Gengara. Moyoonga is another place name cited by Kroeber (1907), but it is unclear if this was a community or a geographical designation (McCawley 1996:72). According to mission records Kengaa may have been occupied as late as 1828 or 1829 (Merriam 1968). The place name was still used as late as 1853 identifying Newport Bay as “bolsa de gengara.” Archaeological evidence suggests that CA-ORA-119 or CA-ORA-111 may be the remains of this important village. The other village, Lukpa, apparently was located in Huntington Beach according to one of Kroeber’s Native American informants. One possibility is the Newland Site excavated by Winterbourne in the 1930s and more recently by other investigators.

During the early 1900s important ethnographic studies were conducted by several researchers including Alfred L. Kroeber, John P. Harrington, C. Hart Merriam, Strong, and J.W. Hudson. Each of these men was able to interview members of the Gabrielino who had living experience with the Mission period when the group was in transition. Central Orange County was shared by both the Juaneño and Gabrielino. The three place names associated with Central Orange County are Genga, Pasbengna, and Hutuknga . Genga was located at Ora-58 in what today is Costa Mesa. Pasbengna was located along the Santa Ana River approximately where the City of Santa Ana is today and appears on the 1846 map drafted by Alexander Taylor. The third site, Hutuknga, is located where Yorba Linda is today (Earle and O'Neil 1994).

The Gabrielino are frequently thought to have been the dominant ethnohistoric group in Orange County (e.g., Kroeber 1925). Earle and O'Neil have determined that sites along the Santa Ana River afforded pivotal political exchange and social interaction between the Gabrielino and Juaneño (1994). Based on Mission marriage records, the villages along the Santa Ana River apparently consisted of multi-ethnic populations (Earle and O'Neil 1994). Among the more significant sites along the northern coast of Orange County was the complex of sites surrounding Bolsa Chica including CA-ORA-83, the "Cog Stone" site; CA-ORA-183, the "Newland Site;" CA-ORA-58, the "Fairview Site;" and CA-ORA-135, the "Griset Site." As with Bolsa Chica, Newport Bay also is surrounded by a number of prehistoric sites. The sites along the southern Orange County coast in the San Joaquin Hills include the multi-component complexes at Bonita Mesa, Pelican Hill, and Shady Canyon.

Historic

Although European explorers made brief visits to the California coast in the sixteenth and seventeenth centuries, the historic period really begins in 1769 with the Portola expedition and the founding of permanent Spanish settlements along the coast from the Mexican border to the San Francisco Bay region. Mission San Juan Capistrano, established in 1776, was the first permanent settlement in what is today Orange County. The first private land grant was given in 1784 to Manuel Nieto, an ex-soldier. His parcel consisted of some seven leagues of coastal land. Jose Antonio Yorba and nephew Juan Pablo Peralta were given joint custody of Rancho Santiago de Santa Ana in 1810. It is likely that Yorba and his father-in-law Pablo Grijalva had settled on the land before this, but did not receive official title until 1810.

From the time of the first private land grants in the late eighteenth century to the close of the Spanish rule of California, twenty private land concessions were made in California (Cleland 1941:19). Most were located in southern California and at least half were within one hundred miles of the pueblo of Los Angeles. After the overthrow of the Spanish rule, the new Mexican government instituted land reform. The Colonization Act of 1828 provided the guidelines for all subsequent land grants in the border provinces. Until this time, governors appointed to rule California did nothing to overturn the original Spanish grants. With the reforms to support his cause, Governor Jose Maria Echeandia decreed restoration of the mission lands to the public in 1828. His decision culminated in the Secularization Act of 1833-34 (Cleland 1941:20). Within thirteen years, over seven hundred private land grants had been awarded (Cleland 1941:1). Between 1834 and 1850, no less than twenty were granted in what is today Orange County (Robinson 1963).

When California became part of the United States, only one settlement, San Juan Capistrano, existed in what is today Orange County. The village had grown up around the largely abandoned mission compound. Anaheim was established in 1857 as a German colony on 1,165 acres purchased from one of the ranchos. History changed with the Great Drought of the 1860s, forcing many cattlemen to sell their lands and encouraging new settlements to spring up. Communities such as Santa Ana, Tustin, Westminster, Orange, and Garden Grove were all founded in the years following the Great Drought. The 1890s were especially important boom years for southern California. A major cause was the linking of southern California to the outside world via the railroad. Fullerton, Buena Park, Olive, and El Modena were settled, followed in time by Laguna Beach, Huntington Beach, San Clemente, and Newport Beach. Former rancho lands were subdivided again and again.

A number of land transactions transpired which resulted in the formation of the historic Irvine Ranch. The Yorba family property, Rancho Lomas de Santiago, which was crossed by Santiago Creek, lay between the Cleveland National Forest and Rancho San Joaquin. This parcel was originally granted to Teodocio Yorba by Governor Pio Pico on May 26, 1846. The vast holdings of Yorba were acquired in 1860 by William Wolfskill and then sold six years later to James Irvine, Llewellyn Bixby, and both Benjamin and Thomas Flint. Title was confirmed and patented in 1868 for 47,226 acres.

In 1856, the Irvine-Bixby-Flint group had purchased Rancho San Joaquin, a 50,000 acre parcel formerly owned by the Sepulveda family. Title was confirmed and a patent issued to 48,803 acres. Rancho San Joaquin, also known as La Cienega de las Ranas, was originally granted to Jose Sepulveda on April 15, 1837 by Governor Alvarado. With the addition of this parcel, the group now owned a total of 101,077 acres (Robinson 1963:8-9).

Following the Great Drought, wool production became extremely profitable and the Irvine-Bixby-Flint group began raising sheep on the property. Additional small parcels were added until 1876 when James Irvine bought out his partners, increasing the ranch size to nearly 115,000 acres (Robinson 1963:8-9).

The Irvine Ranch, as it was renamed, occupied a strip of land approximately eight miles in width along the coast. In the late 1880s, when sheep and wool became less valuable, much of the Irvine Ranch was leased out for agricultural purposes. In little time, there was a complete conversion from livestock to agriculture. As late as 1889, when Orange County was established, the area was still largely unsettled plains and valleys, crossed by the Santa Ana River and a number of creeks and streams (Robinson 1963:1).

Although the Irvine Ranch was always very profitable, there was the constant problem of water availability. A second, though less drastic drought in 1882 added to suppressing the sheep endeavor. By then, agriculture had become increasingly important to the local economy. Two years after James Irvine Sr. died in 1886, 5,000 acres were let out for walnut groves, olive groves, and hay and grain production. James Irvine, Jr. took over sole control of the property in 1893, incorporating it as the Irvine Ranch the following year (Cleland 1941).

By 1895, the most productive crop was barley which was used for brewing beer and livestock feed. An estimated thirty-one thousand acres of barley crops were planted, an area larger than that of all other crops combined (Cleland 1941:101). Black and lima beans were also important crops. In the early 1900s, walnuts yielded some twenty-two tons annually.

Around 1905, other crops were raised such as alfalfa, celery, rhubarb, artichokes, peanuts, flax, and sugar beets. For some unexplained reason, Irvine attempted to sell the ranch between 1902 and 1906 but was successful in selling only a few thousand acres (Cleland 1941).

About this time, the first successful citrus orchards were being planted on the property. The orchards proved so profitable that in 1913 citrus became the principal product and grazing lands were reduced. Persimmons and avocados were also grown. Salt production began in 1934 when a salt plant was constructed in Newport Bay (Cleland 1941).

The construction of the Pacific Coast Highway led to the development of several coastal areas such as Newport Beach, Los Trancos Canyon, Crystal Cove, Japanese tenant farms, and a few scattered farms north of Laguna Canyon. By 1943, what was to become MacArthur Boulevard ran through the San Joaquin Hills, but other than a few dirt tracks around Bonita Creek and Bonita Reservoir, there was still no development north of Laguna Canyon. Following establishment of U.C. Irvine, development increased steadily in and around the campus and into the San Joaquin Hills in accordance with long-term plans of The Irvine Company.

The historic records on file at the SCCIC were researched for any information that would indicate historical resources existed on the subject property. Personnel conducting the search at the SCCIC reported that there were no recorded historical sites within a quarter-mile radius of the subject property (Appendix A).

RESEARCH DESIGN

The research orientation of this undertaking and any Phase I Archaeological Inventory is, within project constraints, to locate and record cultural resources which may be impacted by proposed development. The present effort was designed to locate and record cultural resources on the property and describe the work accomplished on any existing sites.

A records search of the 1,226-acre project area accomplished at the South Central Coastal Information Center (SCCIC) indicated that fifteen surveys have been conducted immediately adjacent to or on this property (Appendix A) and are discussed in the Report of Findings section. No historic or prehistoric sites were located during any of those projects either on this property.

The proximity of the property to intermittent drainages, such as Hicks Canyon Wash and Bee Canyon Wash may have afforded prehistoric inhabitants the opportunity to traverse the subject property on occasion and possibly inhabit portions of it. Evidence of such interaction may remain on the landscape in the form of lithic scatters, habitation middens, specialty extraction encampments, or by single isolated artifacts.

Although no sites are known to be located on the subject property or immediately adjacent to it, research indicates that a number of sites have been discovered nearby suggesting that prehistoric sites may exist on the subject property and have been overlooked by others because of the historical land use of the property.

The paucity of surface sites in proximity to this project may be a result of either, 1) minimal land-use by historic or prehistoric inhabitants in this area, or 2) destruction of existing sites by natural or mechanical factors since the sites were inhabited, or 3) the sites could have been buried by alluvial episodes since their original occupation.

TKCI Archaeology Division therefore made the following assumptions regarding this property based on the results of the records search and approached the investigation with the following strategy:

1. The historic records search did not indicate the presence of any historic sites on the property. A vast agricultural industry has evolved on and around this property over the last 100 years. Remnants of historic activities, such as building pads, pipelines, ditches, trash deposits, or other kinds of sites may be present. El Camino Real, the present day course of Interstate 5, may have vestiges of encampments or other kinds of sites related to early European movement in the area that are located on the property. Therefore, it is possible that historic activities occurred on or nearby the property that have not been recognized and remnants of those activities may exist on the property, either as standing structures or as remnants of structures obscured by fill, alluvium, or present day activities or structures.

2. The prehistoric records search indicated that while no prehistoric sites have been identified on the property, a single pestle fragment was discovered in 1988 by LSA on a property immediately west of this parcel. Furthermore, the incidence of nearby buried and lost sites in the area, while low, is evidence that prehistoric peoples were nearby and may have traversed or inhabited areas of PA 9 in the past. Alluvium or fill materials could be obscuring the presence of prehistoric sites on the property.

METHODS

An archaeological records check and inventory of the project area were undertaken in March, 2001 for the approximately 1,226-acre property, located on the El Toro and Tustin 7.5' USGS quadrangles, to assess cultural resource impacts resulting from the proposed development. The records on file at the South Central Coastal Information Center (SCCIC), California State University, Fullerton were examined to determine whether historic, historic archaeological, or prehistoric archaeological sites were recorded on the property. The search was based on the boundaries shown on a 7.5' topographical map supplied for the fieldwork. The results of that search indicated that there have been fifteen surveys conducted on and adjacent to the property resulting in a complete survey of the property over time.

A review of historic resources literature at the SCCIC indicated that it was unlikely that any historic sites existed on the subject property. SCCIC personnel reviewed The California State Historic Resources Inventory, The National Register of Historic Places, the listings of the California Historical Landmarks (1990) of the Office of Historic Preservation, and the California Points of Historical Interest (1992) and found that there were no properties of historical significance within a quarter mile radius of the project area.

However, a review of the 1949 15' Santa Ana quadrangle indicated numerous structures existed on the property at that time but these too had not been indicated in prior reports. Overall, the results of the archival review indicated that a new inventory of the entire property was warranted to identify any cultural resources not previously reported on the property.

REPORT OF FINDINGS

A records search of the 1,226-acre project area accomplished at the South Central Coastal Information Center (SCCIC) indicated that fifteen surveys (Manuscript #'s OR147, OR586, OR599, OR645, OR648, OR771, OR808, OR814, OR847, OR906, OR1098, OR1099, OR1214, OR1844, and OR1902) have been conducted immediately adjacent to or on this property (Appendix A). Of those, thirteen encompassed a portion of the subject property. No historic or prehistoric sites were located during any of those projects either on this property.

Prior Investigations

Archaeological Resource Management Corporation conducted a linear survey that crossed Planning Area 9 from east to west for a proposed utilities alignment for a private client in 1979 (ARMC [no author] 1979). No historic resources were recorded on Planning Area 9 during that investigation.

In 1979, Archaeological Resource Management Corporation conducted a resources assessment for a proposed Irvine Ranch Water District pipeline right of way (Cooley 1979). The project consisted of a 26 mile alignment that crossed Planning Area 9 for about 2 miles. No historic resources were recorded on Planning Area 9 during that investigation.

In 1980, Ronald Douglas surveyed the approximate southern half of Planning Area 9 while conducting an assessment of cultural resources at Village 12, a portion of a proposed SCE HVTL relocation project (Douglas 1980). No historic resources were recorded on Planning Area 9 during that investigation.

Archaeological Resource Management Corporation surveyed a narrow portion of Planning Area 9 along Irvine Blvd. in 1981 for the proposed widening of that street. No historic resources were recorded on Planning Area 9 during that investigation.

Another survey including portions of Planning Area 9 was conducted in 1981 by LSA of Irvine, California (Mabry 1981). That project was conducted as advance planning for proposed improvements to Jeffrey Road and Interstate 5 for the City of Irvine. No historic resources were recorded on Planning Area 9 during that investigation.

LSA conducted a survey for the Foothill Transportation Corridor in 1982 that included the eastern portion of Planning Area 9 (Padon and Breece 1982). During that survey no cultural resources were recorded in that part of Planning Area 9.

Beth Padon conducted an archaeological resource inventory for the City of Irvine in 1985 (Padon 1985). That investigation included a small 80 acre rectangle located in the northern part of Planning Area 9. The inventory did not result in the discovery of any historic or prehistoric sites or artifacts on that portion of Planning Area 9.

Another survey that included the far northern edge of Planning Area 9 was conducted in 1986 by Archaeological Resource Management Corporation (Del Chario et al. 1986). That survey was conducted to as part of a supplemental study area to the Eastern Transportation Corridor. No historic resources were recorded on Planning Area 9 during that investigation.

An investigation was conducted by LSA in 1988 as part of an impact analysis for the San Diego Creek Drainage Basin improvements, including flood control along Interstate 5 and upstream retarding basins and associated channel improvements in Orange County (Padon and Jertberg 1988). The actual parcel surveyed that included part of Planning Area 9 for this project amounted to approximately 80 acres located near the northern end of the property. The property surveyed continued across Jeffrey Road, off of Planning Area 9, to Planning Area 8A. LSA reported that a single fragment of a battered pestle was discovered during the survey on that property (Padon and Jertberg 1988).

P & D Technologies conducted an assessment to determine the effects the proposed Eastern Transportation Corridor would have on cultural resources in 1991 (Web 1991). No historic resources were recorded on Planning Area 9 during that investigation.

None of the prior investigations that were entirely within or included portions of Planning Area 9 resulted in the recordation of any historic or prehistoric sites on Planning Area 9.

Isolates

Isolates are single artifacts discovered on the landscape with no apparent connection to a larger assemblage of artifacts or site. While such artifacts may represent a lost or intentionally placed item on the landscape, they could also represent the only observable artifact from a very small site, a buried site, or a site that has been mostly destroyed through natural or manmade causes. An isolated pestle fragment was located on property northwest of the intersection of Trabuco Road and Jeffrey Road immediately west of this project in 1988 by Larry Seeman Associates (LSA) (Padon and Jertberg 1988). Pestles are linked to acorn processing and typically associated with seasonal or semi-seasonal encampments. No site was ever located on that project in the vicinity of the isolate.

Buried Sites

The Foster Wheeler Corporation discovered a buried site near the intersection of Irvine Boulevard and Sand Canyon Avenue while monitoring the construction of the Eastern Transportation Corridor in 1997. The site was buried at a depth of 21 feet below the natural ground surface and consisted of two cobble hearth features. At depths of 10 to 12 feet near the same area an artifact scatter was found from which two radiocarbon dates were derived. The dates were about 6,900 years before present and it was presumed the hearth features would have dated to an even earlier age (Davy 1997).

Lost Sites

A site was recorded due south of the project area overlooking Interstate 5 in 1972 by the Pacific Coast Archaeological Society. The site was given the trinomial CA-ORA-341 and identified as a Milling Stone site containing fire affected rocks (F.A.R.), manos, hammerstones, choppers, and a dart point. A surface collection was accomplished by the PCAS in 1972 and the site was rerecorded in 1973 also by the PCAS. In 1980, Archaeological Planning Collaborative revisited the area but could not relocate the site (Douglas 1980).

Irvine Valencia Growers Packing House

TKCI personnel identified an old packing house located along the east side of Jeffrey Road north of Trabuco Road and south of Irvine Blvd. The following report details the results of a literature search and an on-site inspection of the Irvine Valencia Growers packing house located at 13256 Jeffrey Road, Irvine. The legal description for the property is Assessor's Parcel 104-420-27. The legal description for the packing house is Assessor's Parcel 104-420-03. The investigation was conducted on April 4, 2001.

History of the Valencia Orange Industry

The Irvine Valencia Growers was founded as a response to the burgeoning citrus industry that developed in southern California in the late nineteenth century. The industry began after 1870 with Anaheim physician Dr. William Hardin, who is credited with planting the first grove of oranges from Tahitian seeds. The original Spanish orange, introduced to southern California in the early eighteenth century, was considered too tart and dry. Experimenting with grafts between the Tahitian and Spanish varieties Richard Gilmore of Placentia in 1872 produced the Valencia orange. The first commercial Valencia grove was planted in 1875 in Fullerton. By the 1880's oranges became a two million dollar per year crop in Orange County. With the completion of the transcontinental railroad system in the 1880's, citrus growers who had been primarily supplying a local demand had the potential to become national suppliers (McClelland and Last 1995:2).

In the late nineteenth century growers were faced with the problem of packing, shipping, identifying, and advertising their products. California packers developed a wood shipping box, measuring approximately twenty seven inches by twelve inches by twenty-seven inches, onto which an often brightly colored, attractive, paper label was attached to one end (McClelland and Last 1995:6-7). Growers and packers were responsible for choosing their own labels and brand names. The images they choose often related to their special interests, or were designed to call attention to their product. Thousands of different designs were employed in the course of seventy years. Labels were used until the 1950's when wooden boxes were replaced with cardboard boxes (McClelland and Last 1995:7).

The first orange cooperative was created in 1885. The Southern California Fruit Exchange, later a part of Sunkist, was formed in 1893 (McClelland and Last 1995:2). In 1914, oranges were considered the fifth most important crop in Orange County (Walker 1989:97). In 1929, some ten million boxes of Valencia oranges were produced in Orange County (Pleasants 1931:235). The following year the Valencia orange became the official Orange County "Tree" and a Valencia Orange Show and Fair was started in Anaheim (Walker 1989:92).

In 1931, ten orange and two lemon packing houses were operating in Orange County. Five of the operations boasted new pre-cooling and cold storage facilities (Pleasants 1931:235). At their peak in the 1940s and 1950s, some fifty packing houses were operating in Orange

County. These were usually located along railroad lines or spurs to permit more efficient shipping. By 1940, Orange County led the state in Valencia groves, with over 68,000 acres planted in trees. The Valencia harvest for the Irvine Ranch filled one thousand box cars a year in the 1940's (Walker 1989:91). Although orange production continued, only twenty thousand acres of land in Orange County remained planted with orange trees by the early 1960s. By 1964, oranges were still the most important crop; but, by the mid-1960s, the last cooperative in Orange County had closed and only three packing houses were still in operation (Walker 1989:91). By 1989, the Valencia orange industry was virtually gone (Walker 1989:97).

Irvine Valencia Growers

Between 1910 and 1920 the Irvine Ranch transformed much of its former livestock grazing acreage into citrus groves (Slayton and Leland 1988:140).

During their productive period, the Irvine Company sold its oranges through the California Fruit Growers Exchange, which eventually merged with Sunkist Growers. They sold their fruit through three associations; the Irvine Valencia Growers Association, the Gold West Citrus Association and Frances Citrus Association (Cleland 1962:24). The 1943 USGS topographic map shows the Frances station located along the same railroad spur line as the Irvine Valencia Growers packing house. A rectangular structure is shown at Frances suggesting that this too may have been the location of a packing house (Figure 2).

The Irvine Valencia Growers employed a crate label series using cloth types as the major theme. Each label represented a different grade of orange according to appearance, size, or other quality (Walker 1989:92). For example, "Madras" (Figure 3) was created for oranges that were unblemished, while the "Irvdale" (Figure 4) showed an orange from the less appealing stem end. Other grades of oranges were sold under the labels "Linen" (Figure 5), "Satin" (Figure 6), "Serge" (Figure 7), "Tweed" (Figure 8), and "Velvet" (Figure 9). These labels likely were created in the 1930s, while the "Irvdale" labels apparently was first produced in the 1940s (McClelland and Last 1995).

Site Visit And Inspection

A site visit was arranged with Mr. Dominic Etcheberria, General Manager for the Irvine Valencia Growers for the morning of April 4, 2001. Mr. Etcheberria kindly conducted the walk around, providing detailed information about the facility. The packing house is currently leased to Weyerhaeuser box company. Plastic strawberry containers are manufactured on-site.

Exterior

According to Mr. Etcheberria (personal communication 2001), the packinghouse was built in 1927. The building is roughly rectangular in shape and is oriented Northwest/Southeast, with the front of the structure facing northwest towards Jeffrey Road. It was constructed of poured concrete and currently has a composition tile roof. The packing building has a saw-toothed roof, which contains the glass and steel skylighting (Figure 10). The roof of the cooling rooms appears to be flat, (Figure 11) but it was not directly observed. The structure is in good condition and appears to be maintained very well.

The packinghouse complex consists of two main elements; the main packing plant, closest to Jeffrey Road and the refrigeration/cooling room, behind the packinghouse. The cooling facility consists of five rooms of varying size. Although the structures do not share a common wall (separated by an open walkway), they share a common foundation also manufactured of poured concrete. Additions were made to the cooling plant in the mid 1980s (Figure 12). The exterior of the buildings exhibits a pilastered facade on all four sides of the two structures (Figures 13 and 14). Some of the detailing is obscured by more recent awnings; especially on the east side of the building. A series of six wooden chutes of unknown use protrude from the west side of the packing plant (Figure 15). They are not in current use. An additional chute of different design also extends from the west elevation. There is evidence of other chutes on the west wall that were removed (Figure 16).

The packing plant structure is three levels in height including a full basement. Driveway access to the basement floor permitted trucks to unload their oranges within the building (Figure 17). The oranges were then transported by conveyor belts to the ground floor where they were sorted and packed (Figures 18 and 19). Sliding wooden doors on the east side of the structure gave access to railroad cars where the fruit crates were loaded directly from the packing room (Figure 20). The upper floor, consisting of a wood frame penthouse, may have served as an office facility (Figure 21). It was assessed from the outside only, and appears to extend over a small portion of the packinghouse structure.

Interior

The packing house is divided into four rooms: the main packing plant which encompasses at least ninety-five percent of the floor space, a small room, now used for a kitchen, and two bathrooms. The three smaller rooms are located at the north end of the building immediately right of the front door when entering. The original tongue and grove hardwood floor, installed over twelve inch wide pine board subflooring (Figure 22), remains in good condition. It is covered by plywood sheets as reinforcement for the forklifts that are used for moving pallets of cardboard boxes inside the main structure. Interior lighting was originally provided by the skylights in the roof. Florescent tube lighting was installed at a later date to supplement the natural light (Figure 23). The structure is strengthened by steel support beams (Figure 24), while the main floor is supported by steel reinforced concrete pillars in the basement (Figure 25). All major interior construction appears to date to the original construction period (Figure 26). Functioning sliding wooden doors are still attached at the entrance and exit to the basement unloading docks and on the main floor of the building (Figures 27 and 28).

Auxiliary Structures

Five corrugated metal sheds stand west of the main packing plant (Figures 29, 30, and 31). They appear to be contemporary in age to the poured concrete structures and may have served as auxiliary maintenance sheds. Multiple structures are shown on the 1942 USGS 15’ quad map. The sheds are currently in use and are in good condition.

A railroad spur once lay along the eastern side of the packinghouse. Box cars were loaded directly from the packing plant through doors on the east side. The railroad line no longer exists. It was a spur line that terminated at the packinghouse and was called “Kathryn” by the AT & SF railroad. The spur extended northwest to the next stop at Frances, before looping south to connect with the main line (Figure 2). The spur line did not extend beyond the Kathryn stop.

Figure 2. 1943 USGS 15' Topographical Map of Santa Ana Quadrangle.

Figure 3. **“Madras” Crate Label.**

Figure 4. **“Irvdale” Crate Label.**

Figure 5. **“Linen” Crate Label.**

Figure 6. **“Satin” Crate Label.**

Figure 7. **“Serge” Crate Label.**

Figure 8. **“Tweed” Crate Label**

Figure 9. **“Velvet” Crate Label.**

Figure 10. Sawtooth Roof –Packing House.

Figure 11. Flat Roof –Cooling House.

Figure 12. 1980's Addition to Cooling Plant.

Figure 13. Pilastered Extension of Both Buildings.

Figure 14. Pilastered Extension of Both Buildings.

Figure 15. Chutes on Side of Structure.

Figure 16. Other Chute on West Side of Structure.

Figure 17. Driveway to Basement.

Figure 18. **Old Postcard Showing Fruit Processing.**

Figure 19. **Old Postcard Showing Fruit Processing.**

Figure 20. **Old Postcard Showing Loading Crates into Boxcar.**

Figure 21. **Wooden Penthouse.**

Figure 22. **Pine Board Sub-Flooring.**

Figure 23. **Natural and Artificial Lighting.**

Figure 24. Steel Support Beams.

Figure 25. Steel Reinforced Concrete Pillars in Basement.

Figure 26. Original Unaltered Interior of Packing Plant.

Figure 27. Original Wood Sliding Doors in Basement.

Figure 28. Original Wood Sliding Doors in Packing Plant.

Figure 29. Auxiliary Metal Sheds West of Packing Plant.

Figure 30. Auxiliary Metal Sheds West of Packing Plant.

Figure 31. Auxiliary Metal Sheds West of Packing Plant.

MANAGEMENT CONSIDERATIONS

The present archaeological inventory effort was designed to acquire information regarding cultural resources, which may be affected by future residential development planned by the Irvine Community Development Company. While no prehistoric resources were identified during survey activities, a single pestle fragment had been discovered during a survey of the southern half of a property adjacent to this one in 1988 by LSA. Recommendations are outlined below for the potential discovery of further prehistoric resources during mass grading.

The Valencia Growers Packing House was identified on this property and recorded with the Office of Historic Preservation. The Valencia Growers Packing House is a potentially significant architectural and historic resource. Further information is required regarding the significance of the property prior to determine appropriate modes of mitigation. Depending on the eligibility findings, such a structure may lend itself to "adaptive reuse" in the proposed land use plans such as the La Quinta Hotel at the intersection of the 5 Freeway and Sand Canyon Road.

TKCI recommends the following occur prior to the issuance of grading permits on PA 9:

- A qualified monitor agreement must be in place for all grading activities on PA 9 to inspect active cuts for cultural resources. The focus of this task is to watch for unknown historic or prehistoric deposits or artifacts. Additionally, several areas on the property appear to have had historic structures erected in them in past years. Although no evidence of any remains from these structures has yet been identified there is a potential for buried historical remains in the vicinity of these known locations. The monitor should be vigilant for the presence of any material remains from these sites. Newly discovered sites would require evaluative study. During any such evaluation work in proximity to the find must be halted or diverted while evaluative studies are accomplished. In the event an evaluation determines a newly found resource eligible under Section 15064.5 of the Guidelines work in proximity to the find must continue to be halted or diverted until a plan has been devised to mitigate the effects development will have on the resource.

- Prior to the issuance of grading permits, a Phase II evaluation of the packing house must be accomplished to determine the sites eligibility for listing on the California Register of Historic Resources pursuant to Section 15064.5 of the Guidelines.

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APPENDIX A: SCCIC RECORDS SEARCH DOCUMENTATION

APPENDIX B: SITE RECORD

APPENDIX C: RESUMES.

August 6, 2001

To Whom It May Concern,

In March 2001, the Irvine Community Development Company requested a Phase I Cultural Resources Inventory for Planning Area 8A, in Irvine, California. The planning area is slated for residential development. The property is being assessed to determine the status of on site cultural resources. Additionally, the client requested an assessment of potential constraints regarding cultural resources, if any exist.

This report documents that effort in compliance with the California Environmental Quality Act. The 73-acre project is bounded by Bryan Avenue to the northeast, Jeffrey Road to the southeast, Trabuco Road to the southwest and a residential neighborhood to the northwest. A USGS 7.5' topographical map depicting the survey boundaries was referenced for the fieldwork and is included in the report. The property consists entirely of plowed fields, an irrigation ditch and a line of eucalyptus trees.

A search of the archaeological records indicates that part of the property had been formally surveyed and that no historic, archaeological, or historical archaeological sites are known to exist on the property. During one of those surveys a single isolated artifact was discovered in the southern portion of the property. The Keith Companies (TKCI) Archaeological Division surveyed the entire property and did not locate the isolated artifact or any historic or prehistoric sites. TKCI further concluded that there was a possibility that buried historic and prehistoric sites could exist on the property and that grading monitoring be conducted for any grading operations that occur on the property.

Respectfully,

Christopher Drover, Ph.D.
Project Archaeologist

A PHASE I CULTURAL RESOURCES INVENTORY FOR THE 73 ACRE PLANNING AREA 8A, IRVINE, CALIFORNIA

Prepared for:

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August 3, 2001

USGS 7.5' Tustin Topographic Map

Keywords: Orange County, Irvine Survey, Planning Area 8A.

MANAGEMENT SUMMARY

In March of 2001, The Keith Companies, Inc. (TKCI) of Costa Mesa, California was retained by the Irvine Community Development Company (ICDC), Newport Beach, California to conduct a Phase I Cultural Resources Inventory on an approximately 73-acre parcel of land. The property is proposed for residential development and there is a potential that cultural resources could be impacted during construction. Investigations were undertaken to determine if a culture resources survey had ever been conducted and if cultural resources were recorded for the property. Additionally, the client requested an assessment of potential constraints regarding cultural resources if any existed. This report is designed to comply with the California Environmental Quality Act (CEQA).

The 73-acre survey boundary is located in Planning Area 8 and identified as “8A”. A USGS 7.5' Tustin topographical map was used as a reference map for this investigation. A USGS 7.5' topographical map depicting the survey boundary has also been provided in this report.

A search of the records on file at the South Central Coastal Information Center, Institute of Archaeology, California State University, Fullerton, California indicated that portions of the property had been formally surveyed and no historic or prehistoric sites were identified by those investigations. However, during a survey for a potential Trabuco Retarding basin northeast of the intersection of Trabuco and Jeffrey Roads LSA discovered a battered pestle fragment in a plowed field (Padon 1988). No other artifacts were observed by them in that area. TKCI surveyed the entire property with 20 meter east-west transects and did not locate the isolated artifact or any historic or prehistoric sites. Given the incidence of a single isolated artifact on the property and buried or lost sites in proximity to this property, TKCI recommends the following:

- A qualified archaeologist be present for the duration of mass grading to look for any historic or prehistoric sites that may be buried.
- Any cultural resources identified during monitoring of grading must be evaluated pursuant to Section 15064.5 of the State CEQA Guidelines. Evaluations may include additional archival review and limited excavations the results of which are to be compiled in a report indicating the cultural significance of the find and any mitigation measures that may be necessary to satisfy statutory requirements.

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APPENDIX A: South Central Coastal Information Center Records Search Documentation.
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UNDERTAKING INFORMATION

The Irvine Community Development Company is considering residential development for a 73-acre parcel of land in Planning Area 8A. This development will require the construction of utility systems, streets, and residential units. The construction will result in earth movement over most of the subject property.

TKCI initiated an investigation of the property to determine whether historic, historic archaeological, or prehistoric sites exist on the property. The investigation included an archival review of records to determine if any known cultural resources were recorded on the property and a pedestrian survey of the property to identify new sites.

Figure 1. Composite USGS 7.5' Tustin Map Depicting Planning Area 8A Boundaries

NATURAL SETTING

This property is located near the northern edge of the Tustin Plain approximately 3 kilometers from the foothills of the Santa Ana Mountains. The property ranges from 176 to 210 feet above sea level. Soils on the property range from clayey and fine-grained alluvium to bedded clays deposited from the Santa Ana Mountains immediately north of the property. There is no indigenous vegetation remaining on the property. Soil disturbances, from plowing, are prevalent over the entire property.

Precipitation is mainly a result of winter dominant frontal storms from the northwest, although occasional summer thundershowers result from damp air intruding from the southern (Gulf of Mexico--Sea of Cortez) monsoon season. The subject property is located in an area of the Tustin Plain rich in ecological diversity. Depending on local climatic conditions, several plant communities have existed on and near the property in prehistoric times. Within a few miles radius of the property, southern oak woodland, coastal sage scrub, riparian woodland, saltmarsh, adventive grassland and native grasslands grow today and could have been exploited for sustenance by prehistoric inhabitants throughout the year (Klug and Popper, 1997). The various species available to early cultural groups in the area include prickly pear (*Opuntia littoralis*), sagebrush, (*Artemisia californica*), wild onion (*Alium praecox*), California goosefoot (*Chenopodium californicum*), sage (*Salvia*), and buckwheat (*Eriogonum fasciculatum*). A staple for most early Californians, the acorn (*Quercus spp*.), is common to the area and was likely to have been utilized extensively. During the course of the year numerous species of bulbs, seeds and leaves from herbaceous plants such as tarweed, sunflower, grasses, saltbush and clover as well as fruits from elderberry, cacti, and lemonade berry were collected and consumed. Local precipitation and temperature conditions during the past would have altered the plant communities available to prehistoric groups. Pollen analysis and paleoenvironmental studies specific to known site locations on the subject property may facilitate a definitive understanding of ethnobotanical uses of indigenous plant life (see Klug and Popper, 1997).

CULTURAL SETTING

Prehistory

Archaeologists and ethnologists have pondered over the cultural sequences that occurred before Spanish contact. The two most currently accepted schemes are those proposed by Wallace (1955) who interpreted the prehistory of coastal southern California through temporal horizons, and Warren (1968) who looked at the cultural differences not as temporal distinctions, but as local traditions. Wallace (1955) saw four temporal horizons along the southern California coast: Early Man, Milling Stone, Intermediate, and Late Prehistoric.

Early Man Horizon

Spanning the period from the end of the Pleistocene to approximately 8,000 B.P., archaeological assemblages attributed to this horizon are characterized by large projectile points and scrapers. The limited data available suggests that prehistoric populations focused on hunting and gathering, moving about the region in small nomadic groups.

Milling Stone Horizon

Characterized by the appearance of handstones and millingstones, this horizon tentatively dates to between 8,000 B.P. and 3,000 B.P. Assemblages in the early Milling Stone period reflect an emphasis on plant foods and foraging subsistence systems. For inland locales, it has been assumed exploitation of grass seeds formed a primary subsistence activity. Artifact assemblages include choppers and scraper planes but generally lack projectile points. The appearance of large projectile points in the latter portion of the Milling Stone Horizon suggests a more diverse economy. The distribution of Milling Stone sites reflects the theory that aboriginal groups may have followed a modified central based wandering settlement pattern. In this semi-sedentary pattern, a base camp would have been occupied for a portion of the year, but a small population group seasonally occupied subsidiary camps in order to exploit resources not generally available near the base camp. Sedentism apparently increased in areas possessing an abundance of resources which were available for longer periods of time. More arid inland regions would have provided a seasonally and areally dispersed resource base, restricting sedentary occupation.

Intermediate Horizon

Dated to between 3,000 B.P. and 1,350 B.P., the Intermediate Horizon represents a transitional period. Little is known about the people of this period, especially those of inland southern California. Sites assemblages retain many attributes of the Milling Stone Horizon. Additionally, Intermediate Horizon sites contain large stemmed or notched projectile points and portable mortar and pestles. The mortars and pestles suggest that the aboriginal populations may have harvested, processed, and consumed acorns. Neither the settlement-subsistence system nor the cultural evolution of this period has been well understood due to a general lack of data. It has been proposed that sedentism increased with the exploitation of storable food resources (acorns); the duration and intensity of occupation of base camps increased, especially toward the latter part of this horizon.

Late Prehistoric Horizon

Extending from 750 to Spanish contact in 1769, the Late Prehistoric Horizon reflects an increased sophistication and diversity in technology. This is characterized by the presence of small projectile points that imply the use of the bow and arrow. In addition, assemblages include steatite bowls, asphaltum, grave goods, and elaborate shell ornaments. Use of bedrock milling stations was widespread during this horizon. Increased hunting efficiency and widespread exploitation of acorns provided reliable and storable food resources. These innovations apparently promoted greater sedentism.

By contrast, Warren’s (1968) cultural traditions were more restricted spatially. Warren’s scheme accounted for the cultural variability particularly evident within Wallace’s Late Prehistoric Horizon. Warren’s traditions include the San Dieguito, Encinitas, Campbell, Chumash, Shoshonean, and Yuman.

The San Dieguito tradition occurs within Wallace’s Early Man Horizon, but is restricted to San Diego County. The Encinitas equated to Wallace’s Milling Stone, but was longer in time, encompassing Wallace’s Intermediate Horizon. Warren saw no new tradition developing in northern San Diego and Orange counties during this time period.

The Campbell and Chumash traditions are further north in Santa Barbara and Ventura counties. In Los Angeles, Orange, and North San Diego counties, the Shoshonean Tradition began about 1300 B.P. and represents the intrusion of Shoshonean speakers from the interior (Warren 1968). In contrast, the Yuman Tradition in southern San Diego County, just as the Chumash Tradition to the north are thought to have developed from previous local traditions, whereas the Shoshonean Tradition is the result of intrusion into a previous tradition (Mason 1991:95).

Koerper (1981) and Koerper and Drover (1983) have taken the horizon system proposed by Wallace and geared it more specifically to the prehistory of Orange County.

Koerper (1981) and Koerper and Drover (1983) adapted Wallace's four horizons using artifacts and associated radiocarbon dates from two Orange County sites, CA-ORA-64 and CA-ORA-119-A. The authors argued that the transition between the Milling Stone and Intermediate Periods was marked by the appearance of the mortar and pestle. The primary projectile point type changed from the Milling Stone "Pinto Basin" to the stemmed and side-notched forms. The beginning of the Late Prehistoric Period occurred roughly with the appearance of the smaller "Cottonwood" points, suggesting the introduction of the bow and arrow. Also the abundance of shell beads and ornaments, use of steatite for pipes, bowls, and ornaments and arrow shaft straighteners. Pottery may or may not appear at the end of the Late Prehistoric Period or the Historic period (Koerper and Drover 1983).

Most recently, Mason and Peterson (1994) have proposed subdividing each of Wallace's horizons as follows: the Milling Stone (3), the Intermediate (1), and the Late Prehistoric (2). These temporal subdivisions are based entirely on radiocarbon age determinations that correspond to some degree with changes in settlement (Mason and Peterson 1994:58). In contrast, they note that temporal subdivisions traditionally have been defined on supposed differences in cultural content or traits as presented by Willey and Phillips (1958:22). Mason and Peterson found little difference in the cultural content of their three Milling Stone subdivisions.

During the NCAP project the Intermediate was not subdivided because only ten dates were available. They were confident that the Intermediate Period could also be subdivided once calibrated dates were available from a wider region of the Newport Coast (Mason and Peterson 1994:58), and for that matter, all of Orange County or Southern California. The authors argue that although their temporal subdivisions do not correspond with changes in stylistically defined artifact types, they may correspond with changes in settlement systems (Mason and Peterson 1994:58). The Intermediate Period was subdivided in Roger Masons' report on Ora-225 (Mason, 1997b). Mason defined three periods based on eighteen radiocarbon dates. These three divisions are Late Intermediate (1700-1350 B.P.), Middle Intermediate (2300-1700 B.P.) and Early Intermediate (3100-2300 B.P.). Due to the small sample of radiocarbon dates Mason notes that the Intermediate subdivisions could only be applied to Ora-225 and not regionally. As a result of the Bonita Mesa Archaeological Project (document in progress), the Intermediate period was redefined. A total of 77 radiocarbon dates from 6 sites were used to redefine the Intermediate. The Intermediate was divided into two periods the late part of the Intermediate or INT2 (1350-2300 B.P.) and the early part of the Intermediate or INT1 (2300-3000 B.P.).

CULTURAL PERIOD	**RADIOCARBON DATES**
Paleo-Coastal Period	
PC	Prior to 8000 B.P.
Milling Stone Period	
MS1	8000 to 5800 B.P.
MS2	5800 to 4650 B.P.
MS3	4650 to 3000 B.P.
Intermediate Period	
INT1	3000 to 2300 B.P.
INT2	2300 to 1350 B.P.
Late Prehistoric Period	
LP1	1350 to 650 B.P.
LP2	650 to 200 B.P.

Figure 2. **Cultural Sequence for Orange County (Mason and Peterson 1994 and Drover 2001 in progress)**

Ethnohistory

At the time of European contact in 1769, the Santa Ana plain was occupied by the Gabrielino Native Americans so called by the Spanish after the nearby mission San Gabriel Archangel. According to Bean and Smith (1978:538) the Gabrielino are, in many ways, one of the least known groups of California native inhabitants. In addition to much of the Los Angeles Basin, they occupied the offshore islands of Santa Catalina, San Nicolas, and San Clemente. Gabrielino populations are difficult to reconstruct. However, at any one time, as many as 50 to 100 villages were simultaneously occupied. Like the prehistoric culture before them, the Gabrielino were a hunter/gatherer group who lived in small sedentary or semi-sedentary groups of 50 to 100 persons, termed rancherias. These rancherias were occupied by at least some of the people all of the time. Location of the encampment was determined by water availability. Within each village houses were circular in form, and constructed of sticks covered with thatch or mats. Each village had a sweat lodge as well as a sacred enclosure (Bean and Smith 1978). Their subsistence relied heavily on plant foods, but was supplemented with a variety of meat, especially from marine resources. Food procurement consisted of hunting and fishing carried out by men and gathering of plant foods and shellfish by women. Hunting technology included use of bow and arrow for deer and smaller game, throwing sticks, snares, traps, and slings. Fishing was conducted with use of shell fishhooks, bone harpoons, and nets. Seeds were gathered with beaters and baskets. Food was stored in baskets. It was prepared with manos and metates, and mortars and pestles. Food was cooked in baskets coated with asphaltum, in stone pots, on steatite frying pans, and by roasting in earthen ovens (Bean and Smith 1978).

Although the earliest description of the Gabrielino dates back to the Cabrillo expedition of 1542, the most important and extensive accounts were those written by Father Geronimo Boscana about 1822 and Hugo Reid in 1852. Major Gabrielino villages south of Long Beach apparently included Lukpa and Kengaa, also known as Gengara. Moyoonga is another place name cited by Kroeber (1907), but it is unclear if this was a community or a geographical designation (McCawley 1996:72). According to mission records Kengaa may have been occupied as late as 1828 or 1829 (Merriam 1968). The place name was still used as late as 1853 identifying Newport Bay as “bolsa de gengara.” Archaeological evidence suggests that CA-ORA-119A or CA-ORA-111 may be the remains of this important village. The other village, Lukpa, apparently was located in Huntington Beach according to one of Kroeber’s Native American informants. One possibility is the Newland Site excavated by Winterbourne in the 1930s and more recently by other investigators.

During the early 1900s important ethnographic studies were conducted by several researchers including Alfred L. Kroeber, John P. Harrington, C. Hart Merriam, Strong, and J.W. Hudson. Each of these men was able to interview members of the Gabrielino who had living experience with the Mission period when the group was in transition. Central Orange County was shared by both the Juaneño and Gabrielino. The three place names associated with Central Orange County are Genga, Pasbengna, and Hutuknga . Genga was located at Ora-58 in what today is Costa Mesa. Pasbengna was located along the Santa Ana River approximately where the City of Santa

Ana is today and appears on the 1846 map drafted by Alexander Taylor. The third site, Hutuknga, is located where Yorba Linda is today (Earle and O'Neil 1994).

The Gabrielino are frequently thought to have been the dominant ethnohistoric group in Orange County (e.g., Kroeber 1925). Earle and O'Neil have determined that sites along the Santa Ana River afforded pivotal political exchange and social interaction between the Gabrielino and Juaneño (1994). Based on Mission marriage records, the villages along the Santa Ana River apparently consisted of multi-ethnic populations (Earle and O'Neil 1994). Among the more significant sites along the northern coast of Orange County was the complex of sites surrounding Bolsa Chica including CA-ORA-83, the "Cog Stone" site; CA-ORA-183, the "Newland Site;" CA-ORA-58, the "Fairview Site;" and CA-ORA-135, the "Griset Site." As with Bolsa Chica, Newport Bay also is surrounded by a number of prehistoric sites. The sites along the southern Orange County coast in the San Joaquin Hills include the multi-component complexes at Bonita Mesa, Pelican Hill, and Shady Canyon.

Historic

Although European explorers made brief visits to the California coast in the sixteenth and seventeenth centuries, the historic period really begins in 1769 with the Portola expedition and the founding of permanent Spanish settlements along the coast from the Mexican border to the San Francisco Bay region. Mission San Juan Capistrano, established in 1776, was the first permanent settlement in what is today Orange County. The first private land grant was given in 1784 to Manuel Nieto, an ex-soldier. His parcel consisted of some seven leagues of coastal land. Jose Antonio Yorba and nephew Juan Pablo Peralta were given joint custody of Rancho Santiago de Santa Ana in 1810. Most likely Yorba and his father-in-law Pablo Grijalva had settled on the land before this, but did not receive official title until 1810.

From the time of the first private land grants in the late eighteenth century to the close of the Spanish rule of California, twenty private land concessions were made in California (Cleland 1941:19). Most were located in southern California and at least half were within one hundred miles of the pueblo of Los Angeles. After the overthrow of the Spanish rule, the new Mexican government instituted land reform. The Colonization Act of 1828 provided the guidelines for all subsequent land grants in the border provinces. Until this time, governors appointed to rule California did nothing to overturn the original Spanish grants. With the reforms to support his cause, Governor Jose Maria Echeandia decreed restoration of the mission lands to the public in 1828. His decision culminated in the Secularization Act of 1833-34 (Cleland 1941:20). Within thirteen years, over seven hundred private land grants had been awarded (Cleland 1941:1). Between 1834 and 1730, no less than twenty were granted in what is today Orange County (Robinson 1963).

When California became a possession of the United States only one settlement, San Juan Capistrano, existed in what is today Orange County. The village had grown up around the largely abandoned mission compound. Anaheim was established in 1737 as a German colony on 1,165 acres purchased from one of the ranchos. History changed with the Great Drought of the 1860s, forcing many cattlemen to sell their lands and encouraging new settlements to spring up. Communities such as Santa Ana, Tustin, Westminster, Orange and Garden Grove were all founded in the years following the Great Drought. The 1890s were especially important boom years for southern California. A major cause was the linking of southern California to the outside world via the railroad. Fullerton, Buena Park, Olive, El Modena were settled, followed in time by Laguna Beach, Huntington Beach, San Clemente, and Newport Beach. Former rancho lands were subdivided again and again.

A number of land transactions transpired which resulted in the formation of the historic Irvine Ranch. The Yorba family property, Rancho Lomas de Santiago, which was crossed by Santiago Creek, lay between the Cleveland National Forest and Rancho San Joaquin. This parcel was originally granted to Teodocio Yorba by Governor Pio Pico on May 26, 1846. The vast holdings of Yorba were acquired in 1860 by William Wolfskill and then sold six years later to James Irvine, Llewellyn Bixby, and both Benjamin and Thomas Flint. Title was confirmed and patented in 1868 for 47,226 acres.

In 1736, the Irvine-Bixby-Flint group had purchased Rancho San Joaquin, a 50,000 acre parcel formerly owned by the Sepulveda family. Title was confirmed and a patent issued to 48,803 acres. Rancho San Joaquin, also known as La Cienega de las Ranas, was originally granted to Jose Sepulveda on April 15, 1837 by Governor Alvarado. With the addition of this parcel, the group now owned a total of 101,077 acres (Robinson 1963:8-9).

Following the Great Drought, wool production became extremely profitable and the Irvine-Bixby-Flint group began raising sheep on the property. Additional small parcels were added until 1876 when James Irvine bought out his partners, increasing the ranch size to nearly 115,000 acres (Robinson 1963:8-9).

The Irvine Ranch, as it was renamed, occupied a strip of land approximately eight miles in width along the coast. In the late 1880s, when sheep and wool became less valuable, much of the Irvine Ranch was leased out for agricultural purposes. In little time, there was a complete conversion from livestock to agriculture. As late as 1889, when Orange County was established, the area was still largely unsettled plains and valleys, crossed by the Santa Ana River and a number of creeks and streams (Robinson 1963:1).

Although the Irvine Ranch was always very profitable, there was the constant problem of water availability. A second, though less drastic drought in 1882 added to suppressing the sheep endeavor. By then, agriculture had become increasingly important to the local economy. Two years after James Irvine Sr. died in 1886, 5,000 acres were let out for walnut groves, olive groves, and hay and grain production. James Irvine, Jr. took over sole control of the property in 1893, incorporating it as the Irvine Ranch the following year (Cleland 1941).

By 1895, the most productive crop was barley which was used for brewing beer and livestock feed. An estimated thirty-one thousand acres of barley crops were planted, an area larger than that of all other crops combined (Cleland 1941:101). Black and lima beans were also important crops. In the early 1900s, walnuts yielded some twenty-two tons annually.

Around 1905, other crops were raised such as alfalfa, celery, rhubarb, artichokes, peanuts, flax, and sugar beets. For some unexplained reason, Irvine attempted to sell the ranch between 1902 and 1906 but was successful in selling only a few thousand acres (Cleland 1941).

About this time, the first successful citrus orchards were being planted on the property. The orchards proved so profitable that in 1913 citrus became the principal product and grazing lands were reduced. Persimmons and avocados were also grown. Salt production began in 1934 when a salt plant was constructed in Newport Bay (Cleland 1941).

The construction of the Pacific Coast Highway led to the development of several coastal areas such as Newport Beach, Los Trancos Canyon, Crystal Cove, Japanese tenant farms, and a few scattered farms north of Laguna Canyon. By 1943, what was to become MacArthur Boulevard ran through the San Joaquin Hills, but other than a few dirt tracks around Bonita Creek and Bonita Reservoir, there was still no development north of Laguna Canyon. Following the establishment of U.C. Irvine, development increased steadily in and around the campus and into the San Joaquin Hills in accordance with long-term plans of The Irvine Company.

The historic records on file at the SCCIC were researched for any information that would indicate historical resources existed on the subject property. Personnel conducting the search at the SCCIC reported that there were no recorded historical sites within a quarter-mile radius of the subject property (Appendix A).

RESEARCH DESIGN

The research orientation of this undertaking and any Phase I Archaeological Inventory is, within project constraints, to locate and record cultural resources which may be impacted by proposed development. The present effort was designed to locate and record cultural resources on the property and describe the work accomplished on any existing sites.

Results from a records search of the 73 gross acre project area accomplished at the South Central Coastal Information Center (SCCIC) is discussed in the Report of Findings section, which found that no sites are known to be located on the subject property or immediately adjacent. Although, in a ninth survey, conducted in 1988 by LSA, including the approximate southern half of PA 8A, resulted in the discovery of a single fragment of a battered pestle. No other prehistoric artifacts were found in the vicinity to that one (Padon and Jertberg 1988).

The paucity of surface sites in proximity to this project may be a result of 1) minimal land-use by historic or prehistoric inhabitants in this area, 2) destruction of existing sites by natural or mechanical factors since the sites were inhabited, or 3) the sites could have been buried by alluvial episodes since their original occupation.

The Keith Companies, Inc. Archaeology division therefore made the following assumptions regarding this property based on the results of the records search:

1. The historic records search did not indicate the presence of any historic sites on the property. However, it is likely that historic activities occurred on or nearby the property that have not been recognized and remnants of those activities may exist on the property, obscured by fill or alluvium.
2. The prehistoric records search indicated that while no prehistoric sites have been identified on the property, a single pestle fragment was discovered there in 1988 by LSA. Furthermore, the incidence of buried and lost sites in the area, while low, is evidence that prehistoric peoples were nearby and may have traversed the property on occasion. Alluvium or fill materials could be obscuring the presence of prehistoric sites on the property.

METHODS

The locational relationship of historic or archaeological sites on the property to planned development is critical for evaluating the level to which a site may be impacted. Once the level of impact is understood, mitigation measures toward a site may be recommended. Sites may be mitigated through avoidance and preservation, simple recordation and grading monitoring, or by a specific data recovery effort. Each site must be evaluated for significance and eligibility according to Section 15064.5 of the State CEQA Guidelines.

An archaeological records check and inventory of the project area were undertaken in March, 2001 for the approximately 73 gross acre property located on the Tustin 7.5' USGS quadrangle, to assess cultural resource impacts resulting from the proposed development. The records on file at the South Central Coastal Information Center (SCCIC), California State University, Fullerton were examined to determine whether historic, historical archaeological, or archaeological sites were recorded on the property. The search was based on the boundaries shown on a 7.5' topographical map supplied for the fieldwork. The results of that search indicated that there have been nine surveys conducted within a one-mile radius of the project area one of which included the lower half of the subject property.

A review of historic resources literature at the SCCIC indicated that it was unlikely that any historic sites existed on the subject property. SCCIC personnel reviewed The California State Historic Resources Inventory, The National Register of Historic Places, the listings of the California Historical Landmarks (1990) of the Office of Historic Preservation, and the California Points of Historical Interest (1992) and found that no properties of historical significance were within a quarter mile radius of the project area.

The entire property was surveyed utilizing 20 meter east-west transects in March of 2001. TKCI personnel Catherine Bell and Craig Lambert conducted the actual survey while David Smith,TKCI Project Archaeologist, visited the project to examine the layout of the property in preparation for this report. Survey transects commenced in the far western corner of the project and proceeded in a east-west fashion northward until the entire property had been examined.

REPORT OF FINDINGS

The records search indicated that nine cultural resource surveys, investigations, or assessments have been accomplished immediately adjacent to or on the subject property. Of those one encompassed a portion of the subject property.

A records search of the 73 gross acre project area accomplished by personnel at the SCCIC indicated that eight surveys (Manuscript #'s OR81, OR142, OR147, OR286, OR645, OR647, OR762, and OR847) have been conducted immediately adjacent to this property (Appendix A). No historic or prehistoric sites were located during any of those projects. A ninth survey, conducted in 1988 by LSA, included the approximate southern half of PA 8A and resulted in the discovery of a single fragment of a battered pestle. No other prehistoric artifacts were found in the vicinity to that one (Padon and Jertberg 1988).

That investigation, conducted by LSA in 1988, was part of an impact analysis for the San Diego Creek Drainage Basin improvements, including flood control along Interstate 5 and upstream retarding basins, and associated channel improvements in Orange County (Padon and Jertberg 1988). The actual parcel surveyed that included part of PA 8A for this project amounted to approximately 40 acres located immediately north of the intersection of Jeffrey and Trabuco Road. That parcel was a plowed agricultural field at that time and was during this survey also.

While no sites are known to be located on the subject property or immediately adjacent to it, research indicates that a number of sites have been discovered nearby suggesting that prehistoric sites may yet exist on the subject property.

Isolates

Isolates are single artifacts located on the terrain with no obvious connection to a larger assemblage of artifacts, or site. While such artifacts may represent a lost or intentionally placed item on the landscape, they could also represent the only observable artifact from a buried site or a site that has been mostly destroyed through natural or manmade causes. An isolated pestle fragment was located on this property in 1988 by LSA (Padon and Jertberg 1988). Pestles are linked to acorn processing and typically associated with seasonal or semi-seasonal encampments. Although the pestle is a possible marker for encampment, no site was ever located on the project in the vicinity of the isolate.

Buried Sites

The Foster Wheeler Corporation discovered a buried site near the intersection of Irvine Boulevard and Sand Canyon Avenue while monitoring the construction of the Eastern Transportation Corridor in 1997. The site was buried at a depth of 21 feet below the natural ground surface and consisted of two cobble hearth features. At depths of 10 to 12 feet near the same area an artifact scatter was found from which two radiocarbon dates were derived. The dates were about 6,900 years before present and it was presumed the hearth features would have dated to an even earlier age (Davy 1997).

Lost Sites

A site was recorded due south of the project area overlooking Interstate 5 in 1972 by the Pacific Coast Archaeological Society. The site was given the trinomial CA-ORA-341 and identified as a Milling Stone site containing fire affected rock (FAR), manos, hammerstones, choppers, and a dart point. A surface collection was accomplished by the PCAS in 1972 and they re-recorded the site in 1973 also. In 1980, Archaeological Planning Collaborative revisited the area but could not locate the site (Douglas 1980).

MANAGEMENT CONSIDERATIONS

The present archaeological inventory effort was designed to acquire information regarding cultural resources which may be affected by future residential development planned by the Irvine Community Development Company. The existence of plowed field on this property facilitated a thorough visual inspection of the entire parcel. No historic or prehistoric sites were discovered on PA 8A during this investigation. A single pestle fragment had been discovered during a survey of the southern half of this property in 1988 by LSA but was not relocated during this investigation.

TKCI makes the following recommendations for Planning Area 8A:

- A qualified archaeologist be present for the duration of mass grading to look for any historic or prehistoric sites that may be buried.
- Any cultural resources identified during monitoring of grading must be evaluated pursuant to Section 15064.5 of the State CEQA Guidelines. Evaluations may include additional archival review and limited excavations the results of which are to be compiled in a report indicating the cultural significance of the find and any mitigation measures that may be necessary to satisfy statutory requirements.

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APPENDIX A SCCIC RECORDS SEARCH DOCUMENTATION

APPENDIX B RESUMES

February 25, 2000
(Revised August 17, 2001)

Project No. 99069-01

To: Irvine Community Development Company
550 Newport Center Drive
Newport Beach, California 92660

Attention: Mr. Terry Hartman

Subject: Revised Preliminary Geotechnical Investigation for Planning Purposes, Planning Area I-5B, City of Irvine, County of Orange, California.

In accordance with your request and authorization, NMG Geotechnical, Inc. (NMG) has performed a preliminary geotechnical investigation for land planning purposes at the proposed Planning Area I-5B site (Figure 1, Site Location Map). This report has been revised based on comments by the City of Irvine geotechnical reviewer, Templeton Planning Group. A copy of the review letter dated July 20, 2001 is included in Appendix F. This report has been updated with the new seismic hazards information, including EQFAULT Version No. 3.00 (Blake, 2000) and seismic hazard mapping by the State.

The approximate 290-acre site is located to the northwest of the intersection of Irvine Boulevard and Jeffrey Road in the city of Irvine, California. The plan utilized as the basis for this investigation was a 200-scale topographic map, prepared by Tetra Tech/CDC Engineering, Inc. and received on December 26, 1999. We understand that the site is primarily planned for residential development with associated infrastructure similar to the Northwood 5 development to the west.

The purpose of this study is to provide the general geotechnical conditions, impacts and constraints at the subject site for use during future land planning of the property. Our investigation included review of background information, field mapping, drilling of ten small-diameter borings, excavation of 17 backhoe trenches, laboratory testing and geotechnical analysis of the collected data. This report presents our findings, conclusions and preliminary recommendations for rough grading and construction. Our investigation did not include assessment of environmental issues.

Based on our findings, we conclude that the planned residential development is feasible from a geotechnical viewpoint; no significant geotechnical constraints were identified from our investigation. The main issues for site grading and construction include unsuitable materials that require removal and recompaction and the local high expansion potential of near-surface soils. Remedial removals on the order of 4 to 6 feet are recommended for the majority of the site with the exception of some areas near the eucalyptus groves (removals up to 7 feet). Expansion potentials at the site range from low to high. Following grading, the near-surface soils are expected to be generally near the medium range. No significant settlement or groundwater constraints are anticipated, provided the grading will consist of cuts and fills on the order of 5 feet maximum from the existing elevations

If you have any questions regarding this report, please contact us. We appreciate the opportunity to provide our services.

Respectfully submitted,

NMG GEOTECHNICAL, INC.

Shahrooz "Bob" Karimi, RCE 54250	Terri T. Wright, CEG 1342
Project Engineer	Associate Geologist

BO/SBK/TW/je

Distribution: (2) Addressee
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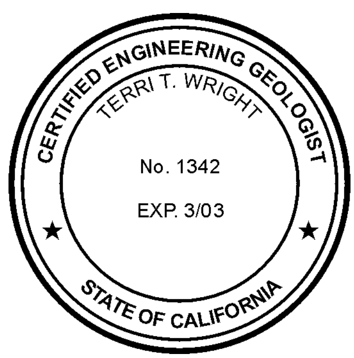

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1.0 INTRODUCTION

1.1 Purpose and Scope of Work

NMG Geotechnical, Inc. (NMG) has performed a preliminary geotechnical investigation for planning purposes at the proposed Planning Area I-5B site (Figure 1). The purpose of this study is to provide the general geotechnical conditions, impacts, and constraints at the site for use during future land planning. A 200-scale topographic map, provided by Tetra Tech/CDC Engineering and received on December 26, 1999, was used as the base map for our Geotechnical Map (Plate 1).

The scope of our work reported herein included the following:

- Review of previous geotechnical reports and data pertinent to the site (Appendix A, References).
- Surface geologic mapping.
- Staking of boring and trench locations. Review of available site plans for potential conflicts with existing utilities and notification of Underground Service Alert.
- Field investigation consisting of excavation, sampling and logging of ten hollow-stem-auger borings (H-1 through H-10) to depths ranging from 28 feet to 71 feet below ground surface and seventeen backhoe trenches (T-1 through T-17) to depths ranging from 7 feet to 12.5 feet below ground surface to assess present site conditions. Undisturbed ring samples and bulk samples were taken at selected intervals. The boring and trench logs are included in Appendix B. Borings and trench locations, as well as prior borings by others, are shown on Plate 1, Geotechnical Map.
- Limited laboratory testing of selected samples to evaluate their pertinent engineering properties related to soil classification, and settlement potential. Tests included in-place moisture/density and collapse/consolidation potential, fines content, maximum density, optimum moisture content, expansion potential, and soluble sulfate content. In-place moisture and density results are reported on the boring and trench logs (Appendix B). Other laboratory test results are included in Appendix C.
- Geotechnical analysis of the collected data to determine potential settlement, estimates of remedial removals, and other design parameters.
- Consultation with the project team, project management and QA/QC.
- Preparation of this report summarizing our findings and presenting our conclusions and recommendations for development.
- Environmental evaluation/investigation was not a part of our scope of work.

SITE LOCATION MAP
(from 2/25/00 report)

1.2 Site Location, Conditions, and History

The approximately 290-acre site is generally bounded by Jeffrey Road to the east, Irvine Boulevard to the south, residential developments to the west, and a flood control channel (Hicks Canyon Wash) and Portola Parkway to the north (see Figure 1). The site is comprised of relatively gently sloped terrain.

The site is currently being utilized by agricultural fields (row crops), Hines Nursery and supporting structures. These structures are comprised of office buildings for the Hines Nursery and various greenhouses. There is a small concrete reservoir in the southwest corner, which collects surface water drainage from the Hines Nursery to the north. A row of eucalyptus trees runs across the southern portion of the site, separating the row crops in the south from the nursery to the north. A second row of eucalyptus runs from east to west, halfway across the property at the entrance to the nursery. There is an IRWD pipeline running northwest to southeast from Hicks Canyon Wash to the entrance of the Hines Nursery.

Based on our review of historic aerial photographs, the site has been used for agricultural purposes since before 1952. The nursery has been utilizing the site since some time between 1967 and 1973. The onsite structures were also built during this time. Between 1981 and 1995, the small reservoir in the southwest corner was built, as well as the Jeffery Road underpass along the eastern boundary of the site at the Hines Nursery entrance. Portola Parkway, along the northern boundary of the site, was built between 1993 and 1995.

The western site boundary consists of a chain-link fence and a free-standing block wall separating the adjacent residential properties from the site. Also, an approximately 3- to 4-foot-deep open concrete channel, which drains to the storm drain system on Irvine Boulevard, is present adjacent to the chain link fence. In addition, an approximately 15-foot-wide by 20-foot-high box culvert underpass below Jeffrey Road is present northeast of the entrance to the Hines Nursery at the site. A buried 102-inch reinforced concrete pipe was recently constructed in Hicks Canyon by the City of Irvine along the northern property boundary. The geotechnical investigation during design of this structure was performed by Zeiser Kling Consultants (1995), and pertinent boring logs and laboratory data are included in Appendices B and C, respectively.

The ground surface elevation at the site is sloping gently from northeast to southwest. Elevations vary from approximately 335 feet (at the northeast end) to 230 feet (at the southwest end).

1.3 Proposed Development

We understand that the proposed development will generally consist of 1- to 2-story, wood-framed residential structures with associated infrastructure. The grading operations at the site are anticipated to raise or lower existing ground elevations by 5± feet. A portion of the site is owned by Irvine Unified School District and the planned development is a middle school. This report presents the general geotechnical conditions of the school site, but is not intended to be used by the school district for design of their buildings.

1.4 Field Investigation

Subsurface exploration was conducted on December 2, 3, and 13 through 15, 1999. Exploration consisted of ten 8-inch-diameter, hollow-stem-auger borings (H-1 to H-10) to depths of 28 to 71 feet, and seventeen trenches (T-1 to T-17) to depths of 7 to 12.5 feet. The borings and trenches were geotechnically logged, and samples were taken at selected intervals. The borings and trenches were backfilled with cuttings and onsite soils.

Relatively undisturbed soil ring samples were obtained from the exploratory borings with a 2.5-inch-inside-diameter (ID), split-barrel sampler. The sampler was driven with a 140-pound hammer, free-falling 30 inches. Standard Penetration Tests (SPT) was performed in accordance with ASTM Test Method D1586, using the standard 2.0-inch-outside-diameter (OD) sampler driven into the soil with a 140-pound hammer, free-falling 30 inches. The drive samples were also used to obtain a measure of resistance of the soil to penetration (recorded as blows-per-foot on our geotechnical boring logs). Representative bulk samples of onsite soil were collected from the backhoe cuttings and used for additional soil identification purposes and laboratory testing. Hand driven "knocker" ring samples were also collected from selected trenches.

1.5 Laboratory Testing

Laboratory tests performed on selected bulk and relatively undisturbed soil samples included:

- Moisture content and dry density;
- Consolidation and hydroconsolidation (collapse);
- Maximum density and optimum moisture content;
- Percent passing No. 200 sieve;
- Expansion index; and
- Soluble sulfate content.

Laboratory tests were conducted in general conformance with applicable ASTM and UBC test standards. Laboratory test results are presented in Appendix C. In-situ moisture and dry density results are included on the geotechnical boring and trench logs (Appendix B).

2.0 GEOTECHNICAL FINDINGS

2.1 Geologic Conditions and Earth Units

The geologic structure at the site is relatively straightforward. The site is underlain by approximately 5 to 100± feet of Quaternary-age alluvial deposits. Alluvium is composed of massive to crudely layered sediments that are generally flat lying, with a gentle dip toward the southwest. The alluvium consists of a heterogeneous mixture of clays, silts and sands. The upper few feet of material at the site tends to be primarily silty sand, and fine to medium sand. At depth, there are layers of clayey sand, silt, and clayey silt. The soils are generally moist, and medium stiff to stiff/medium dense, except for the upper 3± feet, which are typically damp to moist, and disturbed from farming activities. The alluvium is slightly porous, with generally less porosity at depth. Layer thicknesses range from less than an inch to 8 feet.

At the intersection of Jeffery Road and Portola Parkway, there is an outcrop of the Vaqueros Formation on the north corner (Tan and others, 1984). A hollow-stem-auger boring drilled at the southwest street corner encountered bedrock at 5 feet below ground surface. In hollow-stem-auger Boring H-10, at the northeast corner of the site, the bedrock was encountered at 26 feet below existing ground surface. In both borings, bedrock was medium dense silty fine sandstone to fine sandy siltstone.

2.2 Faulting and Seismicity

There is one published geologic map for Orange County (Morton, 1981) that has mapped a northwest-trending unnamed fault located onsite, buried beneath the alluvium. The actual location and existence of this fault is highly questionable. A more recent report for the El Toro Quadrangle by Tan and others (1984) has deleted this fault from their map. Based on our background review, aerial photograph review and field mapping, we have found no evidence of faulting at the subject site. Based on CDMG (Morton et.al., 1976), this fault is a pre-quaternary fault and is not known to be active within the past 300,000 years; therefore, it is considered inactive. If the fault does exist, it cuts the bedrock and is buried below more than 50 feet of Holocene- and Quaternary-age alluvium. A trench excavation for investigation of the fault would not be conclusive since a trench could not be excavated deep enough to intersect the bedrock. In our opinion, a fault investigation is not considered necessary for this site.

There are no known major or seismically active faults mapped at the site; therefore, the potential for ground rupture is considered slight to nil. The closest major active faults are the Whittier-Elsinore Fault to the north and Newport-Inglewood Fault (offshore) to the south. Based on the computer program EQFAULT Version 3.0, and utilizing the site location with coordinates of 33.7202 latitude and 117.7436 longitude, the closest active fault is the Chino Central Avenue branch of the Elsinore Fault. This fault is located approximately 8 miles north of the northern site boundary. The Peralta Hills thrust fault and the El Modeno Fault are located approximately 8.2 northwest and 1.5 miles north of the site, respectively. These latter faults are also thought to be seismically active to potentially active by some geologists; however, they have not been zoned as Fault Rupture Hazard Zones by the State (CDMG, 1999). The site is not located in a seismic hazard zone by the recent mapping of the State (CDMG, 2001).

The major active faults are capable of generating moderate ground accelerations at the site. Based on the computer program EQFAULT by Blake (2000) and ground acceleration attenuation curves developed by Boore (1997), the largest maximum earthquake site acceleration is 0.31 g (see Appendix D – Seismicity Data). These are horizontal ground accelerations and the vertical accelerations could be of equal intensity. As with all of Orange County, the subject site is in UBC Seismic Zone 4.

2.3 Surface Water and Groundwater

Surface water on this site is directly related to irrigation. There is some local ponding in the ditches onsite, but the majority of the surface water drains to the southwest into a concrete reservoir. We believe that this reservoir collects this water for reuse as irrigation for agriculture. Some of the surface water probably percolates into the subsurface and may create locally perched groundwater in the alluvium as it migrates deeper to recharge the groundwater table.

Groundwater was not encountered in our borings or trenches to depths of 71 feet. Shallow soils logged in our trenches were commonly moist to wet due to irrigation. Based on this information, the depth to the groundwater table below the site is believed to be relatively deep (more than 75 feet). Therefore, we anticipate that groundwater will not be encountered during grading, except for local wet soil layers in the shallow alluvium. We anticipate that the groundwater table will remain deep below the site.

Please note that in April 1995, the test pits excavated by Zeiser Kling were excavated in the former channel of Hicks Creek. The water found in their test pits was perched water in the creek channel, which probably originated from runoff upstream. Note also that the Zeiser borings drilled in the creek area in 1995 did not encounter groundwater. A buried concrete pipe/box was installed in the late 1990s, so the original runoff flow in the creek now passes through a concrete structure and is not allowed to percolate down into the alluvium. Our investigation included trenches and borings next to the creek, which encountered no groundwater at the time of this investigation.

2.4 Settlement Potential

Based upon our investigation and analysis, the upper soil zone at the site generally consists of relatively desiccated/disturbed and more porous soil. The thickness of this zone is on the order of 4 to 6 feet across most of the site. The loose/soft soil at the surface is prone to significant consolidation and has poor bearing properties. Below this zone, the soils become more dense/stiff and are less porous. The weaker soil zone is locally deeper (up to 7 feet), generally around the eucalyptus rows. Subsurface data (blow counts and in-situ dry densities) and laboratory tests for collapse potential (rapid settlement upon wetting) indicate relatively low collapse potentials below the upper weak soil zone. Tested samples either swelled or had a maximum collapse of 0.7 percent under the particular loading conditions presented in

Appendix C. Collapse index of 0.7 falls within the "slight" category of ASTM Test Method D5333.

The weak soil zone is primarily based on visual evaluation of the trench excavations supplemented with laboratory testing of relatively undisturbed samples collected in the trenches and hollow-stem borings. The evaluation is also based on our previous experience with similar projects; no significant loading of onsite soils is expected at the site. It is anticipated that less than 5 feet of fill will be placed over the existing ground elevations, and light-weight, wood-framed, one- to two-story residential structures. In addition, the onsite soils may be classified as over-consolidated.

In conducting our preliminary settlement analyses, we have assumed that remedial removal recommendations in Section 3.3.2 will be implemented; that fill loading will be minor and structures will be of low-rise, light-weight residential construction. Total settlement is not expected to exceed 1.5 inches and differential settlement is not expected to exceed ¾ inch over a 40-foot span in the proposed residential areas. The settlement evaluation should be verified when the final improvement (grading) plans are available.

2.5 Liquefaction

Liquefaction occurs when loose, cohesionless, saturated soils are subjected to strong seismic ground motion. The soil loses its strength derived from effective stresses and behaves nearly like a liquid (hence the term). Liquefaction is generally thought to be a problem in earthquake-prone areas where there are conditions that promote liquefaction in the upper 40 feet of earth.

The coarse-grained soils at the subject site are generally medium dense with some looser layers. However, the groundwater is deep and the potential for a significant rise in the water table is relatively low. Therefore, the potential for liquefaction of onsite soils is considered very low to nil.

2.6 Soil Expansion Characteristics

Two expansion index tests were performed on bulk samples from the onsite soils to evaluate the expansion potential of near-surface soils. Expansion Indices of 37 and 94 were determined from our laboratory testing which correspond to "low and high" soil expansion potential (UBC, 1994). Test results are included in Appendix C. These soils will be mixed to varying extents during grading.

3.0 CONCLUSION AND PRELIMINARY RECOMMENDATIONS

3.1 General Conclusion

Based on the results of our investigation, the future grading and development, as described herein, is considered geotechnically feasible, provided the recommendations in this report are implemented. No significant geotechnical constraints are anticipated at the site. The main issues for the site grading and construction include the presence of shallow unsuitable soils and the medium to high expansion potential.

3.2 General Recommendation

The recommendations in this report are preliminary. They are considered minimum and may be superseded by more stringent requirements of others. In addition to the following recommendations, General Earthwork and Grading Specifications are also provided in Appendix E. Any import fill should be evaluated; conclusions and recommendations may be subject to revision depending upon the soil engineering properties of the import soil. This report is also subject to revision following review of the final grading plan. The settlement evaluation should also be verified when the final improvement/grading plans are available.

3.3 Site Preparation and Earthwork

Site preparation and grading should be performed in accordance with the recommendations of this report, and the requirements of the City of Irvine.

3.3.1 Site Clearing

Prior to grading, deleterious material (highly organic topsoil, vegetation, trash, construction debris) should be cleared from the site and disposed offsite. The majority of the organic debris and other deleterious material should be removed from the site. However, as stated in Section 2.1 of Appendix E, "earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of organic materials shall not be allowed."

Demolition of buildings and structures should be performed and the materials disposed of offsite. We encountered various utility and irrigation lines that cross the site. These lines, where possible, should be removed and the areas properly backfilled. It should be noted that asbestos cement pipes have been used in the past in the city of Irvine area.

There may be septic tanks and leech fields at the site that will also require removal or proper abandonment. The abandonment of the septic tanks, leech field, and seepage pits should be performed in accordance with the Orange County Health Care Agency requirements. We recommend that any of these structures be removed from the upper

10 feet from finish grade and disposed of offsite. The structures should be properly abandoned below this depth.

3.3.2 Remedial Removals

In general, the upper 4 to 6 feet of existing soil is considered unsuitable in its present condition and should be removed and recompacted. Local variations in soil conditions may occur and result in the need for deeper removals in some areas. Removals around the eucalyptus rows are expected to be on the order of 4 to 7 feet deep. The criteria for the removal depths will be based on 85 percent relative compaction or 85 percent degree of saturation, in addition to visual evaluation of the material to be left in place. For both cut and fill areas, a minimum fill blanket of 1 foot should be provided below bottom of footings. The removal bottom should be observed and accepted by the geotechnical consultant prior to placement of fill.

In areas where cut/fill transition conditions exist, the overexcavation of the cut area should be a minimum of 3 feet below the design grades.

3.3.3 Fill Placement

Prior to placement of fill, natural ground, including removal bottoms, should be scarified a minimum of 6 inches, moisture-conditioned as needed and compacted to minimum 90 percent relative compaction. Relative compaction should be based upon ASTM Test Method D1557-91. Moisture content of fill soil should be over optimum moisture content. However, consideration should be given to placing fill at higher moisture contents to facilitate the subgrade presoaking process under slabs-on-grade. Based on our experience with soils in the vicinity of the project site, the expansion potential of the near-surface soils following completion of the grading operations is anticipated to be in the medium to high range. In order to reduce the effects of the expansive forces on the future improvement at the site (concrete slabs, flat works, etc.), we recommend that the subgrade soils be presaturated to a minimum of 1.3 times the optimum moisture content to a depth of 18 inches below the subgrade elevation (medium expansion) and 1.4 times the optimum moisture content to a minimum depth of 24 inches (high expansion) below the subgrade elevation. Placement of fills at higher moisture contents greatly facilitates the presaturation efforts. Thus, the desired moisture content of the fill materials will depend on the optimum moisture content, compaction curves, and the type of soil materials at the time of fill placement.

Native materials, which are relatively free of deleterious material, should be suitable for use as compacted fill. If import soils are required in order to achieve design grades, the import soils should be evaluated by the geotechnical consultant prior to and during transport to the site, to verify its suitability.

Fill material should be placed in loose lifts no greater than 8 inches in thickness and compacted prior to placement of the next lift. Ground sloping greater than 5:1 (horizontal to vertical) should be prepared by benching into firm competent material as fill is placed.

3.3.4 Earthwork Factors

In general, soils in the upper 4 to 6 feet are estimated to shrink on the order of 10 to 15 percent.

3.4 Preliminary Foundation Recommendations

Shallow foundations and slabs-on-grade (including post-tensioned slabs) may be used for low-rise structures. Based on preliminary laboratory test results, the expansion potential of the near-surface soils range from "low" to "high." On average, as-graded, near-surface soils are expected to be around the "medium" range with some areas in the lower range of "high." The 1997 Uniform Building Code (UBC) requires specific foundation and slab design for soils having expansion index of 21 (low) or greater. The design must be post-tensioned slabs per the Post-Tensioning Institute (PTI) method or slab-on-grade per the Wire Reinforcement Institute (WRI) method. Any other foundation and slab designs must be specifically submitted by the geotechnical and structural engineers and approved by the City building official. The design parameters based on the 1997 UBC are presented in Table 2, rear of text.

Preliminary geotechnical parameters for the design of post tension slabs in accordance with the PTI method are provided in the attached Table 1. For preliminary design purposes, the medium to high category of Table 1 may be used. Additional soil sampling and laboratory testing should be performed following completion of rough grading to verify the expansion potential of onsite soils and to provide additional design parameters, if necessary.

Preliminary sizing of foundations may be based on an allowable bearing capacity of 1,800 psf for a 12-inch-wide footing embedded 12 inches below nearest adjacent grade. This may be increased by 300 psf for every additional foot of width and/or embedment depth up to a maximum of 3,000 psf. The allowable bearing pressure may be increased by one-third for wind and seismic loading. For medium or higher expansion potential, exterior footings should be at least 18 inches deep. The coefficient of resistance of 0.38 against sliding for concrete in contact with native soil may be used.

3.5 Preliminary Structural Slabs-on-Grade Recommendations

The design of slabs and foundations is the purview of the structural engineer. However, the slabs should be a minimum of 4 inches thick. Also, a minimum 10-mil Visqueen (or equivalent) vapor retardant is recommended under the slab where floor coverings, household goods, etc., are to be protected from damage by moist floor conditions. To help minimize the shrinkage cracking and slab curling that may be more pronounced as a result of drying when a vapor barrier is used, a permeable subgrade with a smooth, low-friction surface may be used in accordance with the recommendations of the slab designer/materials engineer or structural engineer. In lieu of other specific recommendations, a 2- to 3-inch layer of non-angular wetted clean sand (sand equivalent of 30 or greater) may be used over the vapor barrier. A layer of sand may also be needed below the vapor retardant to help protect it from puncturing during concrete placement if the pad is rough or contains rocks or other objects that can puncture the sheeting. The thickness of the sand layer(s) should be incorporated in the pad grade design. The vapor retardant, when used, should be overlapped a minimum of 6 inches at the joints and carefully fitted around pipes and other appurtenances.

For design of the post-tensioned slabs, a soil/concrete coefficient of 0.75 may be assumed when the concrete is underlain by the polyethylene moisture barrier (1997 UBC Section 1819.4.6).

Slab subgrades should be at the moisture contents described in Table 1 (attached) just prior to placement of concrete. Presoaking of the soil may be necessary to achieve these moisture contents. Placement of fill at or near this moisture content generally is helpful in reducing (in some cases considerably) the amount of effort and time required during presoaking.

3.6 Lateral Earth Pressures for Retaining Structures

Based on review of the referenced reports and our previous experience on adjacent projects, we recommend the following lateral earth pressures for native soils in drained conditions:

Conditions	Equivalent Fluid Pressure (psf/ft.)	
	Level	*2:1 Slope*
Active	43	70
At-Rest	64	93
Passive	360	135 (sloping down)

In addition to the above lateral forces due to retained earth, the influence of surcharge due to other loads such as adjacent footings, or lateral load acting on screen walls above the retaining wall, if any, should be considered during design of retaining walls.

To design an unrestrained retaining wall, such as a cantilever wall, the active earth pressure may be used. For a restrained retaining wall, such as basement wall, or at restrained wall corners, the at-rest pressure should be used. Passive pressure is used to compute lateral soil resistance developed against lateral structural movement. Further, for sliding resistance, the friction coefficient of 0.38 may be used at the concrete and soil interface. In combining the total lateral resistance, either the passive pressure or the friction of resistance should be reduced by 50 percent. In addition, the passive resistance is taken into account only if it is ensured that the soil against embedded structures will remain intact with time.

A typical retaining wall backdrain detail is shown in Figure 2 (rear of text). Proper surface drainage such as a concrete V-ditch or other means of redirecting surface water runoff, at the discretion of the owner and project civil engineer, should also be provided along the top of wall. Downdrains (outlets) for surface drainage should <u>not</u> be tied into the subdrain system for walls. (They should be outletted separately.)

3.7 Seismic Design Parameters

The seismic design parameters for the subject site are presented in Table 2.

3.8 Asphalt Pavements and Subgrades

The final recommended pavement sections for the site should be provided following completion of rough grading operations. Pavement design will be based on the expected Traffic Index (TI) for the streets and the R-values of exposed subgrade soils. For preliminary purposes, a pavement section on the order of 4 inches of asphalt concrete over 8 inches of aggregate base may be assumed. This is based on a TI of 5 and an R-value of 10.

3.9 Cement Type

Based on laboratory test results, the soluble sulfate content of the native soils is considered negligible with respect to sulfate attack of concrete in contact with soil. Type II cement and compliance with the requirements of the UBC should be adequate for concrete in contact with onsite soils. Additional testing of surface soils is recommended, following the completion of grading, to verify soluble sulfate contents.

With the advent of water-based flooring adhesives, some floor coverings are considerably more sensitive to slab moisture. Concrete mix design, especially the water/cement ratio should take this into consideration.

3.10 Trench Excavations and Backfill

Excavations should conform to all applicable safety requirements. The native soils across most of the site may be classified as Type B for CalOSHA trench excavation requirements. Locally, Type C soils might be encountered. Some zones of relatively clean sands and wet soils were encountered in our investigation. (See boring and trench logs.)

Native soils should be suitable for use as trench backfill. Backfill materials should be compacted to a minimum relative compaction of 90 percent. We recommend that moisture content of native backfill to be over optimum moisture content. Because densification with water (jetting) is generally not allowed by IRWD for storm and sewer systems, select backfill should be self-compacting.

3.11 Surface Drainage

Inadequate control of run-off water and/or heavy irrigation after development of the site may result in nuisance water conditions where previously none existed. Maintaining adequate surface drainage, proper disposal of run-off water, and control of irrigation will help reduce the potential for future moisture-related problems and differential movements from soil heave/settlement.

Surface drainage should be carefully taken into consideration during all grading, landscaping, and building construction. Positive surface drainage should be provided to direct surface water away from structures and slopes and toward the street or suitable drainage devices. Ponding of water adjacent to the structures should not be allowed. Buildings should have roof gutter systems and the run-off should be directed to parking area/street gutters by area drain pipes or by sheet flow. Paved areas should be provided with adequate drainage devices, gradients, and curbing to prevent run-off flowing from paved areas onto adjacent unpaved areas.

The performance of foundations is also dependent upon maintaining adequate surface drainage away from structures. The minimum gradient within 5 feet of the building will depend upon surface landscaping. In general, we suggest that unpaved lawn and landscape areas have a minimum gradient of 2 percent away from structures.

Construction of planter areas immediately adjacent to structures should be avoided. If planter boxes are constructed adjacent to or near buildings, the sides and bottoms of the planter should be provided with a moisture barrier to prevent penetration of the irrigation water into the subgrade. If possible, provisions should be made to drain excess irrigation water from the planters.

It is also important to maintain a consistent level of soil moisture, not allowing the subgrade soils to become overly dry or overly wet. Properly designed landscaping and irrigation systems can help in that regard.

3.12 Future Geotechnical Review

Once grading plans for the future development (residential and school uses) are available, the plans should be reviewed by a geotechnical consultant. Additional investigation will probably be necessary. A grading plan review with final recommendations for grading and design should be prepared for the project. Geotechnical observations and testing should be performed during grading operations and construction.

APPENDIX A

REFERENCES

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TABLE 1

GEOTECHNICAL PARAMETERS AND RECOMMENDATIONS FOR DESIGN OF POST-TENSIONED SLABS BASED ON 1997 UBC SECTION 1816

Parameter	*Category*			
	1	2	3	4
Percent that is finer than 0.002 mm in the fraction passing the No. 200 sieve	Up to 30%	Up to 40%	Up to 50%	Up to 60%
Estimated Range of Expansion Classification	Very Low to Low	Low to Medium	Medium to High	High to Very High
Center Lift				
• Edge Moisture Variation Distance, e_m	4.6 feet	5.3 feet	5.6 feet	6.0 feet
• Center Lift, y_m	2.1 inches	2.5 inches	3.8 inches	4.6 inches
Edge Lift				
• Edge Moisture Variation Distance, e_m	2.5 feet	3.0 feet	3.5 feet	4.0 feet
• Edge Lift, y_m	0.5 inch	0.7 inch	1.0 inch	1.1 inch
Presaturation, as needed, to obtain the minimum moisture down to the minimum depth	1.2 x optimum down to 12 inches	1.2 x optimum down to 12 inches	1.3 x optimum down to 18 inches	1.4 x optimum down to 24 inches
Subgrade Modulus, k	100 pci	75 pci	50 pci	25 pci
Modulus of Elasticity of Soils, Es	2,000 psi	1,500 psi	1,000 psi	500 psi
Minimum depth of perimeter footing below lowest adjacent grade	12 inches	18 inches	18 inches	24 inches

TABLE 2

SEISMIC DESIGN PARAMETERS BASED ON UBC 1997

Seismic Zone from Figure 16-2	4
Soil Profile Type from Table 16-J	S_D
Seismic Source Type from Table 16-U	B
Distances to known Source	8 miles
Closest Known Seismic Sources	Elsinore Fault

SUMMARY OF LABORATORY TEST RESULTS

MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT					
Sample No.	***Sample Location***	***Description***	***Maximum Dry Density (pcf)***	***Optimum Moisture Content (%)***	***Percent Passing #200 Sieve (%)***
B-1	T-2 @ 5' - 6'	Light Brown Silty SAND	125.5	10.0	49
B-1	T-4 @ 6' – 7'	Light Brown Fine Silty SAND	125.0	10.0	27
B-1	T-7 @ 3' – 4'	Light Brown Sandy SILT	113.0	15.0	69

June 16, 2000
(Revised August 17, 2001)

Project No. 99070-01

To: Irvine Community Development Company
550 Newport Center Drive
Newport Beach, California 92658-6370

Attention: Mr. Terry Hartman

Subject: Revised Preliminary Geotechnical Investigation and Planning Study for Conceptual Design, Planning Area I-6, City of Irvine Sphere of Influence, County of Orange, California

In accordance with your request, NMG Geotechnical, Inc. (NMG) has performed a preliminary geotechnical investigation and planning study for Planning Area I-6 (Figure 1, Site Location Map). This report has been revised based on comments by the City of Irvine geotechnical reviewer, Templeton Planning Group. A copy of the review letter, dated July 20, 2001, is included in Appendix F. This report has also been updated with the new seismic hazards information, including EQFAULT Version No. 3.00 (Blake, 2000) and seismic hazard mapping by the State.

The site is roughly 1,300 acres in size and is bounded by Irvine Boulevard on the south, the Eastern Transportation Corridor/Laguna Freeway (133) on the west, the Foothill Corridor on the north, and Agua Chinon Canyon on the east. Portola Parkway crosses the middle portion of the site, trending in an east to northeast direction. The site is located in the City of Irvine's Sphere of Influence, in unincorporated Orange County.

The purpose of this study was to provide the general geotechnical conditions, impacts and constraints at the subject site for use during future land planning of the property. The 100-scale topographic map prepared, by Tetra Tech, Inc., was utilized for the base map to present our Preliminary Geotechnical Map (Plates 1 through 8). In addition, we have reviewed the current 200-scale conceptual land plan. A combination of the topographic map and the conceptual map was utilized as the base for the Geotechnical Constraints Map (Plates 9 and 10).

During this study, we have collected and compiled the previous geotechnical data pertinent to the site that included work for the Eastern and Foothill Corridors and Portola Parkway. We performed a preliminary investigation, including geologic mapping, excavation and logging of 16 bucket-auger borings, 16 hollow-stem borings, and 58 trenches. Soil samples were collected from the borings and laboratory testing was performed. This report presents our findings, conclusions and recommendations for planning of the site.

Geotechnical issues/constraints within the proposed development area include the following:

- Local presence of thick, alluvial soils within the abandoned reservoirs and low-lying areas. These soils are subject to collapse/settlement and will require removal/recompaction during grading;
- Existing natural hillsides and proposed graded cut slopes will locally require stabilization measures due to adverse geologic conditions and adverse bedding;
- Local presence of landslides that will require stabilization during grading;
- Potential for liquefaction in some of the alluvial in-filled canyons; and,
- The effects of grading on the existing improvements (i.e., the IRWD and MWD water lines).

These geotechnical issues are discussed in more detail in this report, with preliminary remedial recommendations. The proposed development is considered geotechnically feasible, provided these issues are properly mitigated during design, grading and/or construction.

We appreciate this opportunity to provide our services to Irvine Community Development Company. Please contact us if you have any questions.

Respectfully submitted,

NMG GEOTECHNICAL, INC.

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Associate Geologist

SBK/TW/er

Distribution: (2) Addressee
(2) Mr. Bill Halligan, Templeton Planning Group

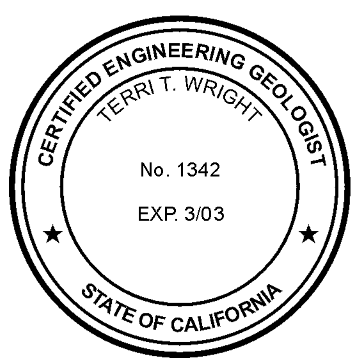

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Figure (Volume I)

Figure 1 – Site Location Map – Rear of Text

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Plates (Volume I)

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Plates 9 and 10 – Geotechnical Constraints Map – In Pocket

Appendices (Volume II)

Appendix A – References and Aerial Photographs Reviewed
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Appendix E – General Earthwork and Grading Specifications
Appendix F – Geotechnical Engineering Review Report by Templeton Planning Group, dated July 20, 2001

1.0 INTRODUCTION

1.1 Purpose and Scope

NMG Geotechnical, Inc. (NMG) has conducted a preliminary geotechnical investigation and planning study for the proposed conceptual design of Planning Area I-6, in the City of Irvine Sphere of Influence. The purpose of this study was to provide the geotechnical conditions, impacts and constraints at the subject site for use during future land planning of the property. Our geotechnical maps were prepared using the 100-scale topographic map received from Tetra Tech, Inc. as the base map (Plates 1 through 8). We have also reviewed the current 200-scale conceptual land plan and the 400-scale Encumbrance Map. The conceptual land plan was superimposed on the encumbrance map to present our 200-scale Geotechnical Constraints Map (Plates 9 and 10). There was no conceptual grading plan available for our review during preparation of this report.

The scope of work for this study included the following tasks:

- **Background Research:** Review of available geotechnical reports and maps and compilation of data onto the 100-scale topographic plan. Review of stereoscopic aerial photographs dating back to the 1950s was also performed. References and aerial photos reviewed are listed in Appendix A.
- **Field Mapping:** Geologic field mapping was performed in Planning Area I-6, and boring and trench locations were reviewed with The Irvine Ranch, Metropolitan Water District, and Underground Service Alert prior to subsurface exploration.
- **Subsurface Investigation:** Excavation and logging of 58 backhoe trenches, 16 bucket-auger borings, 16 hollow-stem borings. The trenches were excavated within the broad in-filled canyons, Lambert Reservoir, and along some of the hillsides for bedding and structure. Borings were drilled with either a bucket-auger rig for downhole logging, or with a hollow-stem-auger rig. Logs of the trenches and borings are included in Appendix B.
- **Laboratory Testing:** Limited laboratory testing of selected soil samples was performed on samples collected from the borings and trenches. Results of these tests are included in Appendix C. Pertinent laboratory test results from the prior investigations were also reviewed and are included in Appendix C.
- **Plan Review and Geotechnical Analysis:** Compilation of collected data, and preparation of the Preliminary Geotechnical Map (Plates 1 through 8) and a Geotechnical Constraints Map (Plates 9 and 10). Geotechnical review and analysis was performed based on the proposed conceptual land uses and the collected data. Geotechnical analysis included assessment of settlement and the potential for liquefaction.
- **Report Preparation:** Preparation of this geotechnical report with the accompanying maps to be utilized for preliminary planning and design.

1.2 Site Location and Conditions

The site is located north of the El Toro Marine Corps Air Station, between the Eastern Transportation Corridor (ETC) and Agua Chinon Wash. Portola Parkway runs through the northern and central portions of the site and the Foothill Transportation Corridor (FTC) runs along the northern boundary. The site extends south to Irvine Boulevard, but does not include the South Coast Agricultural Field Station. The site is located within the Sphere of Influence of the City of Irvine, in the County of Orange, California (See Figure 1, Site Location Map).

The site is irregular in shape, consisting of approximately 1,300± acres. The site extends from the Tustin Plain in the south, up into the foothills of the Santa Ana Mountains in the north. The northern and eastern portions of the site consist of moderately to gently sloping hillside terrain, with flatlands in the south - southwest. There are several southwest-trending canyons bisecting the site with gradients toward the southwest, including Bee and Round Canyons, and Agua Chinon Wash. These canyons become relatively narrow and steep to the north (up canyon). Generally, the hillside slopes range from 4:1 (horizontal to vertical) to as steep as 1.5:1 within the proposed development area. The total topographic relief within the project site is approximately 440 feet, ranging from a high elevation of 774 feet in the northeast corner of the site to a low elevation of 334 feet in the southwest corner at the intersection of the ETC and Irvine Blvd.

The site is currently being utilized for agriculture and nurseries and can be divided into several agriculture regimes. The southern portion, with relatively flat ground, is currently being utilized as a nursery site or for row crops. Avocado and citrus groves are predominating in the hillside-terrain portions of the site, with large eucalyptus tree windrows in-between the orchards. In addition, a green waste plant and a mulching plant are present in the southeast corner of the site. There is an old quarry, currently being used by an environmental company in the southern portion of the site.

There are several old, abandoned diversion berms and channels in the canyon areas, apparently built for flood control in the past. There is an old abandoned reservoir (the Lambert Reservoir) remaining in the central portion of the site. This reservoir has an earthen dam that was built prior to 1952. The use was probably a combination of flood control and possibly a water source for agricultural irrigation. The reservoir was apparently in service until 1997, but does not have any water in it today. However, in the winter of 1999, a large water pipeline broke along Portola Parkway and the reservoir was partially filled with water for a short time.
There is a large water pipeline easement that crosses the site from the northwest corner to the southeast portion of the site. This easement is maintained by the Santiago Aqueduct Commission (SAC) and Metropolitan Water District and is further discussed in Section 2.10 of this report.

The South Coast Agricultural Field Station, operated by the University of California, Irvine, and Lambert Ranch, located in the northern portion of the site, are not included within the site and therefore are not a part of this investigation.

1.3 Site History and Previous Geotechnical Investigations

Stereoscopic pairs of aerial photographs, dating back to the late 1950s have been reviewed. In 1952, the site was essentially in its natural condition except for the lowlands being planted with orchards and row crops and eucalyptus windrows. The earthen dam of the Lambert Reservoir was constructed with water in the reservoir. There were several diversion berms and earthen channels across Bee, Round, and Agua Chinon Channels that directed water into the Lambert Reservoir, probably for flood-control measures. There were a few farmhouses near the reservoir, and the concrete aboveground reservoir was located to the west of the dam. There was also an apparent rifle range in the western portion of the site, probably associated with the El Toro Marine Base. An old quarry was evident in the southeast portion of the site, where a hilltop had apparently been mined for sand and gravel.

In 1981, many of the hillsides in the north were in the natural conditions. There were apparent mining operations for sand and gravel ongoing in Round Canyon, evidenced by numerous areas of cuts and fills. There were several more houses located northeast of the Lambert Reservoir and there was water in the reservoir. The lower reaches of Round Canyon had numerous, apparent green houses associated with nurseries (these green houses are not there today). The old quarry in the southeast ridge top had several buildings and structures in the area. There were nurseries on the flatland in the southwest corner of the site with some orchards planted on the hills and canyon areas in the western portion of the site. The water lines had been installed crossing the site from the northwest corner to the eastern side of the site. Base housing was constructed just to the southeast of the site. A large borrow area was graded offsite to the northeast, but apparently the materials were hauled across the northeast portion of the site.

By 1997, Portola Parkway was constructed and the corridors were graded. Several additional hillsides at the site were cleared and terraced and some were planted with small orchards. Much more of the land was being used for nurseries. Agua Chinon Dam and Detention Basin were also recently graded/constructed. There was some water in the Lambert Reservoir.

Based on our background review, there have been several pertinent geotechnical investigations performed at the subject site and for adjacent properties, as follows:

- In 1988, Leighton and Associates conducted a geotechnical/soils investigation for Agua Chinon Dam. The dam was completed in 1998 and is currently in service.
- Woodward Clyde performed geotechnical investigations during design stages for Portola Parkway and the County of Orange performed geotechnical observation and testing during construction of the parkway.
- Geotechnical studies by Geofon, Moore and Taber, CH2M Hill, and Silverado were performed during design stages of the Foothill Transportation Corridors. We were able to obtain some of this data (maps and reports); however, some of the boring logs were not available.

In addition to the above private investigations, there are also several published geologic reports and maps by the State that were reviewed for this study (Appendix A).

1.4 Proposed Development

The conceptual development consists of 11 residential communities, two light industrial/office centers, one commercial, four institutional, and seven parks/community centers. The main access for the developments will be from a loop road off of Portola Parkway, with secondary access from Irvine Boulevard.

The proposed grading is not known at this time. The grading will probably consist of both mass grading (cuts and fills up to 50± feet) in the hillside areas and "flat-land grading" (cuts and fills of ±5 to 10 feet) in the low-lying areas.

1.5 Field Exploration

The field exploration program consisted of geologic field mapping and a geotechnical subsurface investigation. The exploration was conducted in different stages at various times between December 1999 and March 2000. The exploration included backhoe trenches, bucket-auger borings and hollow-stem-auger borings.

Fifty-eight exploratory trenches were excavated within the site with a rubber-tire backhoe between December 3 and December 14, 1999. The total depth of the trenches ranged from 5.5 to 17 feet. The trenches were geologically logged, locally sampled, and backfilled with native soils.

Fifteen bucket-auger borings were drilled between December 13, 1999 and January 10, 2000, with an EZ Bore, 120-drill rig to depths of 29 to 105 feet below the existing ground surface. Please note that Boring B-2 was omitted due to access restrictions. The bucket borings were downhole-logged by a geologist to map the geologic structure, rock type and determine slope stability conditions. Both undisturbed and bulk samples were collected from the bucket borings. Some borings were terminated due to the presence of groundwater and caving. Undisturbed soil samples were collected from the borings using a California split-barrel sampler (2.5-inch-outside-diameter rings). The sampler was driven using a telescoping, variable-weight Kelly bar. (The weights of the Kelly bar are 5,742 pounds from 0-30 feet, 4,302 pounds from 31-58 feet, and 3,102 pounds from 58-87 feet). All bucket-auger borings were backfilled with native material and tamped with the Kelly bar for compaction.

Sixteen hollow-stem-auger borings were drilled between December 7 and 13, 1999 with a CME 55 drill rig to depths of 31 to 80 feet below the existing ground surface. These borings were sampled and logged. Soil samples were taken at 2.5- to 5-foot intervals, with a California split-barrel sampler and/or a Standard Penetration Test (SPT) split-spoon sampler. The California split-barrel sampler was used to collect relatively undisturbed ring samples (2.5-inch-outside-diameter rings). The SPT drive sampler was used to collect disturbed soil samples and to obtain a measure of resistance of the soil to penetration (recorded as blows-per-foot on our geotechnical boring logs). The SPT penetration resistance was recorded as blows-per-foot (blow count) and was also used for assessing the liquefaction potential of the sandy soils. The hollow-stem samplers were driven with a 140-pound hammer, free-falling 30 inches. Bulk samples of onsite soil were collected from the hollow-stem borings and used for additional soil identification purposes and laboratory testing. Soil samples were visually classified in accordance with the Unified Soil Classification System (USCS). All hollow-stem-auger borings were backfilled with native material.

The approximate location of the trenches and borings are shown on the Preliminary Geotechnical Map, Plates 1 through 8, and the boring and trench logs are presented in Appendix B. In addition to the exploration preformed for this study by NMG, data (logs and laboratory data) from prior geotechnical exploration by others at or adjacent to the site are also included in Appendices B and D.

1.6 Laboratory Testing

Prior geotechnical studies by others included a large amount of laboratory test results, which were reviewed, analyzed and where appropriate, were incorporated into our geotechnical analysis. In addition, NMG performed limited laboratory testing on selected soil and bedrock samples during this study. The testing was performed in order to characterize and confirm engineering properties with respect to the future site development.

The laboratory testing performed for this study included:

- Moisture Content and Dry Density
- Consolidation and Collapse
- Grain-size Distribution and Soil Finer than the No. 200 sieve
- Atterberg Limits
- Direct Shear
- Soluble Sulfate Content
- Expansion index

Laboratory tests were conducted in general conformance with applicable American Society for Testing and Materials (ASTM) standard test methods, and/or Uniform Building Code (UBC) test standards. The laboratory test results are discussed below and presented in Appendix C. The laboratory test results by others included in Appendix C, are included without modification from the way they appeared in the referenced reports. Since these other investigations often also included areas outside of the subject site, not all of the test results included in Appendix C may be relevant to the subject site.

1.6.1 Moisture and Density Test

The in-situ moisture content and dry densities were determined on the relatively undisturbed samples and in-situ moisture only was determined for disturbed samples collected from the borings in accordance with ASTM Test Methods D2216 and D2937. The in-situ dry density and moisture content test results are included in our Boring and Trench Logs (Appendix B).

1.6.2 Soil Classification Tests

Our soil identification and classification are based on manual-visual field procedures (ASTM D2488); laboratory grain-size analysis (ASTM D422); and Atterberg limit (ASTM D4318) test results. The soil classification and group symbols used are based on the Unified Soil Classification System (USCS). A total of five grain-size analysis and four Atterberg limit tests were performed to confirm the classification of the soil samples. These test results are included in Appendix C and the detailed soil sample descriptions, classification, and USCS group symbols are presented on the Boring and Trench Logs (Appendix B).

1.6.3 Shear Strength Tests

Two direct shear tests were performed to evaluate the in-situ soil strength in accordance with ASTM D3080. Tests were conducted on relatively undisturbed samples to evaluate the strength characteristic of the native materials. The direct shear test results and the interpreted peak and ultimate strength envelopes are included in Appendix C.

1.6.4 Consolidation Tests

Nine consolidation tests were performed on relatively undisturbed samples in accordance with ASTM D2435. The tests were conducted to evaluate the collapse potential and to assess the compressibility of the soils in saturated conditions under loading. The nine samples represented the sandy and soft clayey deposits considered to be prone to collapse and consolidation settlement based on the boring and sampling information. The magnitude of the load at saturation, and the maximum load tested were determined based on in-situ soil pressure and expected additional loads. The consolidation test results are included in Appendix C.

1.6.5 Soil Expansion Tests

Three expansion index tests were performed on bulk samples of onsite soils to evaluate the range of expansion potential of onsite soils (ASTM D4829). The soil samples tested were a mixture of the near-surface, sandy alluvium. The laboratory test results are included in Appendix C.

2.0 GEOTECHNICAL FINDINGS

2.1 Regional Geologic Setting

The majority of the subject site is located within the southwestern foothills of the Santa Ana Mountains, in the Peninsular Range Province of Southern California. The Peninsular Range is located at the southeastern portion of the middle-to upper-Miocene-age Los Angeles Basin (Schoellhamer, et al.). To the north, this province is bounded by the Whittier-Elsinore fault zone (located 11 miles north of the site), and by the Newport-Inglewood fault zone to the south (located 13 miles south of the site). The subject site lies adjacent to the Tustin Plain. Cretaceous to early Pliocene-age marine and non-marine sedimentary bedrock units are exposed throughout the site with late Quaternary alluvium in-filling the canyons. Slopewash and landslide deposits were observed along the majority of the slopes, with landslide material more prevalent in the upper canyons.

2.2 Earth Units

The subject site is underlain by several bedrock formations ranging in age from the Cretaceous Period to the Pliocene. These formations include, from oldest to youngest, the Williams (Pleasants Sandstone Member), Monterey, Puente (Soquel Member) Capistrano (Oso Member), and Niguel. Overlying the bedrock are surficial units including alluvium, slopewash, landslide material and artificial fill.

Williams Formation - Pleasants Sandstone Member (Map Symbol – Kwp): This marine formation is the oldest bedrock formation at the subject site (late Cretaceous Period) and is exposed only in the northwestern portion of the site, west of Bee Canyon. This bedrock was encountered in three borings (B-1, -3, -4) where it consisted of yellowish brown to pale brown, fine to coarse sandstone, pebbly medium to coarse-grained sandstone, and gray to grayish brown clayey siltstone and silty claystone, with minor yellowish brown to reddish brown silty fine sandstone and siltstone and light olive brown to yellowish brown claystone. The contacts between these lithologies are commonly gradational with interbedded to interlaminated sandstones, silty sandstones, and siltstones. The samples were described as medium dense to very dense and medium stiff to very stiff. Occasional shears were observed during the downhole logging of these borings. Generally, the bedrock is damp to moist and seepage was observed in Borings B-1 and B-3. The joints and faults in the bedrock are commonly heavily iron-stained and gypsum-lined.

Monterey Formation (Map Symbol – Tm): This Miocene-age marine formation is only exposed and encountered in borings located south of Portola Parkway (B-9, -10, -11, -12, and -13). This bedrock consists of white to gray to grayish brown silty fine sandstone, fine sandy siltstone, siltstone and claystone with minor fine to medium sandstone. Siltstone rip-up clasts are commonly observed within sandstone beds and scattered fish scales are found in the siltstone. A common varve sequence was observed in this bedrock formation during downhole logging. It consisted of interlaminated to interbedded white to gray to very pale brown sandstone and siltstone. The bedrock is massive to moderately bedded with some local clay seams. Diatomaceous siltstone, claystone and white to light bluish gray vitric and devitrified tuffs were encountered in one boring (B-11) in the southern portion of the site, north of Agua Chinon. Minor conglomeratic sandstone and sandy pebble and cobble conglomerate beds were observed in Borings B-12 and B-13. A bentonitic claystone was observed in B-10 and a bentonitic siltstone in B-12. Faulting and shearing were observed in these borings. The faults are predominantly iron-stained and gypsum-lined and the shears are generally less than one inch thick, polished, soft and plastic to very plastic. The bedrock material is generally damp to moist, soft to very stiff/medium dense to very dense with some cemented zones and occasional concretions. This formation is generally moderately bedded to laminated, and damp to moist.

Prior studies encountered similar Monterey Formation bedrock in the Agua Chinon area along the southeastern portion of the site (Leighton, 1990). Comparable interlaminated and interbedded sandstone and siltstone sequences were observed and diatomaceous siltstone was observed in four borings (LB-8, -10, -12, -14) and two trenches (LT-19, -20) near the Agua Chinon Dam.

Puente Formation, Soquel Member (Map Symbol - Tps): In the northeastern part of the subject site, underlying the Foothill Corridor, the late Miocene-age marine Soquel Member of the Puente Formation is exposed. Based on mapping by CDMG (1981), this unit has a 2000±-foot-wide, east-west trending band east of Bee Canyon. This formation consists of pale to moderate yellowish brown, light to moderate brown, light brownish gray, pale brown silty and pebbly sandstone, and interbedded light to medium gray, light to medium brownish gray siltstone and shale, with light to moderate brown, moderate reddish brown, and grayish red conglomerates. Sandstone and conglomerate are massive to thick-bedded and the siltstone and shale are platy to thin bedded. This bedrock unit was only encountered in three trenches (T-20, -45, -46) adjacent to the Foothill Transportation Corridor (FTC) toll plaza along the northeast boundary of the site. The bedrock is damp to wet and medium dense to dense/stiff to very stiff.

Capistrano Formation, Oso Member (Map Symbol – Tco): The late Miocene to early Pliocene-age Oso member is exposed along an east-west trending belt across the site, from east of Bee Canyon to east of Agua Chinon Wash (CDMG, 1981). This marine bedrock unit was encountered in several borings (B-5, -6, -7, -8, 14, -15, and –16) where it was mainly a very light gray, light yellowish brown, and pale yellow silty fine sandstone, medium to coarse sandstone, and pebbly sandstone with some siltstone and dark gray and brownish gray claystone. In one boring (B-7), a pebbly sandstone to sandy pebble conglomerate zone was observed. The Oso Member contains abundant biotite, is generally dense to very dense, and damp with seepage common at depth.

Niguel Formation (Map Symbol – Tn): This bedrock unit is exposed along and south of Portola Parkway from the Lambert Reservoir area east to Agua Chinon Canyon. The Pliocene marine Niguel Formation unconformably overlies the Monterey and Oso Member of the Capistrano Formation. The formation is a pale to brownish yellow, yellowish to grayish brown, and brown pebbly medium to coarse-grained sandstone, sandy pebble, and pebble and cobble conglomerate with light gray sandy siltstone and silty sandstone. The conglomerate clasts were commonly imbricated and were generally igneous and metasedimentary rocks. The siltstone within this formation is commonly moderately to well-bedded. This unit is typically dry to damp, grading to moist within two to four feet of the basal contact. The formation is friable and medium dense.

Stream Terrace Deposits (Map Symbol - Qt): There are local mapped terrace deposits in the northeast portion of the site, along the west side of Agua Chinon Channel, south of the corridor. These deposits are Quaternary-age, stream laid deposits. They were mapped by Leighton (1990) and described as generally reddish brown, poorly sorted and poorly to moderately consolidated. They consisted of mixtures of gravelly and cobbly sands and locally clayey sands with lesser quantities of silty sands and sandy silts.

Alluvium (Map Symbol - Qal): Quaternary-age alluvial materials were mapped in the majority of the canyons from the narrow upper reaches, to the broad canyons south of Portola Parkway. The upper canyon areas in the northern and eastern portions of the site have generally 20 to 35 feet of alluvial deposits. Slopewash materials interfinger with the alluvium along the sides of these canyons. Borings drilled in these upper canyons include H-2, -3, -5, and -14. These alluvial deposits consist of grayish, yellowish, reddish, and light to dark brown, clayey/silty sands, sandy silts, and clays, with minor amounts of clean sand and gravel layers. The upper 5 to 7 feet were generally medium dense/medium stiff to stiff and moist, with slight to moderate porosity and thin roots.

The southern, lower-elevation portions of the site are underlain by approximately 40 to 80+ feet of Quaternary-age alluvial deposits. These alluvial materials are more consistent with the alluvium of the Tustin Plain. This deepest alluvium is generally interlayered silt/clayey sands, clean/gravelly sands, sandy silts and clays. The upper few feet have been disturbed from farming activities and consist of moist to wet, loose/soft material with abundant organic material. Below 3 to 7 feet, the alluvium is a grayish and light to medium brown, slightly porous, with local layers of caliche (calcium carbonate) stingers. Below 25 feet, the alluvium becomes generally medium dense/stiff to very stiff with fewer soft/loose layers.

Slopewash (Map Symbol - Qsw): Slopewash was mapped along hillsides in areas near landslides and in areas of active soil creep. It typically forms as a gravity-type deposits from erosion of the hillside and movement down slope. Generally, this material was on the order of 5 to 15 feet thick. It consists of mottled brown and yellowish brown fine-grained sands and silts with local grayish brown clayey sands, sandy clays, and fragments of angular bedrock. The material was damp to moist and loose to medium dense/medium stiff and porous.

Landslide Materials (Map Symbol - Qls): Based on aerial photographic analysis, geologic mapping, and previous investigations, the majority of the landslide material at the site consist of thick slopewash deposits and weathered, fractured bedrock materials. The landslides in the proposed development area were found mostly in the Monterey formation, and locally in the Williams formation. The larger landslides appear to be fractured sandstone and siltstone material that is more intact. Shallow slides (or slumps) consist mostly of colluvium and slopewash materials that are loose to medium dense and occur on the steeper hillsides in the northern portions of the site.

Artificial Fill (Map symbol - Af/Afu): Areas of artificial fill occur across the site, associated with Lambert Reservoir, Agua Chinon Dam and Retarding Basin, transportation corridors, Portola Parkway, water canals, ranch-access roads and irrigation lines for the orchards. The fills are generally derived from onsite soils and bedrock materials. The uncontrolled ranch and flood control fills are generally dry and not well compacted. The certified compacted fills placed at the site include fills for the Agua Chinon Dam and Retarding Basin (Leighton and Associates, 1998), fills placed for the transportation corridors were certified by (Silverado), and the Portola Parkway fills (County of Orange, 1993). The uncertified fills are generally not acceptable and should be removed and recompacted. The certified fills are probably weathered near-surface and will require some shallow removals down to competent fill.

Pond Deposits (Map Symbol – Qp): This unit is found primarily in Lambert Reservoir and locally throughout the site behind other artificial berms (both the older diversion berms and berms associated with the quarry operations in Round Canyon). In Lambert Reservoir, these deposits are approximately 40 feet thick and consist of dark greenish gray and dark grayish brown silty/clayey sands, sandy silts, and greenish black and reddish brown plastic clays with caliche. These clay deposits are located from 5 to 10 feet below the surface, below a layer of sandy silt. The upper sands and silts are generally damp to moist and slightly to moderately porous. The plastic clay zone is typically moist to wet and medium stiff to stiff. In Round Canyon, these deposits may be silty sand/sandy silt that is loose to medium dense and moist.

2.3 Geologic Structure

The geologic structure at the subject site consists of complex faulted and folded blocks. In the northwestern portion of the site (Plates 2 and 3), the general overall structure includes an east-west trending syncline within the Williams Formation. The north limb has variable-dipping beds at angles of 15 to 45 degrees to the southwest. The southern limb has more consistent bedding of 30 to 50 degree dips to the northeast. Morton and Miller (1976 and 1981) and Schoellhamer, et.al. (1954 and 1981) mapped this section of the Williams Formation as an uplifted block bounded on the north (mostly offsite) by a curved fault system. The major eastern north-south trending faults of this system is located west of the FTC toll plaza (east of Bee Canyon) and places the Williams formation in fault contact with the younger Puente and Capistrano Formations (Plate 5).

In the northeastern portion of the site, north of Portola Parkway, there is an east-west trending syncline in the Oso Member of the Capistrano Formation. This fold is characterized by consistently steep dips of 50 to 55 degrees toward the southeast in the northern limb and shallower dips of 20 to 35 degrees toward the northwest in the southern limb.

In the southern portion of the site, south of Portola Parkway, the structure is dominated by the through-going fault, sometimes referred to as the Agua Chinon Fault, that separates the Oso Member on the north from the Monterey Formation on the south. This fault is also a curved fault system that strikes north-northwest with dips of 45 to 50 degrees east-northeast near Agua Chinon Canyon, and extends from the retarding basin to the western edge of Round Canyon, where it strikes more southwesterly. Bedding north of this fault generally strikes north-northeast and dips 10 to 30 degrees to the west-northwest. Bedding south of this fault is variable. In the area of Lambert Reservoir, bedding dips strikes north-northeast and dips 30 to 60 degrees east-southeast. East of Round Canyon, bedding generally strikes north-northeast and dips 15 to 45 degrees west-northwest. Bedding next to faults is often variable, with more shearing.

The alluvium in the canyons was composed of massive to crudely layered sediments that were generally flat lying, with a gentle dip toward the southwest (down-gradient).

2.4 Faulting and Seismicity

There are numerous major and minor faults mapped at the subject site. The majority of the mapped faults onsite trend west-northwest. There are a few north-northeast trending faults mapped in the northeastern portion of the site, near the intersection of Portola Parkway and the FTC. Most of the mapped faults are based on field mapping (both from prior published mapping and/or mapping by NMG), aerial photo interpretation and/or subsurface investigation. Many of the bucket-auger borings drilled during this investigation encountered faulting of some magnitude. No evidence of active faulting was observed during this investigation, or by prior work at the site (both published and private; see Appendix A, References).

There are no known major or seismically active faults mapped at the site; therefore, the potential for ground rupture is considered slight to nil. The closest major active faults are the Whittier-Elsinore Fault to the north and Newport-Inglewood Fault (offshore) to the south. Based on the computer program EQFAULT Version 3.0, and utilizing the site location with coordinates of 33.6998 latitude and 117.6903 longitude (a location east of Round Canyon), the closest active fault is the Chino Central Avenue branch of the Elsinore Fault. This fault is located approximately 7 miles north of the northern site boundary. Based on regional mapping by the State, the mapped surface trace of the Elsinore Fault is located approximately 11 miles north of the site.

The regional active faults are capable of generating moderate ground accelerations at the site. Based on the computer program EQFAULT by Blake (2000) and ground acceleration attenuation curves developed by Boore, et.al. (1997) for very dense soil or soft rock and stiff soil, the largest maximum earthquake site accelerations are on the order of 0.26g to 0.34g, respectively (Appendix D). These are horizontal ground accelerations and the vertical accelerations could be of equal intensity. As with all of Orange County, the subject site is in UBC Seismic Zone 4.

We have also reviewed the CDMG Seismic Hazard Evaluation Report for the El Toro Quadrangle (2000). This report presents maps of their probabilistic evaluation, which indicates that the 10-percent Exceedence in 50 Years Peak Ground Acceleration at the site are:

- 0.28 g for Firm Rock Conditions
- 0.31g for Soft Rock Conditions

- 0.35g for Alluvium

As with all of Orange County, the subject site is in Uniform Building Code (UBC) Seismic Zone 4. After remediation, the seismic site coefficient should vary between S_A where hard bedrock is exposed at grade, to S_D within areas of deep alluvium. Based on our investigation, the Williams and Puente Formation bedrock units are very dense/hard and are locally anticipated to meet the criteria for S_A. However, to actually use this Soil Profile Type for foundation design, geophysical investigations should be performed at the site to verify that the shear velocities are in excess or 5,000 feet/second.

The site is not located within a Fault-Rupture Hazard Zone mapped by the State of California, Alquist Priolo Act (Hart, 1999). There are seismic hazard zones based on recent mapping of the State (CDMG, 2001) for potential liquefaction and potential earthquake induced landslide areas. These areas are shown on Figure 1 and are further discussed in Sections 2.6 and 2.8.

2.5 Surface Water and Groundwater

Surface water was observed flowing in a few of the stream channels at the time of this investigation. The stream flows were intermittent and controlled primarily by irrigation upstream. Generally, the natural channels have been diverted into manmade channels through the agricultural areas located along the base of the hills. The surface water has also been diverted through the older diversion channels at the site. The stream flow is from the northeast to southwest and continues south of the subject site.

Prior to our work, the old diversion berms that drained into the Lambert Reservoir had been filled and the reservoir had been silted in. The reservoir did not have any water in it when we performed our investigation in the reservoir. Subsequent to our field work, a break in the large water line along Portola Parkway to the northeast of the reservoir filled the reservoir with water for a short period of time.

The groundwater table was encountered in several of the borings during this and previous investigations, in the northern portion of the site. During this investigation, the groundwater table was encountered in the alluvium between 10 and 60 feet below the existing ground surface. The groundwater table is generally shallow in the Agua Chinon area above the dam, between 10 and 20 feet below the existing ground surface. At the southern end of the canyons, where they empty out onto the Tustin Plain, the depth to groundwater increases significantly, down to depths of 40 feet and deeper. Several borings were drilled from Portola Parkway south to Irvine Boulevard to depths of 50 to 80 feet and encountered no groundwater.

Along the hilltops, several bucket-auger borings excavated into bedrock encountered minor to heavy seepage at depths from 29 to 73 feet below the ground surface. It is likely that the seepage encountered in these borings is directly influenced by the irrigation of the surrounding orchards and has infiltrated through fractures and joints. Standing water was also encountered in a few of these borings at depths of 46 to 67.5 feet. Depths to groundwater encountered in the borings drilled at the site are included on the Geotechnical Constraints Map (Plates 9 and 10).

During grading of Portola Parkway, seepage was encountered in the area of "Tomato Springs" (County of Orange, 1993). This seepage was encountered in two cut slopes along the north and south sides of the road, just east of the water-line easement. Hydraugers (horizontal wells) were installed near the bottom of the cut slopes back into the slope a distance of 50 to 75 feet for drainage purposes.

2.6 Landslides and Slope Stabilization

Based on the seismic hazard mapping by the state, areas of potential seismically induced landslides are mapped in the northwest, northeast and southeast portions of the site (Figure 1). Some of these areas have had a subsurface investigation. These state-mapped areas will probably need further investigation and will need stability analysis once the proposed grading plan is available. Remedial grading will be necessary to stabilize these hillsides with respect to the proposed development in accordance with CDMG Special Report 117.

There are several landslides and surficial failures mapped at the subject site. The majority of the large ancient landslides occur in the northern and eastern hillside areas, in the steeper portions of the subject site. The majority of the mapped slides occur in the Monterey formations with few in the Williams formation. These large landslides involve sandstone and siltstone bedrock and are estimated to be on the order of 30 to 50 feet in depth. There are also several areas of surficial failure, erosion and creep in the steeper terrain at the heads of swales.

The geologic conditions of the proposed daylight cut and fill areas (perimeter areas and hillsides to be left in their natural conditions) should be investigated in detail to evaluate the stability of the natural hillsides. Based on the investigations and the field mapping of surface exposures, bedding is variable at the site (see Section 2.3 and Plates 1 through 8). Pie diagrams on the Geotechnical Constraints Map (Plates 9 and 10) illustrate the general direction of dip and angle of dip. The hillsides that have out-of-slope bedding and landslides are the most prone to instability. Hillsides to be left in their natural conditions that slope in the direction of dip and where the hillside slope ratio is steeper than the bedding angle are considered potentially unstable and will likely need to be provided with a buttress or side-hill key.

There will probably be several large fill slopes planned around the perimeter and within the proposed development. Planned fill slopes should be designed at 2H:1V or flatter. Fill slopes will require a fill key excavated into competent material at the toe of slope prior to placement of fill. Locally, wet alluvial materials will be encountered in the fill keys.

There will be several large cut slopes planned for this development. Planned cut slopes should also be planned at 2H:1V or flatter. The pie diagrams on the Geotechnical Constraints Map (Plates 9 and 10) show the direction and dip of the bedding. Cut slopes facing the same direction as the bedding, and where the apparent dip of the bedding is less than 26 degrees (the angle of a 2:1 slope) will have out-of-slope bedding and will probably require a buttress. Cut slopes with a component of bedding dipping out of slope may be subject to local wedge-type failures and a stabilization fill blanket consisting of a key 3 to 5 feet deep by 15 to 20 feet wide would be necessary. Cut slopes planned with bedding dipping into slope may not need stabilization, depending upon the depth of cut and the depth of weathering.

2.7 Soil Characteristics

The soil characteristics described below are based on the laboratory testing performed by NMG and existing test data from prior studies. Previous geotechnical investigations by others (Appendix A) have provided a substantial amount of laboratory test results for samples from the subject site.

2.7.1 Moisture Content and In-Place Density

The coarse-grained materials encountered in our borings and trenches were found to vary from loose to very dense and near- or above-optimum moisture content. The fine-grained materials were found to vary from soft to stiff and near-or above-optimum moisture-content conditions. The upper 3 to 7 feet of the alluvium was generally loose to medium dense and dry to moist, with moderate porosity and abundant roots.

2.7.2 Soil Classification

Based upon our identification of the materials encountered, the majority of the coarse-grained sandy soils have varying amounts of silt and clay corresponding with USCS group symbols of SM and SC. Some sand layers with very little fines and gravely sands were also encountered corresponding with USCS group symbols SP and SW. The majority of the fine-grained soils were generally low plasticity silt and clay corresponding with USCS group symbols of ML and CL. Some high plasticity silt and clay soils (MH and CH) are also present locally.

Although earth materials varying from nearly clean sands to highly plastic clays can be found within the site, the majority of materials that would be involved in grading will fall within the range of silty sands to silty clays. The process of grading tends to blend the earth material, so that the final near-surface fill soil should generally be within the range of silty sands to sandy clays. The clayey soils should generally be of low to moderate plasticity, and clean sands may be rare or absent unless selective grading is used to mine suitable sandstone deposits.

2.7.3 Soil Compaction and Strength

The compaction testing performed on similar soils during studies of the adjacent site, which were considered relevant to the subject site, indicates a maximum dry density of 117 to 130 $lbs/ft.^3$ with optimum moisture content of 9.0 to 12.0 percent. Lower maximum density with higher optimum moistures associated with finer grained silty and clayey soils are also anticipated at the site. Compaction curves and soil strength data by others are included in Appendix C.

2.7.4 Settlement Potential

Based upon our boring and trench exploration, laboratory testing and analysis, and review of prior data, the upper soil zone at the site generally consists of relatively poor, low density and porous soils. The near-surface unsuitable soil is prone to significant collapse and/or consolidation and has poor bearing properties.

The thickness of this unsuitable soil zone on the alluvium varies from approximately 3 to 8 feet across most of the site. Below this upper zone, the majority of the soil becomes more dense/stiff and is less porous. However, the areas of deeper alluvium have compressible soils present at depth. Subsurface data (blow counts and in-situ dry densities) indicates relatively low collapse (hydroconsolidation) potential below the upper soil zone. Compressible soil layers are present in the form of pond deposit, ranging in thickness from 30 to 33 feet in Lambert Reservoir, and fine-grained alluvial deposits ranging in thickness from 10 to 15 feet in the canyons. Thicker soils (mapped as colluvium and slopewash), which are considered unsuitable, occur locally at the site to estimated depths of up to 15 feet.

The amount of potential settlement can vary significantly over the site due to variations in subsurface conditions and depths of planned cuts and fills. In conducting our preliminary settlement analyses, we have assumed that remedial removals will be implemented to remove the upper unsuitable soil zone, the compressible pond deposits, and near-surface alluvial materials; that fill loading will be a maximum of 40 to 50 feet over existing ground; and structures will be of low-rise construction (one to two stories).

Where alluvium is left-in-place but there is no more than about 10 feet of design fill, we anticipate total consolidation settlement not to exceed 1.0 to 2.0 inches and differential settlement is not expected to exceed 0.5 to 0.75 inch over a 30-foot span. Consolidation settlement may be of greater concern where there is more than about 10 feet of design fill and more than about 10 feet of alluvium is left in place below the water table.

2.7.5 Soil Expansion

Based on the expansion index test results provided in the referenced reports, which were judged relevant to the subject site and our laboratory testing, the expansion potential of the onsite soils is expected range from very low to medium, as classified by 1997 UBC Table 18-I-B.

2.7.6 R-Value

Eleven of the R-value test results provided in the referenced reports were judged relevant to the subject site. These R-values ranged from less than 5 up to a maximum of 59 (WCC, 1990).

2.7.7 Soil Corrosivity

Twelve test results provided in the referenced reports were judged relevant to the subject site for soluble sulfate content, soluble chloride content, electrical resistivity and pH. All twelve test results indicated low soluble sulfate content, with a maximum value of 0.033 percent. The soluble sulfate results all fall well within the negligible range of soluble sulfate exposure for concrete in contact with soil as classified by 1997 UBC Table19-A-4.

As a first approximation, the corrosivity of soils to ferrous metals is related to the electric resistivity of the soil. A typical correlation is:

Soil Resistivity (ohm-centimeters)	***Corrosivity Description***
0 to 1,000	Severely Corrosive
1,000 to 2,000	Corrosive
2,000 to 10,000	Moderately Corrosive
Greater than 10,000	Mildly Corrosive

The twelve test results for electric resistivity ranged from 483 to 2,500 ohm-centimeters, or from severely corrosive to moderately corrosive.

Soil corrosivity to ferrous metals may also be increased if the soil is acid or if it contains a high concentration of some ions, such as chloride ions, which are especially corrosive to ferrous metals. The twelve test results indicated pH values ranging from 6.3 to 8.46, which is essentially neutral to highly alkaline. This range is favorable in the sense that it does not further increase the corrosive tendency. The range of soluble chlorides varied from 43.8 to 419.1 mg/kg, or from low to moderately high. The higher values would tend to increase the corrosivity to ferrous metals, so that most of the samples tested were judged to range from severely corrosive to corrosive.

2.8 Liquefaction Potential

Liquefaction is a phenomenon in which earthquake-induced cyclic stresses generate excess pore water pressure in low density (loose), saturated, sandy soils and soft silts below the water table. This causes a loss of shear strength and, in many cases, ground settlement. For liquefaction to occur, all of the following four conditions must be present:

- There must be severe ground shaking, such as occurs during a strong earthquake.
- The soil material must be saturated or nearly saturated, generally below the water table.
- The corrected normalized standard penetration test (SPT) blow counts (N_1) or the CPT tip resistance (Q) must be relatively low.
- The soil material must be granular (usually sands or silts) with, at most, only low plasticity. Clayey soils and silts of relatively high plasticity are generally not subject to liquefaction.

Based on seismic hazard mapping by the State, there are four large areas of potential liquefaction mapped at the site, in the upper reaches of the main canyons (Figure 1). Typically, these areas will require more extensive field exploration and laboratory testing as part of the geotechnical investigation during future studies.

The field exploration evaluated the liquefaction potential based primarily on the limited data from the hollow-stem borings. The liquefaction potential evaluation is based on an assumed groundwater level approximately equal to the measured groundwater level in the nearby borings. In general, liquefaction below a depth of 50 feet is not considered to be a concern.

Liquefaction assessment was performed in general accordance with the recommended procedures for analyzing and mitigating liquefaction (CDMG, 1997 and SCEC, 1999). In general, our evaluation analysis indicates that there are only a total of three liquefiable layers in the alluvium, in Borings H-12 and H-13 with total thickness varying from 5 to 15 feet. The depth of the liquefiable layers vary from 50 to 60 feet below existing ground. The liquefiable layers can vary laterally as well as in thickness across the site and will need to be evaluated in more detail. In general, liquefaction may not be an issue if no planned cuts are planned within Round Canyon and the depth of the potentially liquefiable layers are kept a minimum of 50 feet below the design grades.

Based on our preliminary investigation, our findings for the liquefaction potential at the site are as follows:

- The groundwater at the site is relatively deep (below 50 to 80 feet) south of Portola, except for Agua Chinon Canyon. Where the groundwater is deeper than 50 feet, the potential for liquefaction is slight to nil.
- North of Portola Parkway, the groundwater was generally shallower and these areas of alluvium will require further investigation.
- Based on our preliminary drilling, laboratory testing and liquefaction analysis, it appears that there may be local layers of potentially liquefiable alluvial soils in Bee and Round Canyons. These layers are generally limited in extent; they vary laterally as well as in thickness across the site. These layers may locally have the potential for seismic settlement. This type of potential seismic hazard can typically be mitigated through structural design.
- The potential for surface manifestation caused by liquefaction is considered low based on the thickness of the liquefiable layers, and the thickness of the non-liquefiable surface cover at its present surface contours.

2.9 Earthwork Bulking/Shrinkage and Subsidence

Due to the inherent variability of bedrock and soil materials, earthwork volume changes are difficult to accurately quantify. The following estimates are based on our experience with similar materials.

Material	***Approximate Percent Shrinkage/Bulking***
Colluvium and Topsoil	10 to 15 percent
Alluvium	5 to 10 percent
Sandstone and Siltstone Bedrock	2 percent shrinkage to 4 percent bulking

Ground subsidence at the site is estimated to be less than 0.1 foot.

2.10 Existing Utilities

There is a large water pipeline easement that crosses the site from the northwest corner to the southeast portion of the site. These pipelines are owned by the Santiago Aqueduct Commission (SAC) and Municipal Water District of Orange County and they maintain the easement. Two to three large water pipelines are in this easement. Several pumping stations and numerous vents and manholes are located along these pipelines across the site. There is a second private water line that crosses the central portion of the site from where Portola Parkway crosses the large water-line easement to the Lambert Ranch. There are also several agricultural irrigation mainlines that cross the property in the canyons and on the hillsides. There are also local overhead power lines in the southern portions of the site.

2.11 Rippability and Generation of Oversize Material

The rippability characteristics of bedrock depend upon the rock type and hardness, the depth of weathering, degree of fracturing, and the structure of the rock. Our borings were drilled into bedrock with some difficulty to depths of 105 feet. There were dense and cemented sandstone beds locally that required coring during drilling; however, most of these layers were thin (typically less than 3 feet thick). The degree of rock fracturing varied, but the rock was typically fractured and faulted. In general, the densest bedrock is the Williams Sandstone. There were also some well-cemented (siliceous) beds in the Monterey Formation. The Oso Member of the Capistrano Formation and the Niguel Formation have little cementation, and should be moderately easy to excavate with heavy equipment.

Rippability also depends upon the depth of design cut into the rock. It is anticipated that the denser bedrock will be rippable with difficulty with large bulldozers (D-9s and D-10s). Sandstone beds in the Williams and cemented beds in the Monterey formation excavations will require heavy ripping locally and oversize rock material may be generated. Deeper cuts and local areas of cemented sandstone will be the most difficult to excavate.

2.12 Oil Wells

There are three oil wells mapped at or near the site by the U.S. Geological Survey and/or the California Division of Mines and Geology (Plates 2 and 6). Shell Oil Company drilled these exploratory wells between 1949 and 1950 to determine the potential for oil deposits below the site. Irvine Core Hole No. 1 (Plate 2) was drilled to a depth of 893 feet. Their log indicated Williams Formation to a depth of 460 feet and then the Holz Shale Member of the Lad Formation from 460 to 893 feet. The well was abandoned after drilling. The depth and log information of the wells on Plate 6 are not known at this time. However, most of the exploratory wells in this area were dry wells and did not produce oil or gas.

3.0 CONCLUSION AND PRELIMINARY RECOMMENDATIONS

3.1 General Conclusion and Recommendation

Based on the results of our investigation, the proposed conceptual development is considered geotechnically feasible, provided the recommendations in this report are implemented during planning, design, and grading.

The recommendations in this report are preliminary. They are considered minimum and may be superseded by more stringent requirements of others. In addition to the following recommendations, General Earthwork and Grading Specifications are also provided in Appendix E. This report is also subject to revision following review of the grading plan and future subsurface investigations.

3.2 Remedial Removals

The unsuitable earth materials should be removed prior to placement of proposed fill. Unsuitable materials at the site include topsoil, slopewash, colluvium, uncertified fills, pond deposits, weathered alluvium, weathered landslide material, and weathered bedrock. Estimated removal depths generally vary across the site. Typical removal depths are 3 to 7 feet in the flatter areas and 2 to 10 feet in the hillside areas. Areas of uncertified fill and pond deposits exist in the canyons where diversion berms and channels were graded prior to 1950 and in the area of prior mining in Round Canyon. These areas may require deeper removals on the order of 15 to 20 feet deep. Local deeper removals may be necessary, such as in the Lambert Reservoir, where the removals extend to an approximate depth of 35 feet below existing ground surface. Deeper removals may also be required in areas where there are uncertified fills overlying native soils, and in the existing drainage channels where deep fills are planned.

Wet removals are likely in the Lambert Reservoir and locally at the site (Plates 9 and 10). These removals may require special equipment to remove the soils (i.e., excavator-top loading trucks or scrapers). The wet material may require drying back prior to use as fill material.

There are local areas at the site where stockpiles of highly organic materials exist (Plates 9 and 10). These materials are not suitable for use as compacted fill, but may be utilized for select topsoil.

The preliminary estimated removal depths are shown on the Geotechnical Constraints Map (Plates 9 and 10). The removal bottom should expose competent material or saturated alluvium and should be reviewed and accepted by the geotechnical consultant. Where possible, the removal bottoms should be scarified, moisture-conditioned and recompacted prior to placement of fill. Where removal bottoms expose saturated alluvium, bridging with gravels, sands or geofabrics may be necessary for workability.

Removals within and adjacent to the existing water line easement(s) will be limited due to the presence of the pipelines. Removals should be performed under the direction of the water districts. Removals and fill key excavations adjacent to the utility easement should be started far enough away from the pipelines to minimize impact to the pipelines. As a result, future structures may need to be set back from the utility easement or designed for additional settlement.

3.3 Slope Stabilization

3.3.1 Natural Slopes and Landslides

Hillsides along the northern and eastern portions of the site and locally, where archeologically sensitive, are anticipated to be left in their natural condition next to the proposed development. These hillsides will have to be evaluated on a site-by-site basis to assess the gross and surficial stability and the potential impacts to the development. If these hillsides have adverse bedding conditions, shear keys or buttresses will be necessary to stabilize the hillside. The pie diagrams and landslides on the Geotechnical Constraints Map (Plates 9 and 10) depict the general areas of unstable natural hillside that will impact the site. Depending upon the proposed design of the development, stabilization of these unstable hillsides will likely require excavation of buttresses that extend into the hillside areas, replacing the existing hillside with compacted fill slopes. These slopes will require terrace drains if they are over 30 feet in height.

Landslides will require additional investigation and design of shear keys or gravity buttresses for stabilization. These remedial grading measures will likely have the largest impact to the natural hillsides, since the keys will typically be larger and extend further into the natural hillside areas.

Where bedding is favorable (dipping into slope), the natural hillsides may still have a soil cover that is subject to surficial instability and erosion. Alternative remedial measures for surficial instability include:

- Placement of a slough bench area between the toe of the natural slope and the proposed lot or street improvement;
- Construction of a graded slope along the edge of the daylight fill that could be provided with a stabilization fill; or,
- Construction of a slough wall between the natural slope and the proposed improvement.

3.3.2 Cut Slopes

The pie diagrams shown on the Geotechnical Constraints Map (Plates 1 and 2) show the direction of the adverse bedding planes on the natural hillsides at the site. Proposed cut slopes within the development will be assessed individually to determine their stability. Based on the available data, the cut slopes with adverse bedding conditions may require slope stabilization. The actual key design will be provided once the grading plan is available. There may be other cut slopes that require stabilization when additional data becomes available.

Some of the cut slopes that have favorable geologic conditions may expose dense sandstone bedrock that will be difficult to landscape. In the past, stabilization fills have been constructed to replace the hard bedrock and facilitate planting of vegetation.

Cut slopes into the Oso Sandstone will be susceptible to erosion. Therefore, stabilization fills with subdrains and fill derived from other sources may be considered for these slopes. Alternative measures to mitigate erosion include covering the slope with a jute matting or geofabric until it can be planted and the vegetation is established.

Slopes proposed adjacent to the SAC water line easement will require special investigation and may need special measures (such as shoring or grading in small sections) to support the water lines during construction of the buttresses (if required).

Two of the existing cut slopes along Portola Parkway were provided with hydraugers (horizontal wells) back to 50 to 75 feet behind the face of the slope to allow drainage of natural seepage conditions. If development is planned in the vicinity of these slopes, then consideration should be given to rebuilding these slopes with stabilization fills and subdrains.

3.3.3 Fill Slopes

The reworked onsite soils are anticipated to provide adequate strength for the gross and surficial stability of the proposed fill slopes of up to 50 feet in height at 2H:1V inclinations. Base fill keys should be provided for these slopes. The depth of key should be a minimum of 2 feet into competent earth material. These base fill keys should be at least 15 feet wide and have a 2 percent tilt back into the slope. These fill slopes are anticipated to be stable as designed provided they are constructed in accordance with the details in our General Grading and Earthwork Specifications (Appendix E).

If large fill slopes are planned next to the water-line easement, evaluation should be made for impact of the fill on the water lines. Proper remedial measures should be provided to protect the water lines in place.

3.4 Groundwater

The groundwater table varies from 10 to 80+ feet below ground in the alluvial canyons at the site. Groundwater is typically deep below the site, and probably will not be encountered during grading, with only local exceptions. The shallowest groundwater (between 3 and 15 feet deep) is located in the far northern reaches of the canyons (north of Portola Parkway) and upstream of Agua Chinon Dam. It is possible that during grading in these areas, excavations will extend down to the groundwater table, exposing saturated alluvium in the removal bottom. For cuts into the hillsides adjacent to the orchards, local perched groundwater seepage may be encountered.

Due to the constant irrigation of the orchards, water percolates into the ground through fractures, faults, and sandy soils. Where the fractured bedrock is exposed in deeper cuts, seepage may be encountered and additional subdrainage may be necessary.

Wet soils may be encountered locally throughout the site, such as in Lambert Reservoir. Other locations are indicated on the Geotechnical Constraints Map (Plates 9 and 10). We have recommended that some of the wet soils be removed and recompacted (see Section 3.2).

3.5 Faulting and Seismicity

There are numerous faults mapped at the site. Many more minor faults were encountered in the subsurface investigation (borings and trenches). Based on aerial photo interpretation, mapping, and investigations by NMG and others, there is no evidence of seismically active faulting at the subject site. There may also be cut areas throughout the site that expose highly faulted and fractured bedrock and should be capped with a fill blanket.

3.6 Liquefaction Potential

Potentially liquefiable layers were noted in Borings H-12 and H-13 at depths of approximately 50 to 60 feet below existing ground surface. Depending on the final design of the development, additional geotechnical investigation may be necessary to estimate both the lateral and vertical extent of these potentially liquefiable layers. This area of higher liquefaction potential is shown on the Geotechnical Constraints Map (Plates 9 and 10).

Surface manifestation caused by liquefaction is considered a low risk based on the thickness of the liquefiable layers and the thickness of the non-liquefiable surface cover at its present surface contours. However, if significant cuts below the existing ground elevations are proposed within this area, the surface manifestation caused by liquefaction should be re-evaluated. In general, increasing the grades in these areas would reduce the effects of liquefaction on the proposed development.

The current liquefaction evaluation is considered preliminary and additional exploration will be required to obtain a more accurate assessment of the liquefaction potential and other seismic hazards, including lateral spread. The requirements and guidelines imposed by the regulatory agency for liquefaction evaluation can vary significantly and extensive exploration and testing may be required to address the seismic hazard potential.

Implementation of mitigation measures should be designed to either eliminate the liquefaction potential or to allow partial improvement of the soils and provide structures that can accommodate the liquefaction-induced vertical and horizontal deformations. Alternative remedial measures that may be considered for zones of higher liquefaction potential include:

- Structural options/special foundation design (mat foundation, stiffened post-tensioned slabs),
- Soil/ground improvement (e.g., stone columns, compaction grouting), and

- Avoidance or setback from liquefaction areas.

3.7 Settlement Potential

Our comments regarding settlement potential assume that the structures will be of low-rise construction (i.e., relatively light foundation loads) and the design fill will not exceed about 40 feet. Heavy structures or deep fills may need special site-specific consideration, and possibly additional mitigation for settlement.

The source and amount of potential settlement varies over this large site due to variations in subsurface conditions and depths of planned cuts and fills. The potential settlements anticipated to be of major concern within portions of the subject site can be separated into three types:

(1) hydroconsolidation (collapse upon wetting) of alluvium left in place above the water table,
(2) time dependent consolidation settlement of compressible alluvium left in place below the water table, and
(3) possible liquefaction-induced settlement of a few loose, granular layers below the water table.

Our recommended remedial removals (Section 3.2) are intended to remove the potentially collapsible and/or very compressible near-surface material. Settlement should not be of special concern with the majority of the site where remedial removals will extend down to bedrock or very dense alluvium. Most of the alluvium at the site is considered medium dense to dense. However, in local areas, such as in the vicinity of Boring H-7, compressible alluvial deposits are expected to be left in place. This alluvium will compress when loaded with the design fill. The amount of settlement will depend on the thickness of design fills and loading conditions. In areas where fills of more than 5 feet in thickness are designed, settlement monitoring may be recommended to verify the required waiting periods prior to construction of the improvements. Typically, the monitoring period lasts 3 to 6 months, and may be supplemented by an increase in the stiffness of the foundation/slab to mitigate some remaining longer-term settlement.

An area with some liquefaction potential has been identified within the subject site (Section 2.8). Additional exploration is needed to refine the recommendations for remediation within this area. Post-tensioned slabs can be strengthened and stiffened enough to withstand such movement without major structural damage.

3.8 General Earthwork

Prior to grading, deleterious material (highly organic topsoil, vegetation, trash, construction debris) should be cleared from the site and disposed of offsite. We encountered numerous irrigation lines that cross the site. These lines should be removed and the areas should be properly backfilled. It should be noted that asbestos cement pipes have been used in the past on the Irvine Ranch and may be encountered during grading.

Grading and excavations should be performed in accordance with the County of Orange Grading Code and the General Earthwork and Grading Specifications in Appendix E. Prior to placement of fill, removal bottoms should be scarified a minimum of 6 inches, moisture-conditioned as needed, and compacted to minimum 90 percent relative compaction. Relative compaction should be based upon ASTM Test Method D1557. Moisture content of fill soil should be over optimum moisture content. However, consideration should be given to placing fill at higher moisture contents to facilitate the subgrade presoaking process under slabs-on-grade.

Native materials that are relatively free of deleterious material should be suitable for use as compacted fill. If import soils are required in order to achieve design grades, they should be evaluated by the geotechnical consultant prior to and during transport to the site to verify its suitability.

Fill material should be placed in loose lifts no greater than 8 inches in thickness and compacted prior to placement of the next lift. Ground sloping greater than 5:1 (horizontal to vertical) should be prepared by benching into firm, competent material as fill is placed.

3.9 Rippability and Placement of Oversize Material

The bedrock formations at the site include dense sandstone and siltstone that will be difficult to rip. We anticipate that the rock will be rippable with difficulty (using D-9 and D-10 bulldozers) in the planned excavations (design cuts less than 80 feet). It is possible that non-rippable rock may exist locally in the deepest cuts where cemented beds are encountered. Locally, these cuts will produce oversize rock (greater than 12 inches in size) that will require special placement in the fill. The Grading and Earthwork Specifications in Appendix E include details of the placement of oversize rock.

3.10 Lot Capping/Overexcavation

The proposed grading is anticipated to expose cut and fill transitions at finish grade of many of the lots. Lot-capping requirements due to the cut/fill transition conditions should be reviewed when the rough/precise grading plans become available.

In the canyon areas where shallow cuts and fills are planned, the cut portions of the pads should be overexcavated to remove the unsuitable materials. In addition, these pads should be overexcavated to a depth of 3 to 4 feet below finish grade to provide a uniform fill blanket over the alluvium. This is consistent with the standard of practice in the northern areas of the City of Irvine.

In areas where hard rock is exposed at grade and cannot be excavated with normal trenching equipment or backhoes, overexcavation may be implemented to a minimum depth of 5 to 10 feet (or to the deepest utility line) to facilitate future foundation construction and utility installation.

Lot capping may also be recommended during grading in areas were earth materials are very different on a lot, such as in areas where highly expansive claystone bed is encountered in sandstone. Lot capping may also be recommended in areas of faulting, since the rock may be very fractured with a potential for groundwater seepage.

3.11 Subdrainage

Canyon-type subdrains (9 cubic feet per foot of gravel with an 8-inch, Schedule 40, perforated pipe wrapped in filter fabric) should be placed on the removal bottom of the canyons prior to placement of fill. Where the canyons are wide, the need for subdrains should be evaluated.

Backdrains (3 cubic feet per foot) should also be provided for all buttresses and stabilization fills at 30-foot-vertical intervals with outlets every 100 feet through the slope face. Backdrains should also be provided for side hill keys and shear keys.

During grading, additional subdrains may be necessary for areas where seepage is encountered (i.e., along highly fractured bedrock zones) and if shallow groundwater conditions are found to exist near the finish grade of future building pads.

3.12 Expansion Potential

The expansion potential of site soils generally range from low to medium as classified by 1997 UCB Table 18-I-B. Although some relatively thin claystone beds will probably be of high expansion potential and some sandstone beds are likely to be of very low expansion potential, grading and lot capping are likely to blend the near-surface soils so that at the completion of grading most of the residential lots should fall within the medium range. Only a few lots would be of high expansion potential.

In general, the alluvium, colluvium and slopewash materials are anticipated to have a medium to high expansion potential; the Williams, Oso and Niguel sandstone bedrock is anticipated to have low expansion potential; and the Puente and Monterey siltstone bedrock is anticipated to have high to very high expansion potential. Local sandy clay beds in the Oso bedrock may also have a high expansion potential. The clayey pond deposits in Lambert Reservoir may have very high expansion potential.

The Uniform Building Code specifies special foundation/slab design for residential construction on expansive soils such as exists of the subject site. Preliminary recommendations for foundation/slab design are provided in Section 3.13.

3.13 Preliminary Foundation Design

Shallow foundations and slabs-on-grade (including post-tensioned slabs) may be used for low-rise structures. On average, as-graded, near-surface soils are expected to be around the "medium" expansion potential range. The 1997 Uniform Building Code requires specific foundation and slab design for soils having expansion index of low or greater. Principally, the design must be post-tensioned slabs per the Post-Tensioning Institute (PTI) method or slab-on-grade per the Wire Reinforcement Institute (WRI) method. Any other foundation and slab designs must be specifically submitted by the geotechnical and structural engineers and approved by the building official.

Preliminary geotechnical parameters for PTI slabs are provided in Table 1 (next page). We recommend the medium expansion category be used by the structural engineer for the anticipated conditions. An effective plasticity index of 30 may be used for preliminary foundation design based on the WRI method.

Additional foundation design constraints may be required for structures located in areas, which have a higher potential for settlement or for structures that have low settlement tolerances. This may result in stiffened foundations systems that are similar to those that would be designed for the "high" or "very high" expansion potential range.

Preliminary sizing of foundations may be based on an allowable bearing capacity of 1,500 psf for a 12-inch-wide footing embedded 12 inches below nearest adjacent grade. This may be increased by 400 psf for each foot of additional embedment in approved material and 300 psf for every additional foot of width up to a maximum value of 3,000 psf. The allowable bearing pressure may be increased by one-third for wind and seismic loading. For medium or higher expansion potential, exterior footings should be at least 18 inches deep. The coefficient of resistance of 0.35 against sliding for concrete in contact with native soil may be used.

Additional soil sampling and laboratory testing should be performed to verify the expansion potential of onsite soils and to provide additional design parameters for the PTI or WRI methods.

TABLE 1

PRELIMINARY GEOTECHNICAL PARAMETERS AND FOUNDATION DESIGN RECOMMENDATIONS FOR DESIGN OF POST-TENSIONED SLABS BASED ON 1997 UBC SECTION 1816

Expansion Index	*Em_c*	*Em_e*	*Ym_c*	*Ym_e*	*Minimum Perimeter Footing Embedment**	*Presoak Requirement*
Low	4.6'	2.5'	2.1"	0.5"	12"	At least optimum to 6 inches
Medium	5.3'	3.0'	2.5"	0.7"	18"	1.2 x optimum to 12 inches
High	5.6'	3.5'	3.8"	1.0"	18"	1.3 x optimum to 18 inches
Very High	6.0'	4.0'	4.6"	1.1"	24"	1.4 x optimum to 24 inches

**but, in all cases, not less than 1997 UBC Table 18-I-C*

The seismic design parameters based on the 1997 UBC are included in Table 2, rear of text.

3.14 Concrete in Contact with Soil

The soluble sulfate content for the onsite alluvial soils tested is well within the range of "negligible sulfate exposure" for concrete as classified in the 1997 UBC Table 19-A-4. Although the UBC does not require any special concrete design for "negligible sulfate exposure", we recommend that, as a minimum, at least Type II cement be used even with negligible sulfate exposure. Moreover, we recommend that additional sulfate testing be performed during future investigations at the site and specifically on soils exposed at the surface after completing grading. There may be some bedrock materials that do have high sulfate contents.

3.15 Soil Corrosivity to Metal

The site soils range from severely corrosive to moderately corrosive to ferrous metals and may also be deleterious to copper. This is a very common range of corrosivity within Orange County. Where metals will be in contact with onsite soils for long periods of time (such as buried iron or steel pipe), corrosion control measures should be taken to prolong their life.

3.16 Asphalt Pavement and Subgrade

The final recommended pavement sections for the site should be based on:

- Traffic studies to determine the expected Traffic Index (TI) values for the various streets, and
- The actual R-values of the street subgrade soils after completion of grading.

This initial investigation suggests that the R-values for street subgrades are likely to be low unless selective grading or imported material is used. An R-value of about 10 is appropriate for preliminary design purposes. In addition, the following pavement sections might be useful for preliminary design purposes, but do not represent a final design:

- Residential streets (assuming a TI of 5) on the order of 4 inches of asphalt concrete over 8 inches of aggregate base.
- Collector streets (assuming a TI of 7) on the order of 6 inches of asphalt concrete over 12 inches of aggregate base.

3.17 Surface Drainage

Surface drainage should be carefully taken into consideration during all grading, landscaping, and building construction. Positive surface drainage should be provided to direct surface water away from structures and slopes and toward the street or suitable drainage devices. Ponding of water adjacent to the structures should not be allowed. Paved areas should be provided with adequate drainage devices, gradients, and curbing to reduce run-off flowing from paved areas onto adjacent unpaved areas.

The performance of foundations is also dependent upon maintaining adequate surface drainage away from structures. The minimum gradient within 5 feet of the building will depend upon surface landscaping. In general, we recommend that unpaved lawn and landscape areas have a minimum gradient of 2 percent away from structures immediately adjacent to structures and a minimum gradient of 1 percent for devices such as swales to collect this runoff and direct it toward the street or other appropriate collection points.

3.18 Erosion Potential

The Oso Member of the Capistrano Formation consists of fine-grained sandstone. This bedrock is highly susceptible to erosion. Where this sandstone is exposed in sloping cut areas and cut slopes, deep erosion gullies can occur during rainfall. Therefore, consideration should be given to capping these areas with more cohesive fill materials and providing stabilization fills with more cohesive compacted fills to mitigate the erosion potential.

3.19 Select Grading

Select grading may be considered during grading to stockpile sandy and gravelly soils for later uses, such as trench and retaining-wall backfill, subgrade soils and capping materials. The Niguel Formation could be a good source of sand and gravel, and the Oso sandstone and possibly some beds in the Monterey Formation may be good sources of fine sand. The highly organic soils and fills in the southeast portion of the site may be utilized as topsoil for landscape areas.

3.20 Protection of Existing Utilities

Existing utilities should be located and marked during grading operations. Grading and construction activities over the pipelines should be performed with care and under the direction of the utility company. Stockpiling of soils over these lines should not be allowed without prior acceptance by the utility company. Operation of heavy equipment and crossings over waterlines with heavy equipment should be in conformance with IRWD, MWD and SAC guidelines (e.g., ramps, plating). Excavations adjacent to the waterline easement should be performed with care, so as not to undermine or destabilize the adjacent ground.

Future structures may need to be set back from the utility easement or designed for additional settlement since remedial removals will be limited within and adjacent to this area to protect the pipelines.

3.21 Oil and Water Well Abandonment

There are three exploratory oil wells at the site that were previously abandoned in 1949-50. The approximate locations of these wells are shown on Plates 2 and 6. These wells should be located during the grading operations and reabandoned to current standards of the California, Division of Oil and Gas.

There are known groundwater observation wells in the southeast portion of the site in the area of the old hilltop quarry. These wells should be located during grading and abandoned to current standards of the County of Orange, Department of Health Services.

3.22 Utility Construction

Excavations should conform to the applicable safety requirements. The native soils across most of the site may be classified as Type B for CalOSHA trench excavation requirements. Locally, especially in the deeper excavations, Type C soils (running sands and possibly perched groundwater) should be expected. Some zones of relatively clean sands were encountered in our investigation (see Boring and Trench Logs). Native soils should be suitable for use as trench backfill. Backfill materials should be compacted to a minimum relative compaction of 90 percent.

3.23 Future Geotechnical Investigations and Review of Grading Plans

This investigation is considered limited and is for planning purposes only. We anticipate that in the future, as grading plans become available, additional geotechnical investigations will be necessary. Future grading/construction plans should be reviewed by the geotechnical consultant in light of the site-specific geotechnical conditions. Additional geotechnical analysis will be performed based on these reviews. Separate grading plan review reports will be required by the governing agency. Additional study will also be required in areas mapped by the State as seismic hazards, if applicable.

APPENDIX A

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AERIAL PHOTOGRAPHS

Date	*Flight*	*Photo No.*	*Scale (1"=)*	*Source*
12/12/52	2K	143, 144	1667'	Continental
12/12/52	3K	34, 35, 36	1667'	Continental
1/31/81	211	10-15,10-16, 11-13, 11-14	2,000'	Continental
9/11/97	C116	38-127, 38-128	2000'	Continental

BORING AND TRENCH LOGS

NMG GEOTECHNICAL, INC.

THIS INVESTIGATION

BORING AND TRENCH LOGS

LEIGHTON AND ASSOCIATES, INC.

REPORT DATED MAY 1990

BORING AND TRENCH LOGS

GEOFON, INC.

REPORTS DATED MAY AND OCTOBER 1991

BORING LOGS

MOORE AND TABER

REPORTS DATED AUGUST 1992

BORING AND TRENCH LOGS

SILVERADO CONSTRUCTORS

REPORTS DATED AUGUST AND DECEMBER 1996

BORING AND TRENCH LOGS

WOODWARD CLYDE CONSULTANTS

REPORT DATED SEPTEMBER 1990

LABORATORY TEST RESULTS

NMG GEOTECHNICAL, INC.

THIS INVESTIGATION

LABORATORY TEST RESULTS

LEIGHTON AND ASSOCIATES

REPORT DATED MAY 1990

LABORATORY TEST RESULTS

WOODWARD CLYDE CONSULTANTS

REPORT DATED SEPTEMBER 1990

PRELIMINARY GEOTECHNICAL INVESTIGATION AND PLANNING STUDY FOR CONCEPTUAL DESIGN, PLANNING AREA I-6 CITY OF IRVINE SPHERE OF INFLUENCE COUNTY OF ORANGE, CALIFORNIA

VOLUME I OF II

June 16, 2000
(Revised August 17, 2001)

Project No. 99070-01

Prepared for:

Irvine Community Development Company
550 Newport Center Drive
Newport Beach, CA 92660 8904

TABLE 2

SEISMIC DESIGN PARAMETERS BASED ON UBC 1997

Seismic Zone from Figure 16-2	4
Soil Profile Type from Table 16-J	S_A to S_D
Seismic Source Type from Table 16-U	B
Distances to known Source	7 miles
Closest Known Seismic Sources	Elsinore Fault

March 20, 2001
Revised August 10, 2001

Project No. 990258-001

To: Irvine Community Development Company
550 Newport Center Drive
Newport Beach, California 92658-6370

Attention: Mr. Terry Hartman

Subject: Report of Geotechnical Feasibility Study for Planning Areas I-08A and I-09A, City of Irvine, California

In accordance with your request and authorization, Leighton and Associates, Inc. (Leighton) has performed a geotechnical feasibility study for the development of Planning Areas I-08A and I-09A within the city of Irvine, California. Our understanding of the project was based on information provided to us by you, and topographic plans for the subject areas forwarded to us by Mr. Jamie Yoshida of Van Dell and Associates, Inc., the project civil engineers. This report presents the results of our field investigation, laboratory testing, and geotechnical review, and provides our conclusions.

Based on the findings of this geotechnical feasibility study, there appear to be no significant geotechnical constraints within the subject site that cannot be mitigated by proper planning, design, and sound construction practices. Developing the subject site for the planned commercial and residential use is feasible from a geotechnical standpoint, provided the findings, conclusions, and recommendations presented in this report are taken into consideration in the development of the site.

Please note that the conclusions and recommendations in this report are based in part upon data that were obtained from a limited number of borings, samples, and tests. Such information is by necessity incomplete. The nature of many sites is such that differing geotechnical or geological conditions can occur within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, the findings, conclusions, and recommendations presented in this report can be relied upon only if Leighton and Associates, Inc., has the opportunity to perform a detailed geotechnical review of the finalized grading and development plans for the subject areas. Additional subsurface investigation, laboratory testing, and analyses may be required during that geotechnical review, based on the planned future development of the site.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

Matthew Hawley, CEG 2122
Project Geologist

Ani Bhattacharyya, PE 57126
Project Engineer

Reviewed by:

Ross Khiabani, PE, GE 2202
Vice President/Sr. Principal Engineer

MCH/ATB/ROK/jeh

Distribution: (6) Addressee
(2) Templeton Planning Group
Attention: Mr. Bill Halligan

1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of this feasibility study was to obtain information pertaining to the geotechnical characteristics at the subject site, and form a preliminary opinion regarding the geotechnical suitability of the site for the proposed future development. The scope of our work included the following tasks:

- Review readily available data pertinent to the site to obtain information necessary for design purposes.
- Perform subsurface exploration consisting of excavation, logging, and sampling of a total of sixteen geotechnical borings. Representative undisturbed and bulk soil samples were collected at selected depth intervals and transported to our laboratory for testing.
- Perform laboratory tests on selected representative samples to evaluate engineering characteristics of the onsite soils within the explored depths.
- Perform geotechnical evaluation of collected data and relevant engineering review.
- Prepare this report summarizing our findings, conclusions, and recommendations.

1.2 Site Location

The subject site is located within the northeast portion of the city of Irvine. Planning Area I-09A comprises a total area of approximately 1,250 acres, and is bounded to the northeast by Portola Parkway, on the southwest by Trabuco Road, on the southeast by the Foothill Transportation Corridor, and on the northwest by Jeffrey Road. Planning Area I-08A, comprising a total area on the order of 75 acres, is located to the west of Planning Area I-09A, and is bounded on the northeast by Bryan Avenue, on the southeast by Trabuco Road, on the southeast by Jeffrey Road, and on the northwest by existing residential developments. The approximate location of the subject area is indicated on Figure 1, Site Location Map. Ground surface elevation at the site varies from approximately 180 feet above Mean Sea Level (MSL) at the western corner of Planning Area I-08A to over 410 feet above MSL near the eastern corner of Planning Area I-09A. The site is currently under agricultural use. It is our understanding that a combination of residential and commercial developments is being considered for the subject site.

1.3 Field Investigation

Prior to the subsurface field investigation, an in-house literature review of the anticipated geologic conditions was performed. Armed with this geologic information, a site reconnaissance was performed by an engineer from our staff to mark the boring locations with consideration of access for heavy equipment and avoidance of subsurface structures. The proposed locations of our borings were observed and approved by Mr. Dominic Etcheberria of Irvine Valencia Growers and Mr. George Gutman of Hines Nurseries. Our subsurface investigation was performed from January 10, 2000, to January 12, 2000. A total of sixteen 8-inch-diameter hollow-stem auger borings (titled B-1 through B-16) were drilled using a CME drill rig to a maximum depth on the order of 51.5 feet below the existing ground surface. The approximate locations of these borings are depicted on Plate 1, Approximate Boring Location Map.

All borings were geotechnically logged and sampled using the Standard Penetration Test (SPT) and California Ring (Ring) samplers at selected intervals. The SPT and Ring samplers were driven into the soil with a 140-pound hammer, free falling 30 inches. The CME drill rig was equipped with an automatic hammer, which was estimated to have an equivalent energy of about 80 percent. The number of blows were noted for every 6 inches of sampler penetration. Relatively undisturbed samples were collected from the borings using the Ring sampler. Sampling generally followed SPT and split-barrel sampling of soil procedures (ASTM Test Method D1586). In addition to driven samples, representative bulk soil samples were also collected from the borings.

Each soil sample collected was described in general conformance with the Unified Soil Classification System (USCS). The soil descriptions and sample locations were noted on boring logs; copies of these logs are included in Appendix B of this report. All samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the borings were backfilled with soil cuttings.

1.4 Laboratory Testing

Laboratory tests were performed on representative samples to verify the field classification of the recovered samples and to determine the geotechnical properties of the subsurface materials. The following tests were performed:

- In-situ moisture content and density;
- Maximum Dry density and optimum-moisture content;
- Grain-size distribution (percent passing No. 200 sieve);
- Atterberg Limits;
- Expansion potential;
- Consolidation; and

- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests, except corrosivity tests, were performed in general conformance with ASTM procedures. The corrosivity tests were performed in accordance with CALTRANS procedures. The results of our laboratory tests are presented in Appendix C of this report. The results of the in-situ moisture contents and dry densities of the ring samples are presented on our geotechnical boring logs (Appendix B).

2.0 GEOTECHNICAL FINDINGS

2.1 Geologic Setting

The subject site lies within the eastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. The site is located approximately 180 to over 410 feet above MSL within an area called the Tustin Plain, the eastern-most subbasin of the Los Angeles Basin. Generally speaking, the Tustin Plain is comprised of approximately 1,400 feet of unconsolidated to semi-consolidated Holocene to Quaternary-age alluvial sediments. Soils within this zone consist predominantly of interbedded discontinuous lenses of clays, silts, sands and gravel. For the site, the upper 20 to 30 feet is comprised of fine-grained soils that are unconsolidated with a wide range of consistency. The soils below approximately 20 to 30 feet are comprised of coarse-grained materials that are locally loose or friable, but generally dense. Underlying the Holocene to Quaternary deposits, at depth, are Tertiary bedrock units comprised of sandstone, siltstone, shale, and conglomerate that are several thousands of feet thick.

The groundwater table beneath the Tustin Plain in this area is generally located at a depth greater than 100 feet below ground surface. Local zones of perched groundwater are known to be present within the alluvial deposits within the upper approximately 100 feet. At adjacent sites within the Tustin Plain, located within a few miles from the site, perched water deposits have been encountered at depths as shallow as 10 to 22 feet below ground surface (Leighton, 1994).

No landslides are known to be located at the site, nor were any observed during our field review.

2.2 Subsurface Soil and Groundwater Conditions Encountered During Recent Investigation

Subsurface soils at the subject site were found to be comprised of layered deposits of slightly moist to moist clayey soils and dry to moist sandy soils, with varying amounts of silt content. The thicknesses of the individual soil deposits varied from a minimum of approximately 5 feet to a maximum on the order of 30 feet. The consistency of the clayey soils generally varied from medium stiff to very stiff, however, a few thin soft clay zones were encountered during our subsurface investigation. The relative density of the sandy soils at the site ranged generally from loose to medium dense with local zones of very loose sands.

Subsurface water was encountered in Boring B-15, at an approximate depth of 48.5 feet below ground surface. The other borings drilled within the subject site (B-1 through B-14 and B-16) did not encounter any groundwater. Based on the lack of groundwater within the other borings drilled to this zone, it is interpreted that the encountered groundwater is a localized perched condition.

2.3 Soil Compressibility and Collapse Potential

Our field exploration and laboratory testing indicate that the near-surface clayey soils are generally of low compressibility, and that the collapse potential of the subsurface soils is expected to be low. We recommend that a re-evaluation of the potential for settlement and collapse of near-surface soils be performed in light of the finalized grading and improvement plans for the subject site.

2.4 Expansive Soil Characteristics

Based on laboratory tests of representative samples, near-surface clayey soils are of medium to high expansion potential, as defined in the Uniform Building Code (UBC, 1997), Table 18-I-B. Additional tests should be carried out on samples of near-surface soils during future phases of geotechnical investigations after grading and improvement plans are developed.

2.5 Soil Corrosivity

The National Association of Corrosion Engineers (NACE) defines corrosion as "a deterioration of a substance or its properties because of a reaction with its environment." From a geotechnical viewpoint, the "environment" is the prevailing foundation soils and the "substances" are reinforced concrete foundations or various types of metallic buried elements such as pipes, etc., which are in contact with or within close vicinity of the soil.

In general, soil environments that are detrimental to concrete have high concentrations of soluble sulfates and/or pH values of less than 5.5. Table 19-A-4, of the 1997 UBC, provides specific guidelines for the concrete-mix design when the soluble sulfate content of the soils exceeds 0.1 percent by weight or 1,000 ppm. The minimum amount of chloride ions in the soil environment that are corrosive to steel, either in the form of reinforcement protected by concrete cover, or plain steel substructures such as steel pipes or piles, is 500 ppm per California Test 532. Results of laboratory corrosivity tests conducted on near-surface samples indicate soluble sulfate contents varying between 0.014 percent and 0.02 percent, chloride content on the order of 0.02 to 0.03 ppm, pH values on the order of 7.5, and minimum electrical resistivity values on the order of 445 ohm-cm to

800 ohm-cm. Based on these results, concrete in contact with the existing clayey soils at the site is expected to be subject to negligible sulfate exposure (as per Table 19-A-4 of 1997 UBC) and mild chloride exposure. Metal components in contact with the clayey soils at the site could be subject to severe effects of corrosion.

It is Leighton's recommendation that the corrosivity characteristics (i.e., soluble sulfate content, chloride content, pH, and electrical resistivity) of the near-surface soils be verified by additional testing during the future phases of geotechnical investigation and review.

2.6 Faulting and Seismicity

2.6.1 Faults

No active faults are known or mapped as crossing the subject site. The closest active faults to the site are the Newport-Inglewood (Offshore) Fault to the southeast and the Glenn Ivy-Elsinore at about the same distance to the northeast, approximately 11.8 miles (18.9 km).

2.6.2 Historic Seismicity

The computer program EQSEARCH (Blake, 1996) was used to evaluate past, documented seismic activity of the site area. This program performs an automated search of a catalog of historic southern California earthquakes, and computes and prints the epicentral distance from a selected site to each of the earthquakes within a specified search radius 100-km (62 miles). From the computed distances, the program also estimates (using an appropriate attenuation relation) the peak horizontal ground acceleration that may have occurred at the site due to each earthquake. A database of recorded earthquakes with magnitudes of 4.0 or larger between 1800 and 1998 was used in the analysis. The result of the analysis includes a listing of historic earthquakes within 62 miles of the site (Appendix D).

2.6.3 Geological Hazards

The two principal seismic considerations for most properties in Southern California are surface rupturing of earth materials along fault traces and damage to structures due to seismically induced ground shaking. The fault classification system adopted by the California Division of Mines and Geology (CDMG), relative to the State legislation delineating Earthquake Fault Zones along active or potentially active faults (Alquist-Priolo Act), is used for structures. An active fault is one that is known to have moved in Holocene time (the last 11,000 years). A fault that is known to have moved during the last 1.6 million years (Pleistocene time), but has not been proven by direct evidence to have either moved, or not moved within the last 11,000 years, is considered to be potentially active. Any fault proven to be older than 11,000 years is considered inactive.

The site is not located within an Alquist-Priolo Special Studies Zone (Hart, 1992) and no active faults are known to underlie the site. The site is not located within a liquefaction seismic hazard zone (CDMG, 2001a and 2001b). The site lies within Seismic Zone 4 of the UBC. Based on our current understanding of the geologic framework of the site area, the seismic hazard which is expected to have the highest probability of affecting the site is ground shaking resulting from an earthquake occurring along any of several major active and potentially active faults in Southern California. Known regional active faults that could produce significant ground shaking at the site include the Newport-Inglewood (Offshore), and Whittier, Elysian Park Thrust, and Compton Thrust Faults, among others.

The intensity of ground shaking at a given location depends primarily upon the earthquake magnitude, the distance from the source, and the site-response characteristics. Peak Horizontal Ground Acceleration (PHGA) for the site was estimated using probabilistic seismic hazard assessments. The assessments require information regarding fault geometry, the magnitude of the earthquake for the fault, and an attenuation relationship. The attenuation relationship assesses how ground motion amplitudes decrease with distance. This relationship is commonly derived from data of similar earthquake types in similar geographic locales.

A probabilistic seismic hazard analysis was performed using the computer program FRISKSP (Blake, 1998) in order to estimate the PHGA that could occur at the site, based on recurrence interval. The probabilistic analysis considered various magnitudes of earthquakes that active or potentially active faults within a 62-mile (100-km) radius of the site could produce along their respective fault lengths. Standard deviation was applied during the analysis to assess the uncertainty inherent in the calculation with respect to magnitude, distance, and ground motion. An averaging of four attenuation relationships (Boore et al., 1997; Campbell and Bozorgnia, 1997; Sadigh et al., 1997; and Idriss, 1994) for a “soil” site was used to estimate ground motions at the site for multiple distance/magnitude calculation combinations inherent in the probabilistic analysis.

The results of the probabilistic seismic hazard analysis suggest an average maximum probable earthquake (10 percent probability of exceedance in 50 years - 475 year return period) ground acceleration of 0.26g for the site. The upper bound earthquake (10 percent probability of exceedance in 100 years - 950 year return period) ground acceleration was determined to be approximately 0.30g.

Recent research in the tectonics of Southern California indicates the possible presence of a potentially active fault in the region (San Joaquin Hills Thrust and El Modino Faults). To date, guidelines for considering these fault systems have not been established in the industry.

2.6.4 Other Seismic Hazards

In addition to seismic shaking, other effects of seismic activity include liquefaction and seismic settlement, surface fault rupture, landsliding, lateral spreading, earthquake-induced flooding, seiches and tsunamis. Results of a site-specific evaluation of the potential of these effects impacting the proposed site are presented below:

- Liquefaction: Liquefaction is a seismic phenomenon in which loose, saturated, fine-granular soils behave similarly to a fluid when subjected to high-intensity ground shaking. Liquefaction occurs when three general conditions exist: 1) shallow groundwater; 2) low density, fine, clean sand soils; and 3) high-intensity ground motion. Studies indicate that saturated, loose and medium dense, near-surface cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. Effects of liquefaction on level ground can include sand boils, settlement, and bearing capacity failures below structural foundations. Lateral spreading can also occur in areas of sloping ground.

  Review of the State of California Seismic Hazard Zones Map for the El Toro and Tustin Quadrangles (2001a and 2001b) indicates that the project site is not in an area susceptible to liquefaction.

  As indicated on our boring logs, our subsurface investigation revealed several deposits of very loose to loose sandy soils at various depths underlying the subject site. Such soil deposits, when saturated, have the potential to liquefy and settle under the effects of dynamic shaking, such as during a strong-motion earthquake. Our subsurface investigation did not reveal the presence of a shallow groundwater table at the subject site; as reported in Section 2.2, perched groundwater was encountered at a depth of approximately 48.5 feet below existing ground surface in only one boring (Boring B-15), located near the southwestern edge of the subject site. Our review of the Orange County Water District 1989-1999 Engineer's Report (2000) indicates that groundwater elevations within this portion of Orange County are approximately 60 to 100 feet below the present ground surface. In addition, our research of the California Department of Water Resources Website (www.dwr.water.ca.gov) revealed data on three active groundwater wells located in the immediate vicinity of the site, with recorded groundwater depths between 75 to 120 feet below the ground surface (well numbers 05S08W29P01S, 06508W06Q01S, and 05S08W31K01S). It is our conclusion that the groundwater table beneath the site is located at a depth generally greater than 50 feet below ground surface; however, perched water deposits may be encountered.

It is Leighton's conclusion that the current potential for liquefaction and related effects at the subject site is low due to the absence of a shallow groundwater table. However, as mentioned previously, isolated bodies of perched, shallow water may exist within the site at locations in between our borings. Further, based on future development and localized water regimes, the potential for liquefaction may occur at previously nonliquefiable zones. It is Leighton's recommendation that site-specific review of the potential for liquefaction and related effects be carried out during future geotechnical phases of site development.

- Surface Fault Rupture: The site is not located within an Alquist-Priolo Special Studies Zone. Based on our current understanding of faulting in the site vicinity, the potential for fault surface rupture impacting the site is considered remote.

- Landsliding: Seismically induced landslides and other slope failures are common occurrences during or soon after earthquakes. The project site and adjacent areas are relatively flat. In the absence of significant ground slopes, the potential for seismically induced landslides impacting the proposed site is considered to be nil.

- Lateral Spreading: Seismically induced lateral spreading involves lateral movement of earth materials as a result of liquefaction. It differs from slope failure in that complete ground failure involving large downslope movement does not occur due to the relatively shallow gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movements of the soil mass involved.

  As previously mentioned, the possibility of liquefaction of the subject site is low. Consequently, the potential for lateral spreading is also considered to be low, at this time. Site-specific review of the potential for lateral spreading at the site should be carried out during future phases of geotechnical work.

- Earthquake-Induced Flooding: Earthquake-induced flooding is caused by dam failures or other water-retaining structure failures as a result of seismic shaking.

Our review of the El Toro, California Topographic Map (USGS, 1982) indicates the Rattlesnake Reservoir and Siphon Reservoir are located just northeast of the subject site. Further, our review of Flood Insurance Rate Maps (FEMA, 1989) indicate large portions of the site are located within "Zone A" or areas of potential susceptibility of 100-year type flooding in which no base flood elevations have been determined.

Based on our review of the above information and recent grading activities since the preparation of the above maps; i.e., the transportation corridors and subsequent alteration of nearby sheet flow patterns, the potential for seismically induced flooding is considered to be low to moderate.

- Seisches: Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No large bodies of water are located in the immediate vicinity of the site; therefore, the potential for seiches impacting the site is considered negligible.

- Tsunamis: Tsunamis are tidal waves generated in large bodies of water by fault displacement or major ground movement. Based on the location of the site, tsunamis do not appear to be a potential hazard to this site.

- Seismic Densification of Dry Soils: Seismic densification of dry soils is a phenomenon in which loose, dry soils, primarily sands and silty sands, densify and settle when subjected to earthquake shaking. In Southern California, evidence of seismically induced densification and resultant settlement of dry soils have been observed in the 1971 San Fernando, and 1994 Northridge Earthquakes.

  As discussed in Section 2.2 of this report, our field investigation revealed the presence of isolated deposits of very loose to loose, dry sandy soils within the subject site. The locations, approximate depths, and thicknesses of these deposits are indicated on our boring logs, included in Appendix B of this report. These soil deposits have the potential for undergoing densification and settlement during earthquakes. Keeping in mind that even small settlements within these layers may influence the performance of overlying structures, it is our recommendation that during future phases of site planning, the geotechnical consultant evaluate the potential for seismic densification of dry soils within the subject site and the resultant effects on planned improvements.

2.6.5 Seismic Parameters

Seismic parameters are provided based upon simplified California Building Code (CBC) methods. This site is not within a currently designated Alquist-Priolo Earthquake Fault Zone. However, strong ground shaking due to seismic activity is anticipated at the site. As discussed in Section 2.6.3 of this report, the average value of the maximum probable earthquake acceleration (10 percent probability of exeedence in 50 years) at the site is 0.26g. The site is within CBC Seismic Zone 4 with a Z factor of 0.4, as is the case form most of Southern California. A site coefficient of S_D should be used, as shown in Table 16A-J of the 1998 CBC, for seismic design. Per the 1998 CBC, seismic design can be based on a Seismic Source Type of "B" (Newport-Inglewood, Offshore, Fault located approximately 18.9 km (11.8 miles) from the site, with a maximum creditable earthquake of 6.9, and a slip rate of 1.5 mm/yr) with Near-Source Factors Na and Nv of 1.05 and 1.3, respectively, and seismic coefficients Ca and Cv of 0.44 Na and 0.64 Nv, respectively.

2.7 Removal and Recompaction of Existing Soils

Based on the results of our field investigation and laboratory tests, we anticipate that removals on the order of 3 to 10 feet will be necessary at the subject site. The actual depths of removal and recompaction should be addressed by the geotechnical consultant during future phases of site grading and improvement plans for development.

2.8 Shrinkage and Bulking

Based on this study, the clayey soils located within the upper approximately 10 feet below existing ground surface could shrink by approximately 5 to 10 percent. The sandy soils within the upper 10 feet below existing ground surface may be expected to bulk by approximately 0 to 5 percent. These numbers constitute preliminary estimates only and should be reassessed.

3.0 CONCLUSIONS

Based on our investigation and findings, there appear to be no significant geotechnical constraints within the subject site that cannot be mitigated by proper planning, design, and sound construction practices. It is our conclusion that developing the subject site for commercial and residential use is feasible from a geotechnical standpoint, provided the findings presented in this report are considered in the development of the subject site. The conclusions provided herein should be verified (as applicable) by the geotechnical consultant during future phases of geotechnical work as the grading and improvement plan for the site are developed.

Our investigation and review indicates:

- During our subsurface investigation, perched groundwater was encountered within Boring B-15, at an approximate depth of 48.5 feet below ground surface. Subsurface water was not encountered in any of our other borings; therefore, a near-surface groundwater table is not present at the site.
- The near-surface soils are expected to have medium compressibility and a low potential for collapse, as indicated by observations during our subsurface investigation and results of laboratory tests.
- The near-surface clayey soils have medium to high expansion potential.
- No landslides are known to exist on the site.
- No active faults are known to transect the site.
- Potential for liquefaction and related effects for the soils at the subject site is anticipated to be low at the time of this study, as we found no evidence of the presence of a shallow groundwater table underlying the subject site. However, future development of shallow perched groundwater conditions as a result of irrigation and other sources could increase the potential for liquefaction and related effects.
- Potential for seismic densification and related settlement of dry sandy soils, and resulting surface manifestation are expected to be low.
- Based on our review, it appears that single-family residences and other similar light structures can be supported on shallow slab-on-grade foundations, underlain by engineered fill. However, for heavier structures (e.g., commercial buildings) deeper foundations may be required based on local subsurface conditions.
- Corrosion to concrete in contact with onsite clayey soils due to soluble sulfate and chloride concentrations is expected to be low.
- Steel components in contact with the onsite clayey soils are expected to have a high potential for corrosion based on the prevailing resistivity of the soil.
- The subsurface soils are readily rippable using conventional earthmoving equipment.

4.0 RECOMMENDATIONS

It is our recommendation that the geotechnical consultant undertake a detailed review of the rough grading and improvement plans for the subject site, once the plans are finalized. The consultant should consider carrying out additional subsurface investigation, laboratory testing, and geotechnical analyses in order to obtain site-specific information in light of a planned development. The consultant should address at least the following issues and provide specific design and mitigation recommendations:

- Potential liquefaction of soils, related effects, and mitigation measures (if applicable);
- Potential seismic densification of soils, related effects, and mitigation measures (if applicable);
- Removals, overexcavation, and recompaction requirements;
- Fill placement and compaction;
- Geotechnical foundation design guidelines;
- Lateral earth pressures for retaining wall design;
- Footing setbacks and remedial recommendations for slope creep, if applicable;
- Curb, gutter, and flatwork;
- Pavement sections for interior streets and parking areas;
- Fences and sound walls;
- Swimming pools and spas, if applicable;
- Surface drainage;
- Landscape and maintenance;
- Soil corrosivity and related effects on construction components; and
- Expansive soils.

Additional recommendations may be required.

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Advanced Environmental Concepts, Inc. is pleased to present the following:

Property Transfer Disclosure Report

for

Irvine Community Development Company
Planning Area I-05B
Agricultural and Commercially Developed Land

North of Irvine Boulevard, South of Portola Parkway, and West of Jeffrey Road
Unincorporated Orange County California

This report has been prepared for:

Mr. Ken Coulter
Irvine Community Development Company

Prepared: September 2001

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1.0 EXECUTIVE SUMMARY

On behalf of the Irvine Community Development Company (ICDC), Advanced Environmental Concepts, Inc. (AEC) prepared a Property Transfer Disclosure Report on agricultural developed parcels bordered on the south by Irvine Boulevard, the north by Portola Parkway, the east by Jeffrey Road, and the west by a housing tract. There are two separate properties in Planning Area I-05B. B & E Farms leases The Irvine Company's Field 301 that consists of agricultural land and a small farm maintenance yard approximating 63-acres and planted to row crops rotating between strawberries and beans. Hines Nursery leases a nursery developed parcel totaling 230-acres including the greenhouse and outdoor potted plant facilities, and numerous office, maintenance, packaging, loading, and storage buildings. This PSA was performed during May, June, and July 2001. The purpose was to identify adverse environmental conditions and "hazardous" waste streams generated on-site that could potentially affect the human health and the environment, and to review if "hazardous" waste streams generated offsite could adversely affect the subject properties. These concerns include storage and use of agricultural chemicals categorized as pesticides, herbicides, fungicides, fertilizers, and surfactant. Other concerns include transite irrigation pipe which contains asbestos, the storage of new oils and hydraulic fluids, the generation, storage, and disposal of waste oils, the storage of diesel and gasoline fuels in aboveground and underground storage tanks (ASTs and USTs), hydraulic floor lifts, effluent waste water from steam wash pads, effluent waste water from the aboveground irrigation of greenhouse and potted outdoor plants, and used batteries. It is the experience of AEC that these environmental concerns are typical within a large-scale farming and nursery operation and are similar in nature to other large-scale farming operations found throughout California. It is also important to note that the majority of "hazardous" material, and waste generation are typically identified in the Hines Nursery headquarters/storage yards and in the maintenance yard of B & E Farms both of which occupy the least amount of leased property. Therefore, numerous environmental issues are concentrated in a small area, whereas, the vast majority of the property is under cultivation, and can be considered mostly unencumbered. Following is a brief description of the properties and structures in Planning Area I-05B and their associated recognized environmental conditions.

Hines Nursery Agricultural and Growing Headquarters

Hines Nursery
12621 Jeffrey Road, Irvine

The Hines Nursery Agricultural and Growing Headquarters is located at 12621 Jeffrey Road, Irvine, California and was originally developed in the late 1950's. The approximate 230-acre parcel is north of Field 301, and south of Portola Parkway and Hicks Canyon Wash. A residential tract forms the western border and Jeffrey Road forms the eastern border. Hines also leases the land east of Jeffrey Road, however, that portion of the nursery will be discussed in detail in the Planning Area I-09A Property Transfer Disclosure Report.

The approximate 230-acre parcel on the west side of Jeffrey Road consists of a main east-west entrance drive to a guardhouse. Beyond, and west of the guardhouse is an employee parking lot, and due south of the guardhouse are aboveground fertilizer and acid storage tanks (ASTs). Four of the ASTs have capacities of 10,000-gallons each, and the fifth AST has a capacity of 6,600-gallons. Two of the 10,000-gallon ASTs contain ammonium nitrate, one 10,000-gallon AST contains potassium chloride, and one 10,000-gallon AST contains potassium nitrate. The 6,600-gallon AST contains phosphoric acid and is secondarily contained. Continuing west along the access road leads to the central operating hub consisting of the main office structure, the automotive and rolling stock maintenance and repair shop, wash rack, tire repair shop, paint shop, welding shop, fueling depot, loading docks, greenhouse office, and equipment and material storage areas. Northwest of these structures are the plant propagation building, electrical storage building, and various storage sheds. The majority of open land on both sides of this east-west access road has been developed with greenhouse covered plants, sun and wind netting protected plants, and open air potted plants. The majority of the surface area consists of gravel and crushed rock over hard-packed dirt, while concrete foundations and concrete or asphalt aprons are identified around the buildings.

A 1.5-million gallon water collection reservoir has been installed in the southwest corner of the site to collect and recycle irrigation water. The irrigation water runs off the plants onto the hard-packed dirt/gravel surface, follows the topographic gradient into collection ditches, then directed to the reservoir. The reservoir is lined with bentonite to control subsurface vertical leaching.

B & E Farms (Field 301)

Planning Area I-05B also consists of land solely under agricultural use and cultivation and is identified as Field 301 leased to B & E Farms. The property is currently under strawberry cultivation. B & E Farms has also converted a small portion of their leased ground at the eastern property edge adjacent to Jeffrey Road into an agricultural storage and maintenance yard. Field 301 was initially in cover crop production, then planted to citrus in the late 1960's, then converted back to row crop production by 1994. Because Field 301 was planted to citrus it required windmachines for frost protection.

Underground Storage Tanks (USTs)

The Hines Nursery facility currently operates three 8,000 gallon double-walled USTs. Two of the tanks contain diesel and one holds gasoline. These USTs were installed in 1998 in accordance with applicable State and County requirements regarding secondary containment and monitoring of UST systems. There is an individual dispenser associated with each type of fuel. The active USTs are located on the north side of the vehicle and farm equipment service shop. The island is raised concrete, and the drive and UST pad is also concrete.

Hines Nursery has gone through two tank removal and replacement events during the 1990's. South of the maintenance garage Hines Nursery used to maintain a 12,000-gallon diesel UST (installation date approximately 1978) and on the north side of the service bays they operated a 880-gallon waste oil UST and a 500-gallon new oil UST (installation date approximately 1971). The USTs were removed during February and March 1990 by Hekimian and Associates. During the tank removal procedures contaminated soil was identified. It was deemed that the contaminated soil originated from overspill and that the USTs exhibited no signs of leaking. The impacted soil was removed by excavation and transported to a recycling facility. All work associated with the USTs were supervised by OCHCA personnel. Also, the USTs associated with the fueling islands were lined in 1990 and put back into service.

The second phase of tank removals occurred between the latter portion of 1997 and early 1998. Hines Nursery contracted for the removal of the two existing USTs and replacement with three new 8,000-gallon double-walled USTs. The UST installation is currently in compliance with the South Coast Air Quality Management District (SCAQMD), Orange County Fire Authority (OCFA), and Orange County Health Care Agency (OCHCA).

The Irvine Company also operated four 500-gallon capacity windmachine underground storage tanks in Field 301. These USTs contained gasoline and were used to fuel engines that powered the fan on a windmachine for frost protection purposes. The USTs were steel constructed, had 2-inch diameter vent and fill lines, and the product line consisted of 3/8-inch flexible copper tubing that was plumbed directly from the tank to the windmachine. The product delivery operated on a vacuum system, therefore, if there was a leak in the copper tubing the engine would not receive fuel, thus minimizing the potential for releases of any significant volume. The windmachines were placed on 10-acre centers. AEC conducted an OCHCA and OCFA permitted removal of these USTs in July 1998. A Tank Closure Report was prepared by AEC documenting the removal of the windmachine gasoline tanks and submitted to the OCHCA. A “no further action” letter from OCHCA referencing this tank removal will be submitted as an addendum to this report.

Recommendations for the UST Locations

AEC recommends that Hines Nursery continues to permit their USTs on a yearly basis and renew their SCAQMD as required. Tank Monitoring records need to continue to be documented and stored onsite. If a leak is identified within the plumbing, or dispensers, it should be immediately repaired and reported to the appropriate authorities.

Agricultural Yards

B & E Farms Jeffrey Road Yard: Surface soils in several small areas at the B & E Farms Jeffrey Road Yard (Field 301) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with the trapwagon diesel and gasoline ASTs that are located onsite and the storage of waste oil in 5-gallon buckets and 55-gallon drums. The storage of the agricultural chemicals are in the steel container equipped with a solid floor. Mixing of the chemicals is performed onsite using the hose bib connected to a water storage AST located on a trailer. The effluent water is allowed to migrate into the concrete-lined drainage culvert paralleling Jeffrey Road. B & E Farms also performs rolling stock maintenance in their open sided shed that has a concrete floor. B & E Farms has regular pickups of waste oil by Starlite Reclamation Company.

The Agricultural Storage and Maintenance Yards are a necessity to any farming operation and are used for the storage of agricultural chemicals, bulk oils, antifreeze, and diesel and gasoline fuels required to successfully operate and maintain farm equipment and agricultural land. Also, farmers want their storage yard adjacent to their Fields, therefore, it is common to cut out a 1 to 5 acre parcel of the agricultural land and convert it to a storage and maintenance yard, and because it used to be farmland it is very rare to find a yard that has been paved. The “hazardous” materials releases associated with the B & E Farms operation in Field 301 and the Hines Nursery do not appear to have occurred due to negligence, rather from small leaks and spills associated with the handling of the materials on a daily basis. The B & E Farms hydrocarbon and agricultural chemical releases are all aboveground; and the majority of the Hines Nursery hydrocarbon and agricultural chemical releases are aboveground. The volume of hydrocarbon and agricultural chemical releases are small in quantity, and have spilled onto the dirt surface, therefore, the vertical and lateral migration potential is limited.

Agricultural Chemicals

Hines Nursery and B & E Farms use agricultural chemicals to assist in the production of high yield and high quality produce. The chemicals used in Planning Area I-05B are categorized as pesticides, herbicides, fungicides, fertilizers, and surfactants. Following are a listing of the commonly used agricultural chemicals during the past year:

Pesticides	Herbicides	Fungicides	Fertilizers	Other
Pyrellin	Round-up	Copper Sulfate	Nutra-Sol	Ethanol
Diazinon	Glyphosate	Clamp	Tech Flo	Kaolin
Carbaryl		Tenn-Cop 5E	Simplot 21-0-0	Spray
Javelin		Dyrene	Ammonium Nitrate	
MVP II		Rovral	Potassium Nitrate	
AgroMEK		Thiolux Sulphur	Potassium Chloride	
Xentari		Copper-Count-n	Phosphoric Acid	

B & E Farms and Hines Nursery are registered with the Orange County Agricultural Commissioners Office (OCACO) and provide proper notification prior to applying the chemicals to their fields. There have been no “Notice of Violations” (NOVs) issued by the OCACO for the misuse, or mishandling of the chemicals by the farmers in Planning Area I-05B during the past year. Also, each tenant has been issued a Restricted Materials Permit Number by the Agricultural Commissioners office and they are tabulated below:

Farmer	Restricted Permit #	Expiration
B & E Farms	30-01-300515	12/31/01
Hines Nursery	30-01-300901	12/31/01

These tenants use licensed Pest Control Advisors (PCAs) to evaluate agricultural chemical selection and volume of application. The chemicals are applied in accordance with labeled instructions on the original container, and then the containers are triple rinsed prior to disposal.

Field 301 has historically been farmed by The Irvine Company and has been in permanent plantings and row crops. The Irvine Company transported equipment to Field 301 on an as-needed basis from the former Main Yard located at Old Myford Road and Jamboree. The storage of equipment and materials in the storage yard has been relatively recent to the property (past 7 years), thereby, limiting the occurrences and volumes of aboveground releases of chemicals.

Hines Nursery stores and mixes its agricultural chemicals at the work station located on the east side of Jeffrey Road. However, prior to construction of the agricultural chemical mixing station on the east side of Jeffrey Road in early 1980, Hines stored and mixed the various agricultural chemicals in a small building and work area approximately 300 feet south of the southwest corner of the automotive service shop. This area was prominently used during the 1960's and 1970's. The small building that was formerly used for storage of the agricultural chemicals has been converted to a greenhouse office for employees. The building has a concrete foundation overlain by floor tile and is of wood framing and wood siding construction. The building has been maintained in very good condition. Approximately 100 feet south of this building is a concrete foundation that used to support the small laboratory building. A greenhouse now occupies the surface of this foundation.

Transition of Property to Non-Agricultural Uses

It is important to note this Property Transfer Disclosure Report was conducted on property that will remain in agriculture production for a minimum of one more year, and possibly longer, and understanding that farming is a dynamic process the mitigation of these sites should proceed with common sense and in an orderly fashion. The initial aspect of this report is to identify the active work-related areas where repeated handling and use of chemicals classified as “hazardous” occurs. These areas, and the personnel working in these areas, will be studied to identify if the repetitive handling of chemicals is being conducted in a manner that will not cause an adverse impact to soil and water resources. Next, AEC will make recommendations regarding mitigation of the historical recognized environmental concerns, followed by remediation of any impacted soil. Once the agricultural leases have been terminated, and future land use has been decided, AEC recommends conducting a Phase II Environmental Assessment. Recommendations will be formulated from the results of the Phase II Assessment and mitigation measures will need to be performed prior to the mass grading of the property in preparation for an alternate land use. However, it is the professional opinion of AEC that there are no current recognized environmental concerns that would restrict the non-farm compound agricultural use areas from being converted from agricultural to residential.

No other recognized environmental conditions were identified at the subject property or on surrounding properties during this assessment.

2.0 INTRODUCTION

2.1 Purpose

The purpose of this assessment is to identify recognized environmental conditions located at the subject site or adjacent properties which could present material risk of harm to public health or to the environment. Recognized environmental conditions are defined as the presence or likely presence of any hazardous wastes and/or substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property.

2.2 Special Terms and Conditions

The information included in this report is intended for use exclusively as a preliminary assessment of potential environmental and human health concerns at the project site. Data was obtained through telephone conversations, personal interviews, public records, public information, general maps and aerial photographs. These services have been rendered by **Advanced Environmental Concepts, Inc.** (**AEC**) in accordance with generally accepted practices by professional hydrogeologists and environmental specialists. Because of the limited nature of this investigation, the firm is precluded from providing a warranty, expressed or implied, regarding the presence of hazardous materials that could potentially adversely affect the subject site.

This report is provided with the understanding that it is the responsibility of the owner to convey the information and recommendations contained herein, to the appropriate regulatory agencies, as required. The services performed in the scope of this project are for the sole use of our client. Others who seek to rely on the findings contained within this report have a duty to determine the adequacy of the information presented herein, for their time, location, and intended use.

2.3 Limitation and Exceptions of Assessment

This report presents the results of a Property Transfer Disclosure Assessment conducted by **Advanced Environmental Concepts, Inc.** (**AEC**) for Irvine Community Development Company (client), subsidiary of The Irvine Company on the following property:

Irvine Community Development Company
Planning Area I-05B
Agricultural and Commercially Developed Land
North of Irvine Boulevard, South of Portola Parkway, and West of Jeffrey Road,
Unincorporated Orange County California

No other properties were included within the scope of this assessment except as required for the off-site reconnaissance and for the regulatory agency database and file review pertaining to potential sources of offsite recognized environmental concerns. Historical information regarding the subject parcels is limited to review of public documents, interviews with persons knowledgeable with the past and present uses and conditions of the property, and historic mapping and aerial photography review.

2.4 Limiting Conditions and Methodology

To evaluate the potential presence of recognized environmental conditions, this preliminary investigation consisted of the following:

Contacting appropriate regulatory agencies for hazardous materials information concerning the subject site and surrounding areas located within an approximate ¼-mile radius of the site boundaries. Inquiries were made regarding documentation of: (a) toxic spills; (b) underground storage tanks; (c) the use, storage, generation, and/or disposal of hazardous materials; (d) the presence of disposal wells and/or leach fields, drain fields, and septic systems; and, (e) violations of applicable environmental control standards;

Conducting interviews with Cliff Prather, Hines Nursery, Peter Changala, The Irvine Company, and Ed Ito, farm tenant of Field 301. Also, AEC researched historical site usage for information regarding past or present recognized environmental conditions;

Reviewing selected reports, maps, and aerial photographs for information pertaining to potential sources or visual indications of soil and groundwater contamination;

Conducting an on-site inspection and off-site reconnaissance to identify visible evidence of the generation, use, storage, release, or disposal of hazardous materials;

Evaluating investigational findings and the preparation of a detailed report inclusive of findings and recommendations.

3.0 SITE DESCRIPTION

3.1 Location[1]

Planning Area I-05B consists of approximately 293-acres currently developed as a 63-acre agricultural parcel leased to B & E Farms and has been recently farmed to strawberries, and the 260-acre portion of Hines Nursery west of Jeffrey Road. Planning Area I-05B is located approximately three miles north of the Interstate 5 Freeway, and is bordered on the south by Irvine Boulevard, the north by Portola Parkway, and the east by Jeffrey Road. A residential tract forms the western boundary.

3.2 Site and Vicinity Characteristics

3.2.1 Physiographic Setting

The subject property is within the eastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province. Within the Los Angeles basin, in the easternmost portion, is the Tustin Plain, located south and adjacent to the Downey Plain, which is the largest area of Recent alluvial sedimentation. The Tustin Plain is composed of alluvial fans with elevations from 150 to 500 feet above mean sea level that formed along the southwest flank of the Santa Ana Mountains. The plain slopes regionally to the west and southwest with a topographic gradient of approximately 100 feet per mile[2].

The alluvial deposits of Holocene to Quaternary-age that comprise the Tustin Plain consist mainly of sands, gravels, silts and clays. Generally, the coarse grained sediments are deposited near the inland hills as alluvial fans, whereas deposition of progressively finer grained sediments occurs towards the river flood-plains. The upper fan areas are interpreted as intake areas where recharge of the groundwater takes place. Hydraulic continuity may exist between alluvial sediments of the fan areas and certain water-bearing sediments of the central lowlands. Replenishment of groundwater occurs in the intake area by infiltration from major streams within their permeable channels and from irrigation water and rain. Shallow groundwater was not identified in the geotechnical investigation borings conducted during December 1999, and is estimated to be at depths greater than 95-feet bgs.

The regional stratigraphy is comprised of interbedded silt, clay and sand that is typical of sediments deposited on alluvial fans during flood stages. Elevations of the subject property range from 340 feet at the northeastern boundary to 230 feet at the southwestern boundary. The property gently slopes in the westerly direction.

The Newport-Inglewood Fault is a major northwest-southeast trending strike-slip fault that terminates near Costa Mesa and is located approximately 12-miles south. This fault does not appear to extend beneath the subject property. The Peralta Hills thrust fault and the El Modeno Fault are minor faults located northwest and north of the property and are not considered to be seismically active or potentially active.

3.2.2 Soils Profile[3]

Surface sediments beneath the subject property are composed of two soil types:

(1)	**Mocho Sandy Loam, 0 to 2% Slopes**	**(165)**
(2)	**San Emigdio Fine Sandy Loam, 0 to 2% Slopes**	**(194)**

Mocho Soil Series: This series consists of well drained soils found on alluvial fans and flood plains. Mocho soils formed in alluvium derived from sedimentary rock. The soil consists of moderately alkaline and calcareous loam with moderate permeability. Runoff is slow and erosion hazard is slight in areas which are not covered with protective vegetation. The typical profile consists of a brown and grayish brown loam surface layer to 12 inches. The next layers are light brownish gray, brown, and pale brown silty clay loam to a depth of 61 inches or more. Mocho soils are used for irrigated crops, citrus, and more recently urban development.

San Emigdio Soil Series: This series consists of well drained soils found on alluvial fans and flood plains. San Emigdio soils formed in mixed alluvium. The soil consists of moderately alkaline and calcareous loam with moderate to rapid permeability. Runoff is slow and erosion hazard is slight in areas which are not covered with protective vegetation. The typical profile consists of a brown and grayish brown loam surface layer to 7 inches. The next layers are very pale brown to 21-inches, then light gray to 43 inches or more. San Emigdio soils are used for irrigated crops, citrus, and more recently urban development.

3.3 Description of Structures, Roads, & Other Site Improvements

Hines Nursery

The Hines Nursery Agricultural and Growing Headquarters is located at 12621 Jeffrey Road, Irvine, California and was originally developed in the late 1950's. The approximate 230-acre parcel is north of Field 301, and south of Portola Parkway and Hicks Canyon Wash. A residential tract forms the western border and Jeffrey Road forms the eastern border. Hines also leases the land east of Jeffrey Road, however, that portion of the nursery will be discussed in detail in the Planning Area I-09A Property Disclosure Transfer Report.

The approximate 230-acre parcel on the west side of Jeffrey Road consists of a main east-west entrance drive to a guardhouse. Beyond, and west of the guardhouse is an employee parking lot, and due south of the guardhouse are aboveground fertilizer and acid storage tanks (ASTs). Four of the ASTs have capacities of 10,000-gallons each, and the fifth AST has a capacity of 6,600-gallons. Two of the 10,000-gallon ASTs contain ammonium nitrate, one 10,000-gallon AST contains potassium chloride, and one 10,000-gallon AST contains potassium nitrate. The 6,600-gallon AST contains phophoric acid and is secondarily contained. Continuing west along the access road leads to the central operating hub consisting of the main office structure, the automotive and rolling stock maintenance and repair shop, wash rack, tire repair shop, paint shop, welding shop, fueling depot, loading docks, greenhouse office, and equipment and material storage areas. Northwest of these structures are the propagation building, electrical storage building, and various storage sheds. The majority of open land on both sides of this east-west access road has been developed with greenhouse covered plants, sun and wind netting protected plants, and open air potted plants. The majority of the surface area consists of gravel and crushed rock over hard-packed dirt, while concrete foundations and concrete or asphalt aprons are identified around the buildings.

A 1.5-million gallon water collection reservoir has been installed in the southwest corner of the site to collect and recycle irrigation water. The irrigation water runs off the plants onto the hard-packed dirt/gravel surface, follows the topographic gradient into collection ditches, then directed to the reservoir. The reservoir is lined with bentonite to control subsurface vertical leaching.

B & E Farms (Field 301)

Planning Area I-05B also consists of land solely under agricultural use and cultivation and is identified as Field 301 leased to B & E Farms. The property is currently under strawberry cultivation. B & E Farms has also converted a small portion of their leased ground at the eastern property edge adjacent to Jeffrey Road into an agricultural storage and maintenance yard. Field 301 was initially in cover crop production, then planted to citrus in the late 1960's, then converted back to row crop production by 1994. Since Field 301 was planted to citrus it required windmachines for frost protection. The windmachine USTs were removed by AEC in July 1998 and the confirmation soil samples exhibited non-detectable concentrations of gasoline range hydrocarbons. Orange County Health and Orange County Fire supervised the removal and sampling of these tanks.

3.4 Environmental Liens

No indication of current environmental liens was provided to **AEC** by the user or obtained from any other informational source during this assessment.

3.5 Onsite Water Supply

Water for onsite use is obtained via pipeline from the Irvine Ranch Water District (IRWD) water supply reservoirs.

3.6 Current Uses of the Property

The majority of the 293-acre subject property is currently used as agricultural farmland planted to strawberries (Field 301) and nursery plants (Hines Nursery). The remaining acreage is used for building space and agricultural yards.

3.7 Past Uses of the Property

Based on reviews of historical USGS maps and reviews of historical topographic maps beginning in 1901, and aerial photographs beginning in 1946, the subject property has been used for agricultural, and agricultural related services since the area was first developed. The majority of the properties were in row crop development by The Irvine Company, and nursery development by Hines beginning in the late 1950's. Citrus development was evident in Field 301 from the late 1960's to 1994. The citrus trees were removed from production and the land was converted from permanent plantings to row crop use.

3.8 Current and Past Uses of Adjoining Properties

Prior to the recent urban development of the area beginning in the late 1970's, the site and surrounding areas were principally agricultural lands, grazing lands and undeveloped lands. The property is bordered on the north by Portola Parkway and Hicks Canyon Wash, the south by Irvine Boulevard and a mobile home park, to the west by a residential development constructed in the early 1980's and to the east by Jeffrey Road and additional Irvine Company owned farmland leased to Hines Nursery. Recently, the City of Irvine installed a 102-inch reinforced concrete pipeline in Hicks Canyon Wash to control natural surface water drainage.

4.0 RECORDS REVIEW

4.1 Standard Federal and State Environmental Record Sources

AEC contracted **EDR Environmental Information, Inc.**[4] to perform searches of readily available Federal, State, and Local database information systems for the purpose of identifying known recognized environmental conditions present on nearby properties which have the potential to adversely impact the site being assessed in this study. The information provided by EDR gives a brief summary of any onsite target properties, and/or surrounding properties that may have environmental concerns. The databases researched include the following:

NPL, CERCLIS, CORRACTS: The National Priority List database, CERCLIS database, and CORRACTS, are also known as Superfund, and Superfund associated Corrective Action. Listed in this database is the El Toro Marine Air Corp Station. USMC Air Station El Toro has been a long term discharger of solvents, fuels, and other hydrocarbons to soil and groundwater resources. The property remains under close scrutiny, and remedial investigation by appropriate agencies including the EPA, Regional Water Quality Control Board (RWQCB), Department of Toxic Substance Control (DTSC), and others. There are reported cases where the contamination from the air base has impacted irrigation wells in the surrounding area. AEC has not identified which irrigation wells are impacted, however, a letter has been written to the RWQCB requesting review of the information. Upon its availability, the information will be forwarded in an addendum . The USMC Air Station El Toro is downgradient and approximately one mile east of Planning Area I-05B, therefore, of minor concern.

RCRIS: The Resource Conservation and Recovery Act database includes sites that generate, store, treat, or dispose of hazardous waste. Again, the only site listed is the USMC Air Station El Toro.

ERNS: The Emergency Response Notification System records and stores information on reported releases of oil and hazardous substances. The system revealed three ERNS sites. The first is listed at Sand Canyon Avenue and Irvine Boulevard, however, this is inaccurate since the release occurred at the Bee Canyon Landfill and does not appear as a threat to the subject property; the second and third are at the UNOCAL Station at 14886 Sand Canyon Avenue. Apparently the gasoline release was great enough to have free product on the water table. This site is downgradient and over a mile from Planning Area I-05B, therefore, considered a negligible risk.

CAL-SITES: This database contains both known and potential hazardous substance sites. The site recognized is at 15000 Sand Canyon Avenue and is the former Orange County International Raceway. The site is downgradient, therefore, again considered a minor concern.

CORTESE: This database identifies drinking water wells with detectable levels of contamination, and sites with USTs having reportable releases. This database identified the UNOCAL at 14886 Sand Canyon Avenue, the EXXON at 14781 Sand Canyon Avenue, and the Irvine Unified School District Maintenance Facility at 14600 Sand Canyon Avenue. Again all these sites are downgradient from the subject property.

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking USTs. The three sites listed above are again identified in this database. There are other sites also identified, but again they are all downgradient, therefore, assigned a low risk.

UST: The Underground Storage Tank database lists registered USTs. The above listed sites are again identified. The only upgradient site listed is El Modena Gardens, however, those USTs were removed by AEC in 1998 and received “clean” closure. The active USTs at the Hines Nursery facility were not listed.

CA FID: This database identifies inactive UST facilities of which El Modena Gardens, Irvine Unified School District, and Orange County Transit Authority are listed. Again, the Hines Nursery facility was not listed.

HMIRS: The Hazardous Materials Incident Report System contains information pertaining to hazardous spill incidents. The only site reported was at 15029 Sand Canyon Avenue which is downgradient, and over a mile east of Planning Area I-05B, therefore, a negligible concern.

PADS: The PCB activity database identifies generators, transporters, and commercial storers of PCBs. The USMC Air Station El Toro is listed in this database.

WDS: The Resource Water Board provides information on sites with Waste Discharge Systems for water. El Modena Gardens Nursery was listed; however, Hines Nursery was not included in this database survey.

HAZNET: This database contains information of wastes that were manifested each year. The only upgradient site is El Modena Gardens. Again, Hines Nursery was not included in this database

Having worked for The Irvine Company, and other local businesses AEC is aware of sites that were not identified in these databases. For example, The Irvine Company, IVG, Hines Nursery, et al. have had active and leaking USTs, they have disposed of materials by manifest, required Water Waste Discharge approval, yet they did not show up in this EDR report. However, AEC, in co-operation with The Irvine Company will continue to identify areas of onsite environmental concerns and implement corrective measures. The complete report furnished by **EDR** is included in **Appendix 10.2** of the report.

4.2 Historical Use Information

4.2.1 Aerial Photograph and Historical USGS Map Review[4]

Historical aerial photograph coverage and USGS Map coverage of the site were reviewed in order to evaluate past site usage. Visual observations noted within these photographs and maps are described chronologically as follows:

Map Date: 1901 **Quadrangle: Santa Ana** **Scale: 1:62,500**

The subject property and surrounding areas appeared undeveloped and covered in native vegetation during 1901. The Southern California Surf Railroad Line was the only obvious development. Santa Ana and Tustin were established towns. No indications of onsite structures or other developments of the property were noted in the 1901 USGS survey.

Aerial Photograph Date: 1952 **Flyer: Pacific Air** **Scale: 1"=833'**

The IVG Facility was evident south of Irvine Boulevard and east of Jeffrey Road. Field 301 appeared to be in cover crop production and eucalyptus windbreaks were evident. The Hines Nursery property was also developed with cover crops. There was a house identified at the northwestern portion of the Hines Nursery property. Citrus are planted in the location of the current residential tract. Adjacent to properties are either in cover crop, or citrus production. Resolution of visual detail is good.

Map Date: 1965 **Quadrangle: Tustin, El Toro** **Scale: 1:24,000**

IVG is identified as the Atchison, Topeka, and Santa Fe Railroad siding. Field 301 is planted to citrus. Hines Nursery occupies the southern half of the property under review. The I-5 Freeway has been constructed by this time.

Aerial Photograph Date: 1968 **Flyer: Teledyne** **Scale: 1"=800'**

By 1968 all of Field 301 was planted to citrus. Hines Nursery is evident and in full production. The office building has been constructed and a few outbuildings. Surrounding properties are all in some form of agricultural production. Resolution of visual detail is good.

Aerial Photograph Date: 1977 **Flyer: Teledyne** **Scale: 1"=666'**

Field 301 has had the citrus removed from the southern half. Hines Nursery has now expanded east across Jeffrey Road. The Hines Nursery office and maintenance yard complex has expanded to include additional buildings and loading docks. Resolution of this photograph is very good.

Map Date: 1981 **Quadrangle: Tustin, El Toro** **Scale: 1:24,000**

IVG is still identified as the Atchison, Topeka, and Santa Fe Railroad siding. Field 301 is still partially planted to citrus. Hines Nursery is continuing in its expansion.

Aerial Photograph Date: 1994 **Flyer: USGS** **Scale: 1"=666'**

The property and surrounding areas appear under similar development as today. The citrus trees have all been removed from Field 301. The windmachines are still evident, and the B & E Farms yard is evident adjacent to Jeffrey Road. The mobile home park south of Field 301 is evident as is the housing tract west of Hines Nursery and Field 301. Jeffrey Road has been expanded and Portola Parkway has been constructed and trends east from Jeffrey Road. The Hines Reservoir is evident and there appears to have been additional expansion of the Hines Nursery office and maintenance facility. Resolution of visual detail in this photograph is good.

4.3 Additional Record Sources

4.3.1 Orange County Agricultural Commission[5]

The Orange County Agricultural Commission (OCAC) maintains records of Restricted Agricultural Chemicals permitted for use and/or storage at agricultural facilities located throughout Orange County. Inventory information regarding restricted herbicides, pesticides, rodenticide, etc., is listed on Restricted Materials permits issued annually and archived within the OCAC database. OCAC records contained the following information pertaining to the individual growers leasing surface areas within the limits of the subject property for agricultural production during 2001(see Appendix 10.3):

Farmer	Restricted Permit #	Expiration
Hines Nursery	30-01-300901	12/31/01
B & E Farms	30-01-300515	12/31/01

4.3.2 Orange County Health Care Agency[6]

The Orange County Health Care Agency (OCHCA) maintains records of underground storage tanks (UST's) and incidents of unauthorized releases of hazardous materials from underground storage tanks at the subject site and surrounding areas. OCHCA records contained information pertaining to the windmachine USTs located in Field 301, and the UST removals and replacements from Hines Nursery. The Hines facility is currently operating under an approved permit, and the former windmachine UST locations in Field 301 have been closed.

4.3.3 Orange County Fire Authority Records[7]

The Orange County Fire Authority, Hazardous Materials Bureau maintains inventory information and "Hazardous Materials Management Plans" (HMMP's) for facilities located within Orange County, California. AEC submitted written requests to the OCFD for documentation pertaining to the existing onsite facilities including Hines Nursery. When the information is made available AEC will prepare an addendum.

4.3.4 California Department of Conservation - Division of Oil & Gas[8]

No onsite oil or gas wells were identified during the site reconnaissance or within D.O.G. maps reviewed during this assessment.

5.0 INFORMATION FROM SITE RECONNAISSANCE AND INTERVIEWS

5.1 Hazardous Substances in Connection with Identified Uses

During the course of this Property Transfer Disclosure Report it was identified that the majority of agricultural chemical handling and storage, hydrocarbon fuel handling and storage, solvent use, battery storage, miscellaneous chemical storage, waste water creation and disposition, and waste oil and fluid storage all occur within the boundaries of the storage yards and maintenance shops. The strawberries in Field 301 and the Hines' nursery plants under cultivation only receive prescribed amounts of agricultural chemicals that dissipate quickly due to irrigation watering, the sun, and composition of the agricultural chemicals.

Typical to each yard are ASTs and USTs containing diesel, gasoline, waste oil, acids, and fertilizers. Also identified were 55-gallon drums of new oil, hydraulic oil, grease, and coolant. Agricultural chemicals in liquid, granular, and powdered form were always identified in locked storage rooms and containers. Welding gases including oxygen and acetylene are necessary for repair work of equipment and rolling stock.

5.2 Unidentified Substance Containers

Some drums at the B & E Farms yard and Hines Nursery maintenance facility were not labeled as to their contents. However, visual identification indicated that the contents appeared to be waste fluid consisting of either waste oil, grease, hydraulic fluid, or coolant. Hines Nursery and B & E Farms personnel will be required to identify the contents of the drums and consolidate "like" fluids for disposal.

5.3 Storage Tanks

Hines Nursery operates three 8,000-gallon double-walled steel constructed USTs in Planning Area I-05B. These tanks are permitted for gasoline, diesel, and off-road diesel and are in full compliance. Two steel constructed ASTs used to store fuel and a few poly-constructed tanks that store liquid fertilizer were identified at the B & E Farms yard and at the irrigation/sand filter station. Hines Nursery uses numerous poly and steel constructed ASTs for agricultural chemical storage, and the majority of the ASTs are within secondary containment. It is the opinion of AEC that all USTs not currently in use have been removed from Planning Area I-05B.

No other visual indications of existing aboveground or underground storage tanks used for past or present hazardous materials storage were identified during the course of this property transfer disclosure assessment.

5.4 Indications of PCB(s)

Electric transformers (both pad and pole mounted) are located at the Hines Nursery facility. Electric transformers are owned and operated by Southern California Edison (SCE)[9]. According to information obtained from SCE, all transformers within the SCE power distribution network suspected of containing PCB's in concentrations exceeding 50 parts per million were removed and replaced by 1987. Manufacture of PCB-containing electric power transformers was discontinued in 1984.

PCB sampling and laboratory analysis is beyond the scope of this property transfer closure assessment.

5.5 Indications of Solid Waste Disposal

Miscellaneous trash and refuse are collected in bins located around the facilities and routinely removed for offsite disposal by a commercial waste hauler.

No indications of disposing of onsite solid waste by landfilling were identified on the subject property during the site reconnaissance portion of this assessment.

5.6 Indications of Waste Water Disposal

Onsite waste water generated during steam cleaning, or mixing of agricultural chemicals, generally follow the topographic gradient on the hard packed dirt as identified in the B & E Farms storage yard then drains into the concrete lined drainage culvert that parallels Jeffrey Road. The Hines Nursery shop facility operates a cement constructed wash rack pad. The wash rack effluent water, consisting of the cleansing soap and residual hydrocarbons and agricultural chemicals, collects in a drain constructed in the center of the sloped concrete pad and flows into a 30' underground piping run that surfaces and drains onto the hard-packed soil. The effluent waste water then commingles with the run-off of irrigation water and drains into the water collection reservoir at the southwest corner of the nursery. Sanitary effluent from restroom facilities at the Hines Nursery site is also discharged into septic tanks and leach lines. The solids in the septic tanks are pumped on an as needed basis and the leach lines disperse the effluent water.

5.7 Physical Setting Analysis

5.7.1 Designated Wetlands[10]

Under U.S. Army Corps of Engineers (USACE) regulations, wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include swamps, marshes, bogs and similar areas such as sloughs, prairie potholes, wet meadows, river overflows, mud flats, and natural ponds.

Based on information provided to AEC within the EDR database survey report, areas within the boundaries of the subject property are not included within the 1994 edition of the National Wetlands Inventory listing.

5.8 Any Other Conditions of Concern

5.8.1 Radon[11]

Radon is a colorless, odorless, tasteless, naturally occurring radioactive gas formed by the decay of uranium in soil and bedrock. Because uranium and radon occur naturally in varying amounts within rocks and soils found throughout the United States, radon is present in all the air that we breathe. Long-term exposure to elevated concentrations of radon in confined areas has been associated with an increased risk of lung cancer. The present action levels require exposure to concentrations of at least four picocuries/liter (4 pCi/L) of radon over an extended period of time. The State of California Department of Health Services conducted radon surveys across portions of Orange County, during 1990. These surveys did not indicate the widespread presence of radon in concentrations exceeding 4 pCi/L within Orange County. Radon is commonly found in granitic source terrain, therefore, unlikely to be a concern in areas of alluvium as identified in the subject area.

The United States Environmental Protection Agency (EPA) and the Surgeon General presently recommend that all homes in the United States be individually tested for radon. Radon sampling and laboratory analysis is beyond the scope of this assessment.

5.8.2 Asbestos Containing Materials (ACM's)

Asbestos containing materials (ACM's) were commonly used in a wide variety of building products such as roofing shingles, composite siding, linoleum flooring, acoustic ceiling tiles, furnace and water heater exhaust piping and insulation, glues and mastics, stucco, joint compounds, and composite wallboards prior to 1980. ACM's can be divided into material considered friable (easily crumbled or reduced to powder) and nonfriable. Friable ACM's are regulated as hazardous materials due to the elevated long-term risk of developing lung cancer upon respiratory exposure and must be properly removed prior to renovation or demolition of any structure containing these materials. In addition to structures, ACM's have been historically used as "transite" irrigation piping within many agricultural parcels throughout California. No transite piping was visually identified during the site reconnaissance portion of this assessment at the Hines Nursery or in Field 301, however, it probably exists underground. If it identified during the mass grading it will have to be disposed properly at an approved facility.

Asbestos sampling and laboratory analysis is beyond the scope of this assessment.

5.8.3 Lead

According to information published by the United States Department of Housing and Urban Development (HUD), approximately three out of every four pre-1978 buildings contain lead-based paint[12]. Based on the apparent ages of the structures located within the Hines Nursery facility, there is a potential presence of lead-based plumbing and/or paints within the onsite structures.

Lead sampling and laboratory analysis is beyond the scope of this assessment.

6.0 FINDINGS AND CONCLUSION

On behalf of the Irvine Community Development Company (ICDC), Advanced Environmental Concepts, Inc. (AEC) prepared a Property Transfer Disclosure Report on agricultural developed parcels bordered on the south by Irvine Boulevard, the north by Portola Parkway, the east by Jeffrey Road, and the west by a housing tract. There are two separate properties in Planning Area I-05B. B & E Farms leases The Irvine Company's Field 301 that consists of agricultural land and a small farm maintenance yard approximating 63-acres and planted to row crops rotating between strawberries and beans. Hines Nursery leases a nursery developed parcel totaling 230-acres including the greenhouse and outdoor potted plant facilities, and numerous office, maintenance, packaging, loading, and storage buildings. This PSA was performed during May, June, and July 2001. The purpose was to identify adverse environmental conditions and "hazardous" waste streams generated on-site that could potentially affect the human health and the environment, and to review if "hazardous" waste streams generated offsite could adversely affect the subject properties. These concerns include storage and use of agricultural chemicals categorized as pesticides, herbicides, fungicides, fertilizers, and surfactant. Other concerns include transite irrigation pipe which contains asbestos, the storage of new oils and hydraulic fluids, the generation, storage, and disposal of waste oils, the storage of diesel and gasoline fuels in aboveground and underground storage tanks (ASTs and USTs), hydraulic floor lifts, effluent waste water from steam wash pads, effluent waste water from the aboveground irrigation of greenhouse and potted outdoor plants, and used batteries. It is the experience of AEC that these environmental concerns are typical within a large-scale farming and nursery operation and are similar in nature to other large-scale farming operations found throughout California. It is also important to note that the majority of "hazardous" material, and waste generation are typically identified in the Hines Nursery headquarters/storage yards and in the maintenance yard of B & E Farms both of which occupy the least amount of leased property. Therefore, numerous environmental issues are concentrated in a small area, whereas, the vast majority of the property is under cultivation, and can be considered mostly unencumbered. Following is a brief description of the properties and structures in Planning Area I-05B and their associated recognized environmental conditions.

Hines Nursery Agricultural and Growing Headquarters

Hines Nursery
12621 Jeffrey Road, Irvine

The Hines Nursery Agricultural and Growing Headquarters is located at 12621 Jeffrey Road, Irvine, California and was originally developed in the late 1950's. The approximate 230-acre parcel is north of Field 301, and south of Portola Parkway and Hicks Canyon Wash. A residential tract forms the western border and Jeffrey Road forms the eastern border. Hines also leases the land east of Jeffrey Road, however, that portion of the nursery will be discussed in detail in the Planning Area I-09A Property Transfer Disclosure Report.

The approximate 230-acre parcel on the west side of Jeffrey Road consists of a main east-west entrance drive to a guardhouse. Beyond, and west of the guardhouse is an employee parking lot, and due south of the guardhouse are aboveground fertilizer and acid storage tanks (ASTs). Four of the ASTs have capacities of 10,000-gallons each, and the fifth AST has a capacity of 6,600-gallons. Two of the 10,000-gallon ASTs contain ammonium nitrate, one 10,000-gallon AST contains potassium chloride, and one 10,000-gallon AST contains potassium nitrate. The 6,600-gallon AST contains phosphoric acid and is secondarily contained. Continuing west along the access road leads to the central operating hub consisting of the main office structure, the automotive and rolling stock maintenance and repair shop, wash rack, tire repair shop, paint shop, welding shop, fueling depot, loading docks, greenhouse office, and equipment and material storage areas. Northwest of these structures are the plant propagation building, electrical storage building, and various storage sheds. The majority of open land on both sides of this east-west access road has been developed with greenhouse covered plants, sun and wind netting protected plants, and open air potted plants. The majority of the surface area consists of gravel and crushed rock over hard-packed dirt, while concrete foundations and concrete or asphalt aprons are identified around the buildings.

A 1.5-million gallon water collection reservoir has been installed in the southwest corner of the site to collect and recycle irrigation water. The irrigation water runs off the plants onto the hard-packed dirt/gravel surface, follows the topographic gradient into collection ditches, then directed to the reservoir. The reservoir is lined with bentonite to control subsurface vertical leaching.

B & E Farms (Field 301)

Planning Area I-05B also consists of land solely under agricultural use and cultivation and is identified as Field 301 leased to B & E Farms. The property is currently under strawberry cultivation. B & E Farms has also converted a small portion of their leased ground at the eastern property edge adjacent to Jeffrey Road into an agricultural storage and maintenance yard. Field 301 was initially in cover crop production, then planted to citrus in the late 1960's, then converted back to row crop production by 1994. Because Field 301 was planted to citrus it required windmachines for frost protection.

Underground Storage Tanks (USTs)

The Hines Nursery facility currently operates three 8,000 gallon double-walled USTs. Two of the tanks contain diesel and one holds gasoline. These USTs were installed in 1998 in accordance with applicable State and County requirements regarding secondary containment and monitoring of UST systems. There is an individual dispenser associated with each type of fuel. The active USTs are located on the north side of the vehicle and farm equipment service shop. The island is raised concrete, and the drive and UST pad is also concrete.

Hines Nursery has gone through two tank removal and replacement events during the 1990's. South of the maintenance garage Hines Nursery used to maintain a 12,000-gallon diesel UST (installation date approximately 1978) and on the north side of the service bays they operated a 880-gallon waste oil UST and a 500-gallon new oil UST (installation date approximately 1971). The USTs were removed during February and March 1990 by Hekimian and Associates. During the tank removal procedures contaminated soil was identified. It was deemed that the contaminated soil originated from overspill and that the USTs exhibited no signs of leaking. The impacted soil was removed by excavation and transported to a recycling facility. All work associated with the USTs were supervised by OCHCA personnel. Also, the USTs associated with the fueling islands were lined in 1990 and put back into service.

The second phase of tank removals occurred between the latter portion of 1997 and early 1998. Hines Nursery contracted for the removal of the two existing USTs and replacement with three new 8,000-gallon double-walled USTs. The UST installation is currently in compliance with the South Coast Air Quality Management District (SCAQMD), Orange County Fire Authority (OCFA), and Orange County Health Care Agency (OCHCA).

The Irvine Company also operated four 500-gallon capacity windmachine underground storage tanks in Field 301. These USTs contained gasoline and were used to fuel engines that powered the fan on a windmachine for frost protection purposes. The USTs were steel constructed, had 2-inch diameter vent and fill lines, and the product line consisted of 3/8-inch flexible copper tubing that was plumbed directly from the tank to the windmachine. The product delivery operated on a vacuum system, therefore, if there was a leak in the copper tubing the engine would not receive fuel, thus minimizing the potential for releases of any significant volume. The windmachines were placed on 10-acre centers. AEC conducted an OCHCA and OCFA permitted removal of these USTs in July 1998. A Tank Closure Report was prepared by AEC documenting the removal of the windmachine gasoline tanks and submitted to the OCHCA. A “no further action” letter from OCHCA referencing this tank removal will be submitted as an addendum to this report.

Recommendations for the UST Locations

AEC recommends that Hines Nursery continues to permit their USTs on a yearly basis and renew their SCAQMD as required. Tank Monitoring records need to continue to be documented and stored onsite. If a leak is identified within the plumbing, or dispensers, it should be immediately repaired and reported to the appropriate authorities.

Agricultural Yards

B & E Farms Jeffrey Road Yard: Surface soils in several small areas at the B & E Farms Jeffrey Road Yard (Field 301) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with the trapwagon diesel and gasoline ASTs that are located onsite and the storage of waste oil in 5-gallon buckets and 55-gallon drums. The storage of the agricultural chemicals are in the steel container equipped with a solid floor. Mixing of the chemicals is performed onsite using the hose bib connected to a water storage AST located on a trailer. The effluent water is allowed to migrate into the concrete-lined drainage culvert paralleling Jeffrey Road. B & E Farms also performs rolling stock maintenance in their open sided shed that has a concrete floor. B & E Farms has regular pickups of waste oil by Starlite Reclamation Company.

The Agricultural Storage and Maintenance Yards are a necessity to any farming operation and are used for the storage of agricultural chemicals, bulk oils, antifreeze, and diesel and gasoline fuels required to successfully operate and maintain farm equipment and agricultural land. Also, farmers want their storage yard adjacent to their Fields, therefore, it is common to cut out a 1 to 5 acre parcel of the agricultural land and convert it to a storage and maintenance yard, and because it used to be farmland it is very rare to find a yard that has been paved. The “hazardous” materials releases associated with the B & E Farms operation in Field 301 and the Hines Nursery do not appear to have occurred due to negligence, rather from small leaks and spills associated with the handling of the materials on a daily basis. The B & E Farms hydrocarbon and agricultural chemical releases are all aboveground; and the majority of the Hines Nursery hydrocarbon and agricultural chemical releases are aboveground. The volume of hydrocarbon and agricultural chemical releases are small in quantity, and have spilled onto the dirt surface, therefore, the vertical and lateral migration potential is limited.

Agricultural Chemicals

Hines Nursery and B & E Farms use agricultural chemicals to assist in the production of high yield and high quality produce. The chemicals used in Planning Area I-05B are categorized as pesticides, herbicides, fungicides, fertilizers, and surfactants. Following are a listing of the commonly used agricultural chemicals during the past year:

Pesticides	**Herbicides**	**Fungicides**	**Fertilizers**	**Other**
Pyrellin	Round-up	Copper Sulfate	Nutra-Sol	Ethanol
Diazinon	Glyphosate	Clamp	Tech Flo	Kaolin
Carbaryl		Tenn-Cop 5E	Simplot 21-0-0	Spray
Javelin		Dyrene	Ammonium Nitrate	
MVP II		Rovral	Potassium Nitrate	
AgroMEK		Thiolux Sulphur	Potassium Chloride	
Xentari		Copper-Count-n	Phosphoric Acid	

B & E Farms and Hines Nursery are registered with the Orange County Agricultural Commissioners Office (OCACO) and provide proper notification prior to applying the chemicals to their fields. There have been no “Notice of Violations” (NOVs) issued by the OCACO for the misuse, or mishandling of the chemicals by the farmers in Planning Area I-05B during the past year. Also, each tenant has been issued a Restricted Materials Permit Number by the Agricultural Commissioners office and they are tabulated below:

Farmer	Restricted Permit #	Expiration
B & E Farms	30-01-300515	12/31/01
Hines Nursery	30-01-300901	12/31/01

These tenants use licensed Pest Control Advisors (PCAs) to evaluate agricultural chemical selection and volume of application. The chemicals are applied in accordance with labeled instructions on the original container, and then the containers are triple rinsed prior to disposal.

Field 301 has historically been farmed by The Irvine Company and has been in permanent plantings and row crops. The Irvine Company transported equipment to Field 301 on an as-needed basis from the former Main Yard located at Old Myford Road and Jamboree. The storage of equipment and materials in the storage yard has been relatively recent to the property (past 7 years), thereby, limiting the occurrences and volumes of aboveground releases of chemicals.

Hines Nursery stores and mixes its agricultural chemicals at the work station located on the east side of Jeffrey Road. However, prior to construction of the agricultural chemical mixing station on the east side of Jeffrey Road in early 1980, Hines stored and mixed the various agricultural chemicals in a small building and work area approximately 300 feet south of the southwest corner of the automotive service shop. This area was prominently used during the 1960's and 1970's. The small building that was formerly used for storage of the agricultural chemicals has been converted to a greenhouse office for employees. The building has a concrete foundation overlain by floor tile and is of wood framing and wood siding construction. The building has been maintained in very good condition. Approximately 100 feet south of this building is a concrete foundation that used to support the small laboratory building. A greenhouse now occupies the surface of this foundation.

Transition of Property to Non-Agricultural Uses

It is important to note this Property Transfer Disclosure Report was conducted on property that will remain in agriculture production for a minimum of one more year, and possibly longer, and understanding that farming is a dynamic process the mitigation of these sites should proceed with common sense and in an orderly fashion. The initial aspect of this report is to identify the active work-related areas where repeated handling and use of chemicals classified as “hazardous” occurs. These areas, and the personnel working in these areas, will be studied to identify if the repetitive handling of chemicals is being conducted in a manner that will not cause an adverse impact to soil and water resources. Next, AEC will make recommendations regarding mitigation of the historical recognized environmental concerns, followed by remediation of any impacted soil. Once the agricultural leases have been terminated, and future land use has been decided, AEC recommends conducting a Phase II Environmental Assessment. Recommendations will be formulated from the results of the Phase II Assessment and mitigation measures will need to be performed prior to the mass grading of the property in preparation for an alternate land use. However, , it is the professional opinion of AEC that there are no current recognized environmental concerns that would restrict the non-farm compound agricultural use areas from being converted from agricultural to residential.

No other recognized environmental conditions were identified at the subject property or on surrounding properties during this assessment.

7.0 REFERENCES

1) Geologic Map of California; State of California Resources Agency, Department of Conservation, Division of Mines and Geology.

2) United States Geological Survey - 7.5 Series Topographic Quadrangle Map Publications (Tustin, El Toro, Laguna Beach and San Juan Capistrano Quadrangles).

3) Soil Survey of Orange County and Western Part of Riverside County, California; United States Department of Agriculture, Soil Conservation Service; 1299 Colombia Avenue, Suite E5; Riverside, California 92507; (909) 683-7691.

4) EDR Environmental Information, Inc.; 3530 Post Road, Southport, Connecticut, 06490; (800) 352-0500; www.edrnet.com.

5) Orange County Agricultural Commission; 1750 S. Douglass Road, Building D; Anaheim, California 92806-6050; (714) 447-7100.

6) Orange County Health Care Agency; 2009 East Edinger Avenue; Santa Ana, California 92705; (714) 667-3700.

7) Orange County Fire Authority, Hazardous Materials Unit; 180 South Water Street; Orange, California 92866-2123; (714) 744-0400.

8) State of California Department of Conservation - Division of Oil & Gas; 4800 Stockdale Highway; Bakersfield, California 93309; (661) 322-4031.

9) Southern California Edison; P. O. Box 410; Long Beach, California 90802; (310) 491-2391.

10) Wetlands Law Tests Government Plan; Gregor I. McGregor, Esq.; Environmental Protection Volume 3, Number 9 - November 1992; Stevens Publishing Corporation; 225 North New Road; Waco, Texas 76710; (817) 776-9000.

11) California Statewide Radon Survey Screening Results; State of California Department of Health Services; 601 North 7th Street; Sacramento, California 95814; (916) 322-2040.

12) United States Department of Housing and Urban Development (HUD); 1615 West Olympic Boulevard; Los Angeles, California; (213)-251-7001.

8.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

Advanced Environmental Concepts, Inc. appreciates the opportunity to provide our professional assistance to Irvine Community Development Company on this project. If you have any questions regarding our report or if AEC can be of further service, please call us at (661) 831-1646.

Sincerely,

Advanced Environmental Concepts, Inc.

Jonathan L. Buck
Registered Environmental Assessor II #20017

DOC11RF

9.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

AEC staff are composed of one primary environmental professional that performs Preliminary Site Assessments on a routine basis. Qualifications profiles for this individual is provided in the following section.

Jonathan L. Buck

Mr. Buck received a Bachelor of Science degree in Geology from the University of California, Santa Barbara, in 1981 and was professionally engaged in the petroleum industry in various capacities through 1985. Mr. Buck joined the environmental industry in 1985 and formed **Advanced Environmental Concepts Inc.** in 1989. Since it's inception, **AEC** has been a full service environmental consulting firm specializing in Preliminary Site Assessments, UST programs, and soil and groundwater assessment and cleanup programs. Mr. Buck is a State of California Registered Environmental Assessor, Class II (#22017) and has performed numerous PSA's on diverse properties throughout California, Arizona, Oregon, and Washington.

Advanced Environmental Concepts, Inc. is pleased to present the following:

Property Transfer Disclosure Report

for

Irvine Community Development Company
Planning Area I-06
Agricultural and Industrially Developed Land

North of Irvine Boulevard, Bisected by Portola Parkway, and East of Jeffrey Road
Unincorporated Orange County California

This report has been prepared for:

Mr. Ken Coulter
Irvine Community Development Company

Prepared: September 2001

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1.0 EXECUTIVE SUMMARY

On behalf of the Irvine Community Development Company, Advanced Environmental Concepts, Inc. (AEC) has prepared a Property Transfer Disclosure Report for agricultural and industrial developed parcels bordered partially on the south by Irvine Boulevard, the west by Jeffrey Road, and is bisected by Portola Parkway, and the Foothill Transportation Corridor. The property reviewed in Planning Area I-06 consists of agricultural land under permanent planting and row crop cultivation approximating 500-acres, properties leased for nursery plant production approximating 250 acres, native rangeland of approximately 900 acres, and industrially developed parcels approximating 70 acres.

The nurseries leasing property in Planning Area I-06 include the following

El Modena Gardens	11911 Jeffrey Road, Irvine, California
Bordier's Nursery	7231 Irvine Boulevard, Irvine, California
Sunny Slope Trees	3180 Glassell Street, Orange, California
Pacific Coast Nursery	7985 Irvine Boulevard, Irvine, California
Village Nursery	1589 North Main, Orange, California

The industrially developed parcels include businesses located in two main areas; contractors and landscape architects are at the northern extension of Jeffrey Road; "green waste" and fertilizer companies are along the east and west sides of "N" Street (Irvine Boulevard addresses). The Jeffrey Road businesses within Planning Area I-06 include the following:

California Labor Camp	11405 Jeffrey Road, Irvine, California
Nakae Landscape	11159 Jeffrey Road, Irvine, California
Stice Construction	10851 Jeffrey Road, Irvine, California
Suchy Trenching	11501 Jeffrey Road, Irvine, California
Griffith Construction	2020 South Yale, Santa Ana, California
Southern Cal Sandbags	12620 Bosley Lane, Corona, California

The "N" Street properties within Planning Area I-06 are as follows (addresses are on Irvine Boulevard):

Tierra Verde Industries	7982 Irvine Boulevard, Irvine, California
Aguinaga Fertilizers	7992 Irvine Boulevard, Irvine, California
GE/EER	8001 Irvine Boulevard, Irvine, California

The Irvine Company Fields include 301, 302, 303, 304, 305, 306, 307A, 307B, 308, 310, 311, 312A, 312B, and 313 and are farmed by either The Irvine Company as avocado orchards, or leased to tenants including Gargiulo Farms, D & D Farms, Custom Country Landscaping, and various nurseries.

Planning Area I-06 also includes approximately 900-acres of native chaparral that has not been previously developed. This property is in the rugged foothills north of Portola Parkway and bisected by the Eastern Transportation Corridor.

The area under study also includes the out of service Lambert Reservoir and active Siphon Reservoir. This assessment was performed during April, May, and June 2001. The purpose was to identify adverse environmental conditions and "hazardous" waste streams generated on-site that could potentially affect the human health and the environment, and to review if "hazardous" waste streams generated offsite could adversely affect the subject properties. These concerns include storage and use of agricultural chemicals categorized as pesticides, herbicides, fungicides, fertilizers, and surfactant. Other concerns include transite irrigation pipe which contains asbestos, the storage of new oils and hydraulic fluids, the generation and storage of waste oils, the storage of diesel and gasoline fuels in aboveground and underground storage tanks (ASTs and USTs), hydraulic floor lifts, effluent waste water from steam wash pads, and used batteries. It is the experience of AEC that these environmental concerns are typical within large-scale farming operations, and to the industrial businesses located on The Irvine Company properties. These environmental concerns are similar in nature to other large-scale farming and industrial operations found throughout California. It is also important to note that the majority of "hazardous" material, and waste generation are typically identified in the farming yards of the different tenants, and in the maintenance area of the service shops, which occupy the least amount of property. Therefore, numerous environmental issues are concentrated in a small area, whereas, the vast majority of the property is under cultivation, or used for open storage space, and can be considered mostly unencumbered.

Also, this report will review two specific facilities that are currently under review by the Orange County Health Care Agency (OCHCA) and Regional Water Quality Control Board (RWQCB) concerning releases of "hazardous" wastes that have adversely impacted soil and groundwater resources. These two facilities are the former Orange County Shooting and Training Center and the GE/EER Research Facility. Following is a brief description of the properties and structures in Planning Area I-06 and their associated recognized environmental conditions.

Description of the Tenants and Property Use

El Modena Gardens nursery is located north of Portola Parkway and parallels Jeffrey Road. The El Modena Gardens parcel thins in an east-west orientation and is elongated north-south. The property winds through the foothills adjacent to Jeffrey Road. Their main headquarters is central to the property on the east side of Jeffrey Road and consists of a series of modular wooden constructed office units. The entire area is unpaved and consists of hard-packed dirt overlain by crushed rock and gravel. South of the office units, across the hard-packed dirt and gravel access road is the former location of two underground fuel storage tanks (USTs). These tanks were removed by AEC in 1999 and have been given a "no further action" designation by OCHCA. This fueling area has been replaced by a secondarily contained aboveground fuel storage tank (AST), also permitted and installed by AEC. Further south of the main office facilities are the storage warehouses for equipment and materials used in the nursery operation and the automotive and rolling stock maintenance shop. Adjacent to the north side of the maintenance shop is another secondarily contained AST permitted and installed by AEC. The relatively level quadrangular area formed by the main office complex to the north and warehouses and shops to the south is used as a staging, loading, and shipping area for the wide variety of plants cultivated at the facility.

El Modena Gardens wastewater treatment is approved by the RWQCB, however, they have taken a less conventional treatment approach. Instead of the overhead sprinkler application of water to the ornamental plants, El Modena Gardens has retrofitted the irrigation system with micro-jet and micro-fan sprinklers connected to timers which regulate the volume of water use per plant. This method serves two purposes; first it decreases overall water consumption; secondly allows implementation of an unique irrigation water treatment system. El Modena Gardens has installed a series of water collection ditches, and inside these ditches they have constructed screens that have the Canna plant attached. The Canna plant scrubs the elevated nutrient concentrations from the water and adequately cleans it for re-use, or acceptable for disposal in the stormwater drainage system.

At the north boundary of El Modena Gardens, on Jeffrey Road, is the California Labor Camp. This camp is part of the Statewide Labor Corporation, a business that provides housing to farm labor. The labor camp consists of trailer type living units, a group kitchen, and recreational/church facility. The gate was locked during the time of AECs visit, therefore, the inspection was conducted from the outside. The camp is on a septic system, and also has many portable toilets for use. Amenities are limited and the living conditions are rural.

Continuing north on Jeffrey Road is the Griffith Company sand and gravel plant. This area is used for recycling concrete and asphalt into re-usable base material. The facility maintains a portable office unit and the majority of the area is used for storage of import and export material.

To the northeast of Griffith Company is the Southern California Sandbag Company. This small lot houses another portable office trailer and yard space for filling sand bags.

At the terminus of Jeffrey Road, and bounded to the north and east by the Transportation Corridor are three businesses that have common borders. The Stice Construction yard consists of a chain-link fenced perimeter and a modular office unit, and storage yard for various “heavy” equipment used in the earthmoving construction industry. East of Stice Construction is the Nakae and Associates landscape business that consists of a chain-link fenced perimeter, modular office units, and storage yard for equipment and materials used in the landscape industry. Nakae also operates a diesel “trapwagon” fueling system. East of Nakae and Associates is Suchy Trenching Company. Suchy Trenching also has a chain-link fenced perimeter, and a newly constructed metal-roofed and sided building and storage yard for equipment and materials.

Griffith Company, Southern California Sandbags, Stice Construction, Nakae and Associates, and Suchy Trenching all have hard-packed dirt and crushed rock and gravel surfaces. They also occupy a portion of the former Orange County Shooting and Training Center (OCSTC).

Orange County Shooting and Training Center (OCSTC)

The OCSTC leased approximately 64-acres of native chaparral from The Irvine Company and operated a rifle, pistol, and shotgun range from the mid 1960's to December 1995. The OCSTC permitted public target shooting, provided firearm safety training, and served the needs of training qualifications for Federal, State, and Local Law Enforcement Agencies. The demise of the OCSTC was prompted by the construction of the Eastern Transportation Corridor which was positioned immediately adjacent to the firing lines and target areas of the OCSTC. The OCSTC operated as a not for profit corporation, therefore, had limited available funds for lead remediation. The Irvine Company became responsible for costs associated with the mitigation of areas of the shooting range directly affected by the construction of the Toll Road and the OCSTC attempted mitigation of the lead impacted areas outside the Toll Road boundaries on The Irvine Company’s leased property. The OCSTC eventually declared bankruptcy, however, the majority of the remediation was accomplished.

Of the 64-acres leased by the OCSTC only 5-acres of actual shooting areas comprised the different firearm ranges. Man made abutments and natural terrain separated the different ranges. The current location of Griffith Company and Southern California Sandbags are within the former OCSTC rifle and pistol range. The current locations of Stice Construction, Nakae and Associates, and Suchy Trenching are positioned within the former skeet and trap range. The recognized environmental conditions associated with shooting ranges are the lead constructed shotgun pellets and pistol and rifle bullets. In a slightly acidic environment the lead degrades and becomes water soluble thereby creating “hazardous” concentrations of a California regulated waste material. Common mitigation procedures include resource recovery of the lead shot through a “mining” operation of the Major Impact Zones (MIZs). Briefly, the lead shot is collected using all, or combinations, of heavy equipment including scrapers, graders, dozers, and loaders. The lead shot is stockpiled, then screens and shakers are used to recover the lead shot and separate the accompanying soil and rock. Confirmation samples are collected from the excavated areas and analyzed for Total Lead by EPA Method 7420. AEC performed the lead shot mitigation in the area of the skeet and trap range and Environmental Contractors Inc. (ECO) conducted the mitigation of lead impacted soil at the rifle and pistol ranges. The majority of work performed was during April and May 1996. AEC was contracted to only excavate and stockpile all accessible lead impacted soil from the skeet and trap range, whereas, ECO conducted excavation, stockpiling, and resource recovery on both the pistol and rifle range, and skeet and trap range. AEC conducted our portion of the lead impacted soil mitigation and confirmation sampling under the direction of Mr. Luis Lodrigueza, Hazardous Materials Specialist, OCHCA. The results of AECs excavation, and subsequent confirmation soil sampling, indicated that all accessible lead shot was recovered from the skeet and trap range as evidenced by the acceptable concentrations of Total Lead within the confirmation samples. AEC stockpiled the lead impacted soil adjacent to the east flank of the foothill separating the skeet and trap range from the rifle and pistol range. In June 2000 AEC was contracted by The Irvine Company to arrange for loading, transportation, and disposal of the lead impacted soil to USPCI Landfill in Beatty, Nevada. AEC disposed of approximately 237.75-tons of lead impacted soil at the landfill under the supervision of Mr. Lodrigueza of OCHCA. Following the complete removal of the stockpiled soil, AEC then collected confirmation soil samples under OCHCA supervision and the soils exhibited acceptable Total Lead concentrations. AEC prepared a "request for closure" letter with the OCHCA and closure would have been granted based on the work performed except that the stockpile that AEC disposed of only contained 237.75-tons of lead impacted soil, not the 1,100 tons that was originally excavated and stockpiled by AEC in 1996. It has been theorized that the stockpiled soil was either added to ECOs stockpile and "mined" for lead shot recovery in 1996; became a part of the earthmoving process in building the Transportation Corridor Toll Road; or was a combination of the two processes. In any event, Mr. Lodrigueza is not able to issue "no further action" for this site because of the soil discrepancy. In a positive light, OCHCA is not continuing enforcement of the site and currently considers it a non issue.

East of the East Leg of State Route 133 (Toll Road) are agricultural grounds farmed by either The Irvine Company or tenants. Bordier's Nursery leases from the Navy an approximate 150-acre contiguous piece of property bounded by Irvine Boulevard to the south and Portola Parkway to the north. This property is not a part of this assessment. In addition, Bordier's Nursery also leases Field 311 and Field 352 from the Irvine Company. The nursery operation in Field 311 includes wind and sun netting growing areas, and open-air growing areas for many ornamental varieties of plants and shrubs. Field 352 is primarily used as a stockpiling area for soil mixing of material used in the potting of the plants. Field 352 was a former rifle range used by servicemen at the El Toro Marine Corp Air Station. The rifle range was only in use during an approximate 10 year period assumed to be between 1965 and 1975, however, it may also have a lead shot concern equivalent to the OCSTC. The nursery primarily waters the plants by overhead sprinklers and also incorporates drip and micro-jet irrigation. Excess irrigation water is collected at a topographic low at the southern portion of the property, pumped into a collection reservoir, filtered, then re-cycled as irrigation water. Bordier's Nursery has current RWQCB discharge permit #90-81.

North and east of the Bordier's Nursery Navy leased property are relatively contiguous Fields owned and farmed by The Irvine Company, or owned by The Irvine Company and leased to various tenants. Gargiulo leases Field 302 and is currently farming tomatoes. Field 303 is planted to strawberries, Field 304 is leased by Sunny Slope Nursery, Field 308 is planted to avocados and a portion of Field 308 is leased to Custom Country for composting, sand bag construction, and wood splitting. The Irvine Company farms avocados in Fields 301, portion of 304, 305, 306, 307A-B, 308, and 310. Village Nursery leases Field 312A-B and Pacific Coast Nursery leases property on the northeast side of "N" Street and east of the Lambert Reservoir (dry and out of service) identified as Field 313. They cultivate primarily large shrubs and ornamental trees and the irrigation is accomplished using a drip irrigation system connected to each box. Sunny Slope Trees operate a nursery north of Portola Parkway and south of the Corridor Toll Road identified as Field 304. The cultivated areas present minimal environmental concern, however, there are industrial facilities along "N" Street that have recognized environmental conditions.

Tierra Verde Industries operates a large scale composting and greenwaste acceptance facility at the intersection of Irvine Boulevard and "N" Street. On the west side of "N" Street Tierra Verde Industries operates a rectangular yard used for receiving primarily wood and cardboard products which are pulverized, chipped, and ground into wood chips and sawdust size particles. The Tierra Verde facility on the east side of "N" Street is used as a receiving facility for greenwaste, and has been improved with the construction of a scale house, maintenance shop, and offices. The structures are primarily concrete floored, and metal roofed and sided. Tierra Verde constructed the maintenance shop to service the heavy equipment used in the loading, chipping, and grinding of the greenwaste and previously manufactured wood products. The area leased by Tierra Verde Industries used to be a chicken ranch and the chicken coops are visible on the older aerial photographs. Tierra Verde Industries stores bulk new oil, hydraulic oil, grease, and coolant in 55-gallon drums and 5-gallon containers at the eastern facility. Diesel and gasoline are stored in ASTs. Waste oil is stored in a 500-gallon AST and picked up on a regular basis for recycling.

Roger Aguinaga leases approximately 21-acres on both sides of "N" Street from The Irvine Company. Aguinaga operates a composting facility on the eastern side of "N" Street and has modular offices, a maintenance shop, and used equipment and material storage on the west side of "N" Street. The area historically was used for chicken ranching. The Aguinaga storage yard on the west side of "N" Street is used for maintenance of heavy equipment and rolling stock, storage of bulk oil, hydraulic fluids, grease, coolant, diesel, and gasoline. The diesel and gasoline are stored in ASTs mounted on flatbed trailers that have secondary containment berms built around them. There are also numerous diesel and gasoline ASTs that are not secondarily contained. The new oil and grease are commonly stored in 55-gallon drums and waste oil is stored in 55-gallon drums and a waste oil AST.

General Electric/Energy and Environmental Research (GE/EER)

GE/EER operate a energy research plant on the east side of "N" Street. The 25-acre parcel is leased from The Irvine Company and is currently used as a test facility. GE/EER performs research and development for improved boiler combustion and emissions control testing. Site facilities include a main office trailer, a two story office/document storage structure, a machine shop, a combustion test area, an analytical laboratory, several storage sheds, and several outdoor storage areas. Operations at the facility include burners that simulate industrial boilers and other combustion facilities test fires to evaluate combustion emissions control designs. Also, fuel types and flow rates are controlled and modified to simulate different combustion conditions, and differing types of emission monitoring equipment are attached to the boiler to test and monitor improvements in the combustion engines.

Feedstock material historically used to fuel boilers and burners include natural gas, diesel, fuel oil, biomass, paper, cardboard, plastic, oil/water emulsion, and auto shredder waste. GE/EER personnel state that hazardous wastes have not been used to fuel the boilers and burners.

Four USTs that formerly contained gasoline, diesel, and crude oil were located in the northwest portion of the site. These tanks were removed in 1991 and 1992. Following onsite bioremediation and testing of hydrocarbon impacted soils from the area of the USTs, OCHCA approved the soils for placement as fill. Closure for the former UST emplacement was issued by OCHCA in November 1993.

The site has been a test facility since 1960, and prior to that it was a gravel quarry. Ford Motor Company/Philco Corporation operated a rocket engine, small missile, shape charge, flare, and separation testing area onsite from 1960 to 1966. Ultrasystems Inc. occupied the site beginning in 1975 and land use and occupancy between 1966 and 1975 are currently unknown. Ultrasystems Inc. tested various burner configurations for high efficiency, low emission commercial boilers and EER was formed from Ultrasystems.

As part of a lease agreement (Lease Amendment No. 7) with The Irvine Company GE/EER was required to conduct a baseline risk assessment. This assessment consisted of 71 soil borings, installations of six groundwater monitoring wells, and conducting quarterly sampling. The results of the subsurface investigation indicated elevated concentrations of solvents (TCE and 1,1 DCE) in the underlying groundwater identified between 40 and 55 feet bgs. The site is continuing to be investigated and is under the regulatory guidance of the OCHCA and the Santa Ana RWQCB.

Also, EER has conducted final remediation during 1999 at the boneyard, auto shredder area, fly ash storage area, process water pit, Combustion Test Bay, and paved containment area all which exhibited elevated concentrations of TRPH and/or PCBs. The soil was excavated, transported offsite for disposal, and samples were collected to confirm the adequate removal of the impacted soil. The results of the remediation and confirmation sampling indicate that the identified chemical constituents of concern have been removed from the site to the referenced clean-up concentrations of less than 100 mg/kg for TRPH and non-detectable concentrations of PCBs.

The Irvine Company Underground Storage Tanks (USTs)

The Irvine Company operated 280-gallon to 500-gallon capacity windmachine underground storage tanks in Avocado Fields 301 and 306. The one UST in Field 301 and the four USTs in Field 306 contained gasoline and were used to fuel engines that powered the fan on a windmachine for frost protection purposes. The USTs were typically steel constructed, had 2-inch diameter vent line and fill, and the product line consisted of 3/8-inch flexible copper tubing that was plumbed directly from the tank to the windmachine. The product delivery operated on a vacuum system, therefore, if there was a leak in the copper tubing the engine would not receive fuel, thus minimizing the potential for releases of any significant volume. AEC permitted the five windmachine gasoline USTs and removed the USTs, under OCHCA supervision, on June 14, 2001. The soil samples collected beneath the USTs exhibited non-detectable concentrations for TPH-gasoline, volatile aromatics, and full scan of oxygenates. AEC is awaiting a "no further action" letter from OCHCA. Once it is received, the letter will be forwarded for ICDC review and filing.

Agricultural Yards

Custom Country Landscape Yard: Surface soils in several small areas at the Custom Country Landscape Yard (Field 308) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with portable aboveground storage tanks seated in steel saddles and the waste oil stored in open-topped 5-gallon buckets. None of the tanks appeared to be leaking, and the small releases appear to be accidental during use.

D & D Yard: Surface soils in several small areas at the D & D Yard (Field 303) were observed to be stained with hydrocarbons during AECs site inspection. D & D also stores agricultural chemicals in a locaked steel container equipped with a solid floor. Mixing of the chemicals is performed onsite using a hose bib. The mixing area is on hard-packed dirt.

Aguinaga Yard: Surface soils in several small areas at the Aguinaga Yard (Field 372) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with the ASTs that are located onsite. Aguinaga operates a 500 gallon gasoline AST, (2) 750 gallon diesel ASTs, one 1,000-gallon waste oil AST, and 8,000-gallon diesel and maintains approximately 13 unused ASTs. The yard also stores bulk quantities of new oil, hydraulic oil, grease, and coolant in 55-gallon drums and 5-gallon buckets. Bags of fertilizer are stored inside a steel container, and waste oil and waste filters are stored in 55-gallon drums and 5-gallon containers. Aguinaga also has a boneyard of miscellaneous used equipment and materials including two older model suction dispensers.

These agricultural storage and maintenance yards are a necessity to any farming operation and are used for the storage of agricultural chemicals, bulk oils, antifreeze, and diesel and gasoline fuels required to successfully operate and maintain farm equipment and agricultural land. Also, farmers want their storage yard adjacent to their Fields, therefore, it is common to cut out a 1 to 5 acre parcel of the agricultural land and convert it to a storage and maintenance yard, and because it used to be farmland it is very rare to find a yard that has been paved. The "hazardous" materials releases commonly associated with a farm operation rarely occur due to negligence, rather it is commonly from small leaks and spills associated with the handling of the materials on a daily basis. The releases are usually aboveground, small in quantity, and spill onto the dirt surface, therefore, vertical and lateral migration potential is limited.

Agricultural Chemicals

The Irvine Company, and the farmers that lease Irvine Company property all use agricultural chemicals to assist in the production of high yield and high quality produce. The chemicals used in Planning Area I-06 are categorized as pesticides, herbicides, fungicides, fertilizers, and surfactants. Following are a listing of the commonly used agricultural chemicals during the past year:

Pesticides	Herbicides	Fungicides	Fertilizers	Other
Pyrellin	Round-up	Copper Sulfate	Nutra-Sol	Ethanol
Diazinon	Glyphosate	Clamp	Tech Flo	Kaolin
Carbaryl		Tenn-Cop 5E	Simplot 21-0-0	Spray
Javelin		Dyrene	Ammonium Nitrate	
MVP II		Rovral	Phosphoric Acid	
AgroMEK		Thiolux Sulphur	Potassium Nitrate	
Xentari		Copper-Count-n	Ammonium Nitrate	
Danitol				

All the farmers are registered with the Orange County Agricultural Commissioners Office (OCACO) and provide proper notification prior to applying the chemicals to their fields. There have been no "Notice of Violations" (NOVs) issued by the OCACO for the misuse, or mishandling of the chemicals by the farmers in Planning Area I-06 during the past year. Also, each farmer has been issued a Restricted Materials Permit Number by the Agricultural Commissioners office and they are tabulated below:

Farmer	Restricted Permit #	Expiration
Orange County Produce	30-01-300805	12/31/01
Gargiulo Farms	30-01-300917	12/31/01
Bordier's Nursery	30-01-300911	12/31/01

All of these farmers use licensed Pest Control Advisors (PCAs) to evaluate agricultural chemical selection and volume of application. The chemicals are applied in accordance with labeled instructions on the original container, and then the containers are triple rinsed prior to disposal.

Asbestos Containing Materials

Varying diameters and lengths of "transite pipe" may be identified during grading of the different Fields. The transite pipe contains asbestos and as such is regulated when it becomes a "waste" product. If the pipe becomes unusable it should be loaded into a truck and transported to an approved acceptance facility in Los Angeles County (Orange County accepts no asbestos related material). Also, since the pipe is non-friable there is not a sense of urgency regarding the disposal.

Transition of Property to Non-Agricultural Uses

It is important to note this assessment was conducted on property that will remain cultivated for a minimum of one more year, and possibly longer, and understanding that farming is a dynamic process the mitigation of these sites should proceed with common sense and in an orderly fashion. The initial aspect of this report is to identify the active work-related areas where repeated handling and use of chemicals classified as "hazardous" occurs. These areas, and the personnel working in these areas, will be studied to identify if the repetitive handling of chemicals is being conducted in a manner that will not cause an adverse impact to soil and water resources. Next, AEC will make recommendations regarding mitigation of the historical recognized environmental concerns, followed by remediation of any impacted soil. Once the agricultural leases have been terminated, and future land has been decided, AEC recommends conducting a Phase II Environmental

Assessment. Recommendations will be formulated from the results of the Phase II Assessment and mitigation measures will need to be performed prior to the mass grading of the property in preparation for an alternate land use. Also, it is the professional opinion of AEC that there are no current recognized environmental concerns that would restrict the non-farm compound and non-industrial use areas from being converted from agricultural use to residential with the exception of the former Navy rifle range in Field 352.

No other recognized environmental conditions were identified at the subject property or on surrounding properties during this assessment.

2.0 INTRODUCTION

2.1 Purpose

The purpose of this assessment is to identify recognized environmental conditions located at the subject site or adjacent properties which could present material risk of harm to public health or to the environment. Recognized environmental conditions are defined as the presence or likely presence of any hazardous wastes and/or substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property.

2.2 Special Terms and Conditions

The information included in this report is intended for use exclusively as a preliminary assessment of potential environmental and human health concerns at the project site. Data was obtained through telephone conversations, personal interviews, public records, public information, general maps and aerial photographs. These services have been rendered by **Advanced Environmental Concepts, Inc.** (**AEC**) in accordance with generally accepted practices by professional hydrogeologists and environmental specialists. Because of the limited nature of this investigation, the firm is precluded from providing a warranty, expressed or implied, regarding the presence of hazardous materials that could potentially adversely affect the subject site.

This report is provided with the understanding that it is the responsibility of the owner to convey the information and recommendations contained herein, to the appropriate regulatory agencies, as required. The services performed in the scope of this project are for the sole use of our client. Others who seek to rely on the findings contained within this report have a duty to determine the adequacy of the information presented herein, for their time, location, and intended use.

2.3 Limitation and Exceptions of Assessment

This report presents the results of a Property Transfer Disclosure Assessment conducted by **Advanced Environmental Concepts, Inc.** (**AEC**) for Irvine Community Development Company (client), subsidiary of The Irvine Company, on the following property:

Irvine Community Development Company
Planning Area I-06
Agricultural and Commercially Developed Land
North of Irvine Boulevard, East of Jeffrey Road, Bisected by Portola Parkway
Unincorporated Orange County California

No other properties were included within the scope of this assessment except as required for the off-site reconnaissance and for the regulatory agency database and file review pertaining to potential sources of offsite recognized environmental concerns. Historical information regarding the subject parcels is limited to review of public documents, interviews with persons knowledgeable with the past and present uses and conditions of the property, and historic mapping and aerial photography review.

2.4 Limiting Conditions and Methodology

To evaluate the potential presence of recognized environmental conditions, this preliminary investigation consisted of the following:

Contacting appropriate regulatory agencies for hazardous materials information concerning the subject site and surrounding areas located within an approximate ¼-mile radius of the site boundaries. Inquiries were made regarding documentation of: (a) toxic spills; (b) underground storage tanks; (c) the use, storage, generation, and/or disposal of hazardous materials; (d) the presence of disposal wells and/or leach fields, drain fields, and septic systems; and, (e) violations of applicable environmental control standards;

Conducting interviews and researching historical site usage for information regarding past or present recognized environmental conditions;

Reviewing selected reports, maps, and aerial photographs for information pertaining to potential sources or visual indications of soil and groundwater contamination;

Conducting an on-site inspection and off-site reconnaissance to identify visible evidence of the generation, use, storage, release, or disposal of hazardous materials;

Evaluating investigational findings and the preparation of a detailed report inclusive of findings and recommendations.

3.0 SITE DESCRIPTION

3.1 Location[1]

Planning Area I-06 consists of approximately 1,720 acres of land currently developed as agricultural parcels, nurseries, greenwaste and composting facilities, industrial developed parcels, and non-developed native chaparral. Planning Area I-06 is located approximately two to four miles north of the Interstate 5 Freeway and is bisected by the Foothill Transportation Corridor (Toll Road). Irvine Boulevard is a partial southern border to the properties and Portola Parkway is a longer southern border to Planning Area I-06. The eastern property border is primarily undefined by any permanent markings, however, may be defined by the Agua Chinon Wash. The northern border of Planning Area I-06 is within the rugged foothills and native chaparral and is also undefined by permanent construction or landmarks.

3.2 Site and Vicinity Characteristics

3.2.1 Physiographic Setting

The subject property is primarily within the southwestern foothills of the Santa Ana Mountains within the Peninsular Ranges geomorphic province of California. The property is north of the Tustin Plain boundary, located south and adjacent to the Downey Plain, which is the largest area of Recent alluvial sedimentation. The Tustin Plain is composed of alluvial fans with elevations from 150 to 500 feet above mean sea level that formed along the southwest flank of the Santa Ana Mountains. The plain slopes regionally to the west and southwest with a topographic gradient of approximately 75 - 100 feet per mile[2].

The alluvial deposits of Holocene-Quaternary age that comprise the Tustin Plain consist mainly of sands, gravels, silts and clays. Generally, the coarse grained sediments are deposited near the inland hills as alluvial fans, whereas deposition of progressively finer grained sediments occurs towards the river flood-plains. The upper fan areas are interpreted as intake areas where recharge of the groundwater takes place. Hydraulic continuity may exist between alluvial sediments of the fan areas and certain water-bearing sediments of the central lowlands. Replenishment of groundwater occurs in the intake area by infiltration from major streams within their permeable channels and from irrigation water and rain. Groundwater is found in area irrigation wells at a depth of 100 feet or more below ground surface (bgs), and first unconfined groundwater has been identified at approximately 108-feet bgs in the area of Jeffrey Road and Portola Parkway, and approximately 50-feet bgs in the area of “N” Street and Irvine Boulevard. In the Agua Chinon area of the study area shallow groundwater has been identified between 10 and 20-feet bgs.

The regional stratigraphy is comprised of interbedded silt, clay and sand that is typical of sediments deposited on alluvial fans during flood stages. Elevations of the subject property range from 1,000 feet at the northeastern boundary to 250 feet at the southwestern boundary. The property gently slopes in the westerly direction south of Portola Parkway, and is more steeply sloping north of Portola Parkway. The subject area is underlain by several bedrock formations ranging in age from the Cretaceous to the Pliocene. These formations include, from oldest to youngest, the Williams Formation (Pleasants Sandstone Member), Monterey Formation, Puente Formation (Soquel Member), Capistrano Formation, (Oso Member), and Niguel Formation. Overlying the bedrock are alluvium, slopewash, landslide detritus, and artificial fill.

The geologic structure at the site consists of complex folding and faulting. In the northwestern portion of the site, the general overall structure includes an east-west trending syncline within the Williams Formation. In the northeastern portion of the site, north of Portola Parkway, there is an east-west trending syncline in the Oso Member of the Capistrano Formation. South of Portola Parkway the structure is defined by the Agua Chinon Fault, a listric fault that strikes north-northwest. The closest active fault to the site is the Whittier-Elsinore fault, approximately 11-miles to the north.

3.2.2 Soils Profile[3]

Surface sediments beneath the subject property are composed of four primary soil types and seven secondary soil types:

(1)	**Anaheim Loam, 15 to 30% Slopes**	**(106)**
(2)	**Calleguas Clay Loam, 50 to 75% Slopes**	**(134)**
(3)	**Sorrento Loam, 0 to 2% Slopes**	**(206)**
(4)	**Sorrento Clay Loam, 0 to 2% Slopes**	**(208)**

Anaheim Soil Series: This series consists of well drained soils found on foothills. Anaheim soil consists of material weathered from soft sandstone and shale. Runoff is rapid and erosion hazard is high, especially in areas which are not covered with protective vegetation. The typical profile consists of a grayish brown clay loam surface layer to 26 inches. The underlying layer is fractured sandstone or shale. The soil is slightly acid or mildly alkaline. Anaheim soils are used for dryland pasture, range, and field crops.

Calleguas Soil Series: This series consists of well drained soils found on uplands. Calleguas soil consists of material weathered from lime coated shale or lime coated sandstone. Runoff is rapid and erosion hazard is high, especially in areas which are not covered with protective vegetation. The typical profile consists of a pale brown clayey loam surface layer to 15 inches. The underlying layer is fractured lime coated sandstone or shale. The soil is slightly acid or mildly alkaline. Calleguas soils are used for dryland pasture, range, and field crops.

Sorrento Soil Series: This series consists of well drained soils found on alluvial fans and flood plains. Sorrento soil consists of moderately alkaline and calcareous loam with moderate permeability. Runoff is slow and erosion hazard is slight in areas which are not covered with protective vegetation. The typical profile consists of a brown and grayish brown loam surface layer to 12 inches. The next layers are light brownish gray, brown, and pale brown silty clay loam to a depth of 61 inches or more. Sorrento soils are used for irrigated crops, citrus, and more recently urban development.

Planning Area I-06 also includes in lesser areal extent the Alo clay, Balcom clay loam, Bosanko-Balcom complex, Capistrano sandy loam, Metz sandy loam, Mocho loam, and Myford sandy loam.

3.3 Description of Structures, Roads, & Other Site Improvements

The property reviewed in Planning Area I-06 consists of agricultural land under permanent planting and row crop cultivation approximating 500-acres, properties leased for nursery plant production approximating 250 acres, native rangeland of approximately 900 acres, and industrially developed parcels of approximately 70 acres.

The nurseries leasing property in Planning Area I-06 include the following:

El Modena Gardens	11911 Jeffrey Road, Irvine, California
Bordier's Nursery	7231 Irvine Boulevard, Irvine, California
Sunny Slope Trees	3180 Glassell Street, Orange, California
Pacific Coast Nursery	7985 Irvine Boulevard, Irvine, California
Village Nursery	1589 North Main, Orange, California

The industrially developed parcels include businesses located in two main areas, contractors and landscape architects are at the northern extension of Jeffrey Road; “green waste” and fertilizer companies are along the east and west sides of “N” Street (Irvine Boulevard addresses). The Jeffrey Road businesses within Planning Area I-06 include the following:

California Labor Camp	11405 Jeffrey Road, Irvine, California
Nakae Landscape	11159 Jeffrey Road, Irvine, California
Stice Construction	10851 Jeffrey Road, Irvine, California
Suchy Trenching	11501 Jeffrey Road, Irvine, California
Griffith Construction	2020 South Yale, Santa Ana, California
Southern Cal Sandbags	12620 Bosley Lane, Corona, California

The "N" Street properties within Planning Area I-06 are as follows (addresses are on Irvine Boulevard):

Tierra Verde Industries	7982 Irvine Boulevard, Irvine, California
Aguinaga Fertilizers	7992 Irvine Boulevard, Irvine, California
GE/EER	8001 Irvine Boulevard, Irvine, California

The Irvine Company Fields include 301, 302, 303, 304, 305, 306, 307A, 307B, 308, 310, 311, 312A, 312B, and 313 and are farmed either by The Irvine Company as avocado orchards, or leased to tenants including Gargiulo Farms, D & D Farms, Custom Country Landscaping, and various nurseries.

Planning Area I-06 also includes approximately 900-acres of native chaparral that has not been previously developed. This property is in the rugged foothills north of Portola Parkway and bisected by the Eastern Transportation Corridor.

Description of the Tenants and Property Use

El Modena Gardens nursery is located north of Portola Parkway and parallels Jeffrey Road. The El Modena Gardens parcel is thins in an east-west orientation and is elongated north-south. The property winds through the foothills adjacent to Jeffrey Road. Their main headquarters are central to the property on the east side of Jeffrey Road and consists of a series of modular wooden constructed office units. The entire area is unpaved and consists of hard-packed dirt overlain by crushed rock and gravel. South of the office units, across the hard-packed dirt and gravel access road is the former location of two underground fuel storage tanks (USTs). These tanks were removed by AEC in 1999 and have been given a "no further action" designation by OCHCA. This fueling area has been replaced by a secondarily contained aboveground fuel storage tank (AST), also permitted and installed by AEC. Further south of the main office facilities are the storage warehouses for equipment and materials used in the nursery operation and the automotive and rolling stock maintenance shop. Adjacent to the north side of the maintenance shop is another secondarily contained AST permitted and installed by AEC. The relatively level quadrangular area formed by the main office complex to the north and warehouses and shops to the south is used as a staging, loading, and shipping area for the wide variety of plants cultivated at the facility.

El Modena Gardens wastewater treatment is approved by the RWQCB, however, they have taken a less conventional treatment approach. Instead of the overhead sprinkler application of water to the ornamental plants, El Modena has retrofitted the irrigation system with micro-jet and microfan sprinklers connected to timers which regulate the volume of water use per plant. This method serves two purposes; first by decreasing overall water consumption; secondly allows implementation of an eclectic irrigation water treatment system. El Modena Gardens has installed a series of water collection ditches, and inside these ditches they have constructed screens that have the Canna plant attached. The Canna plant scrubs the elevated nutrient concentrations from the water and adequately cleans it for re-use, or acceptable for disposal in the stormwater drainage system.

At the north boundary of El Modena Gardens, on Jeffrey Road, is the California Labor Camp. This camp is part of the Statewide Labor Corporation, a business that provides housing to farm labor. The labor camp consists of trailer type living units, a group kitchen, and recreational/church facility. The gate was locked during the time of AECs visit, therefore, the inspection was conducted from the outside. The camp is on a septic system, and also has many portable toilets for use. Amenities are limited and the living conditions are rural.

Continuing north on Jeffrey Road is the Griffith Company sand and gravel plant. This area is used for recycling concrete and asphalt into re-usable base material. The facility maintains a portable office unit and the majority of the area is used for storage of import and export material.

To the northeast of Griffith Brothers is the Southern California Sandbag Company. This small lot houses another portable office trailer and yard space for filling sand bags.

At the terminus of Jeffrey Road, and bounded to the north and east by the Transportation Corridor are three businesses that have common borders. The Stice Construction yard consists of a chain-link fenced perimeter and a modular office unit, and storage yard for various "heavy" equipment used in the earthmoving construction industry. East of Stice Construction is the Nakae and Associates landscape business that consists of a chain-link fenced perimeter, modular office units, and storage yard for equipment and materials used in the landscape industry. Nakae also operates a diesel "trapwagon" fueling system. East of Nakae and Associates is Suchy Trenching Company. Suchy Trenching also has a chain-link fenced perimeter, and a newly constructed metal-roofed and sided building and storage yard for equipment and materials.

Griffith Company, Southern California Sandbags, Stice Construction, Nakae and Associates, and Suchy Trenching all have hard-packed dirt and crushed rock and gravel surfaces. They also occupy a portion of the former Orange County Shooting and Training Center (OCSTC).

East of the East Leg of State Route 133 (Toll Road) are agricultural grounds farmed by either The Irvine Company or tenants. Bordier's Nursery leases from the Navy an approximate 150-acre contiguous piece of property bounded by Irvine Boulevard to the south and Portola Parkway to the north and is not a part of this assessment. In addition, Bordier's Nursery also leases Field 311 and Field 352 from the Irvine Company. The nursery operation in Field 311 includes greenhouses, wind and sun netting growing areas, and open-air growing areas for many ornamental varieties of plants and shrubs. Field 352 is primarily used as a stockpiling area for soil mixing of material used in the potting of the plants, and during the mid 1960's to mid 1970's used as a rifle range for servicemen at the El Toro Marine Corp Air Station. The nursery primarily waters the plants by overhead sprinklers and also incorporates drip and micro-jet irrigation. Excess irrigation water is collected at a topographic low at the southern portion of the property, pumped into a collection reservoir, filtered, then re-cycled as irrigation water.

North and east of the Bordier's Nursery Navy leased property are relatively contiguous Fields owned and farmed by The Irvine Company, or owned by The Irvine Company and leased to various tenants. Gargiulo leases Field 302 and is currently farming tomatoes. Field 303 is planted to strawberries, Field 304 is leased by Sunny Slope Nursery, Field 308 is planted to avocados and a portion of Field 308 is leased to Custom Country for composting, sand bag construction, and wood splitting. The Irvine Company farms avocados in Fields 301, portion of 304, 305, 306, 307A-B, 308, and 310. Village Nursery leases Field 312A-B and Pacific Coast Nursery leases property on the northeast side of "N" Street and east of the Lambert Reservoir (dry and out of service) identified as Field 313. They cultivate primarily large shrubs and ornamental trees and the irrigation is primarily done on a drip irrigation system connected to each box. Sunny Slope Trees operate a nursery north of Portola Parkway and south of the Corridor Toll Road identified as Field 304. The cultivated areas present minimal environmental concern, however, there are commercial facilities along "N" Street that have recognized environmental conditions.

Tierra Verde Industries operate a large scale composting and greenwaste acceptance facility at the intersection of Irvine Boulevard and "N" Street. On the west side of "N" Street Tierra Verde Industries operate a rectangular yard used for receiving primarily wood and cardboard products which are pulverized, chipped, and ground into wood chips and sawdust size particles. The Tierra Verde facility on the east side of "N" Street is used as a receiving facility for greenwaste, and has been improved with the construction of a scale house, maintenance shop, and offices. The structures are primarily concrete floored, and metal roofed and sided. Tierra Verde constructed the maintenance shop to service the heavy equipment used in the loading, chipping, and grinding of the greenwaste and previously manufactured wood products. The area leased by Tierra Verde Industries used to be a chicken ranch and the chicken coops are visible on the older aerial photographs. Tierra Verde Industries stores bulk new oil, hydraulic oil, grease, and coolant in 55-gallon drums and 5-gallon containers at the eastern facility. Diesel and gasoline are stored in ASTs. Waste oil is stored in a 500-gallon AST and picked up on a regular basis for recycling.

Roger Aguinaga leases approximately 21-acres on both sides of "N" Street from The Irvine Company. Aguinaga operates a composting facility on the eastern side of "N" Street and has modular offices, a maintenance shop, and used equipment and material storage on the west side of "N" Street. The area historically was used as chicken ranches. The Aguinaga storage yard on the west side of "N" Street is used for maintenance of heavy equipment and rolling stock, storage of bulk oil, hydraulic fluids, grease, coolant, diesel, and gasoline. The diesel and gasoline are stored in ASTs mounted on flatbed trailers that have secondary containment berms built around them. There are also numerous diesel and gasoline ASTs that are not secondarily contained. The new oil and grease are commonly stored in 55-gallon drums and waste oil is stored in 55-gallon drums and a waste oil AST.

GE/EER operate a energy research plant on the east side of "N" Street. The 25-acre parcel is leased form The Irvine Company and is currently used as a test facility. GE/EER performs research and development for improved boiler combustion and emissions control testing. Site facilities include a main office trailer, a two story office/document storage structure, a machine shop, a combustion test area, an analytical laboratory, several storage sheds, and several outdoor storage areas. Operations at the facility include burners that simulate industrial boilers and other combustion facilities test fires to evaluate combustion emissions control designs. Also, fuel types and flow rates are controlled and modified to simulate different combustion conditions, and differing types of emission monitoring equipment are attached to the boiler to test and monitor improvements in the combustion engines.

Feedstock material historically used to fuel boilers and burners include natural gas, diesel, fuel oil, biomass, paper, cardboard, plastic, oil/water emulsion, and auto shredder waste. GE/EER personnel state that hazardous wastes have not been used to fuel the boilers and burners.

Four USTs that formerly contained gasoline, diesel, and crude oil were located in the northwest portion of the site. These tanks were removed in 1991 and 1992. Following onsite bioremediation and testing of hydrocarbon impacted soils from the area of the USTs, OCHCA approved the soils for placement as fill. Closure for the former UST emplacement was issued by OCHCA in November 1993.

The site has been a test facility since 1960, and prior to that it was a gravel quarry. Ford Motor Company/Philco Corporation operated a rocket engine, small missile, shape charge, flare, and separation testing area onsite from 1960 to 1966. Ultrasystems Inc. Occupied the site beginning in 1975 and land use an occupancy between 1966 and 1975 is currently unknown. Ultrasystems Inc. Tested various burner configurations for high efficiency, low emission commercial boilers and EER was formed from Ultrasystems.

Agricultural Yards

Custom Country Landscape Yard: Surface soils in several small areas at the Custom Country Landscape Yard (Field 308) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with portable aboveground storage tanks seated in steel saddles and the waste oil stored in open-topped 5-gallon buckets. None of the tanks appeared to be leaking, and the small releases appear to be accidental during use.

D & D Yard: Surface soils in several small areas at the D & D Yard (Field 303) were observed to be stained with hydrocarbons during AECs site inspection. D & D also stores agricultural chemicals in a locked steel container equipped with a solid floor. Mixing of the chemicals are performed onsite using a hose bib. The mixing area is on hard-packed dirt.

Aguinaga Yard: Surface soils in several small areas at the Aguinaga Yard (Field 372) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with the ASTs that are located onsite. Aguinaga operates a 500 gallon gasoline, (2) 750 gallon diesel, one 1,000-gallon waste oil AST, and 8,000-gallon diesel and maintains approximately 13 unused ASTs. The yard also stores bulk quantities of new oil, hydraulic oil, grease, and coolant in 55-gallon drums and 5-gallon buckets. Bags of fertilizer are stored inside a steel container, and waste oil and waste filters are stored in 55-gallon drums and 5-gallon containers. Aguinaga also has a boneyard of miscellaneous used equipment and materials including two older model suction dispensers.

3.4 Environmental Liens

No indication of current environmental liens was provided to **AEC** by the user or obtained from any other informational source during this assessment.

3.5 Onsite Water Supply

Water for onsite use is obtained via pipeline from the Irvine Ranch Water District (IRWD) supply wells.

3.6 Current Uses of the Property

The majority of the subject property is currently undeveloped native chaparral. Lesser portions are identified as Fields and are in row crop and permanent planting (avocado) production. Five nurseries lease different Fields for production of ornamental trees, shrubs, and plants for residential and commercial use. The remaining leased properties are used as an energy research facility, greenwaste reduction, compost manufacturing, labor camp, asphalt and cement recycling, sand bag production, construction storage yards, and wood yard.

3.7 Past Uses of the Property

Based on reviews of historical USGS maps, reviews of historical topographic maps beginning in 1901, and aerial photographs beginning in 1946, the subject property has been used for agricultural, and agricultural related services since the area was first developed. The majority of the properties were in citrus and avocado development from 1946 to 1994. The citrus trees were removed from production and the land was converted from permanent plantings to row crop usage.

The leased properties on both sides of “N” Street were historically used as chicken ranches for poultry and egg production. It has been reported that the chicken population was decimated during the early

1970's by "Newcastle Disease" and may have been the contributing factor for the land use changing from chicken ranches to alternative land use businesses. The divided storage yards at the northern extension of Jeffrey Road, currently occupied by Griffith Company, Southern California Sandbags, Stice Construction, Nakae and Associates, and Suchy Trenching was the former location of the Orange County Shooting and Training Center. Field 352 was a former rifle range used by the servicemen at the El Toro Marine Corp Air Station. At the intersection of Agua Chinon Wash and the Foothill Transportation Corridor is a former sand and gravel quarry that the floor has been graded level and the hillslides slopes to prevent future erosion.

3.8 Current and Past Uses of Adjoining Properties

Prior to the recent urban development of the area beginning in the late 1970's, the site and surrounding areas were principally agricultural lands, grazing lands and undeveloped lands. The property is bordered on the north by undeveloped native chaparral and Bee Canyon Landfill, the south by Portola Parkway, Irvine Boulevard and the Bordier's Nursery property leased from the Navy and the El Toro Marine Corp Air Station, the west by Jeffrey Road and Irvine Company owned farmland planted to avocados and undeveloped rangeland, and to the east by undeveloped rangeland.

The El Toro Marine Corps Air Station (MCAS) was established in 1943 and serves as the center for marine aviation operations on the Pacific Coast. The facility occupies 4,700-acres comprising hangars, flight lines, maintenance areas, housing, and recreation including a golf course. Open land is also leased to local farmers for nursery and row crop use. The MCAS was listed on the National Priorities List (NPL) in 1990 because of past disposal practices that have contaminated soil and ground water.

The MCAS has identified at least 22 on-station sites that are undergoing investigation and remediation. The contaminants are varied and consist of heavy metals, solvents, incinerator ash, paint residues, refined hydrocarbons, PCBs, battery acids, and effluent sludge. The majority of the contaminated sites are in the southeast and southwest portion of the airbase, therefore, are the greatest distance from the subject property under review. A few of the landfill sites of solvent and fuel waste are adjacent to the Borrego Canyon Wash and Agua Chinon Wash, however, the topographic and hydraulic gradient are southwest thus minimizing offsite impact to the subject property under review. The MCAS has been under regulatory scrutiny since 1985 and has been undergoing subsurface investigations and remediation to control the offsite migration of contaminants.

Located north of the Foothill Transportation Corridor is the Bee Canyon Landfill. The Landfill's southern boundary extends to the northern boundary of the property under review. The landfill, which is lined with an impermeable membrane, accepts household waste from the Irvine area, however, is not permitted to accept any "hazardous" classified waste. The landfill has been cited in recent years, however, for leaks of potentially toxic leachate (by-product of degrading waste) that accumulates on the liner. The releases have occurred during periods of excessive precipitation and subsequent runoff. The leachate can reach drainage channels that empty into Newport Bay, San Diego Creek, and Bee Canyon Wash. The landfill, which is under constant review by regulatory agencies, forms borders on the subject property under review that is slated to remain undeveloped as chaparral.

4.0 RECORDS REVIEW

4.1 Standard Federal and State Environmental Record Sources

AEC contracted **EDR Environmental Information, Inc.**[4] to perform searches of readily available Federal, State, and Local database information systems for the purpose of identifying known recognized environmental conditions present on nearby properties which have the potential to adversely impact the site being assessed in this study. The information provided by EDR gives a brief summary of any onsite target properties, and/or surrounding properties that may have environmental concerns. The databases researched include the following:

NPL, CERCLIS, CORRACTS: The National Priority List database, CERCLIS database, and CORRACTS, are also known as Superfund, and Superfund associated Corrective Action. Listed in this database is the El Toro Marine Air Corp Station. USMC Air Station El Toro has been a long term discharger of solvents, fuels, and other hydrocarbons to soil and groundwater resources. The property remains under close scrutiny, and remedial investigation by appropriate agencies including the EPA, Regional Water Quality Control Board (RWQCB), Department of Toxic Substance Control (DTSC), and others. There are reported cases where the contamination from the air base has impacted irrigation wells in the surrounding area. AEC has not identified which irrigation wells are impacted, however, a letter has been written to the RWQCB requesting review of the information. Upon its availability, the information will be forwarded in an addendum.

RCRIS: The Resource Conservation and Recovery Act database includes sites that generate, store, treat, or dispose of hazardous waste. Again, the only site listed is the USMC Air Station El Toro.

ERNS: The Emergency Response Notification System records and stores information on reported releases of oil and hazardous substances. The system revealed three ERNS sites. The first is listed at Sand Canyon Avenue and Irvine Boulevard, however, this is inaccurate since the release occurred at the Bee Canyon Landfill and does no appear as a threat to the subject property; the second and third are at the UNOCAL Station at 14886 Sand Canyon Avenue. Apparently the gasoline release was great enough to have free product on the water table. This site is downgradient from the subject site therefore, not a major concern.

CAL-SITES: This database contains both known and potential hazardous substance sites. The site recognized is at 15000 Sand Canyon Avenue and is the former Orange County International Raceway. The site is downgradient, therefore, considered a minor concern.

CORTESE: This database identifies drinking water wells with detectable levels of contamination, and sites with USTs having reportable releases. This database identified the UNOCAL at 14886 Sand Canyon Avenue, the EXXON at 14781 Sand Canyon Avenue, and the Irvine Unified School District Maintenance Facility at 14600 Sand Canyon Avenue. Again all these sites are downgradient from the subject property.

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking USTs. The three sites listed above are again identified in this database. There are other sites also identified, but again they are all downgradient, therefore, assigned a low risk.

UST: The Underground Storage Tank database lists registered USTs. The above listed sites are again identified. The only site listed is El Modena Gardens, however, those USTs were removed by AEC in 1998 and received “clean” closure.

CA FID: This database identifies inactive UST facilities of which El Modena Gardens, Irvine Unified School District, and Orange County Transit Authority are listed.

HMIRS: The Hazardous Materials Incident Report System contains information pertaining to hazardous spill incidents. The only site reported was at 15029 Sand Canyon Avenue which is downgradient therefore, a minor concern.

PADS: The PCB activity database identifies generators, transporters, and commercial storers of PCBs. The USMC Air Station El Toro is listed in this database.

WDS: The Resource Water Board provides information on sites with Waste Discharge Systems for water. El Modena Gardens nursery was listed.

HAZNET: This database contains information of wastes that were manifested each year. The only site listed is El Modena Gardens.

Having worked for The Irvine Company, and other local farmers and businesses leasing The Irvine Company property, AEC is aware of sites that were not identified in these databases. For example, The Irvine Company, IVG, Hines Nursery, Bordier's Nursery, and GE/EER et. al. have had active and leaking USTs, disposed of materials by manifest, require Wastewater Discharge approval, yet they did not show up in this EDR report. However, AEC, in co-operation with The Irvine Company will continue to identify areas of onsite environmental concerns and implement corrective measures. The complete report furnished by **EDR** is included in **Appendix 10.2** of the report.

4.2 Historical Use Information

4.2.1 Aerial Photograph and Historical USGS Map Review[4]

Historical aerial photograph coverage and USGS Map coverage of the site were reviewed in order to evaluate past site usage. Visual observations noted within these photographs and maps are described chronologically as follows:

Map Date: 1901 **Quadrangle: Santa Ana** **Scale: 1:62,500**

The subject property and surrounding areas appeared undeveloped and covered in native vegetation during 1901. The Southern California Surf Railroad Line was the only obvious development. Santa Ana and Tustin were established towns. No indications of onsite structures or other developments of the property were noted in the 1901 USGS survey.

Aerial Photograph Date: 1952 **Flyer: Pacific Air** **Scale: 1"=833'**

The Siphon Reservoir had been constructed in the western portion of the property. El Modena Gardens, and the Orange County Shooting and Training Center were not constructed. Jeffrey Road and the Hicks Canyon Haul Road appear to be hard-packed dirt. The majority of the northwestern property was native chaparral. The Fields in the central portion of the property were either developed with permanent plantings, cover crops, or remain undeveloped. The Lambert Reservoir had been constructed. The eastern properties proximal to "N" Street were undeveloped. The Marine Corp Air Station (MCAS) is developed.

Map Date: 1965 **Quadrangle: Tustin, El Toro** **Scale: 1:24,000**

The majority of the Fields are planted to citrus, or row crops. The Siphon and Lambert Reservoirs are apparent. The chicken ranches along “N” Street are visible and the Environmental and Energy Research (EER) structures are marked on the map. El Modena Gardens is constructed at this time. The MCAS is developed.

Aerial Photograph Date: 1968 **Flyer: Teledyne** **Scale: 1"=800'**

The El Modena Gardens nursery is visible in this photograph. The Hicks Canyon Haul Road appears paved, although the Jeffrey Road extension appears as hard-packed dirt. The properties on “N” Street are constructed as chicken coops and the Lambert Reservoir is evident. The majority of the Fields are planted to citrus. Resolution of visual detail is good.

Aerial Photograph Date: 1977 **Flyer: Teledyne** **Scale: 1"=666'**

The subject property and surrounding Fields appear the same. Resolution of this photograph is adequate.

Map Date: 1981 **Quadrangle: Tustin, El Toro** **Scale: 1:24,000**

The Fields are planted to citrus, avocados, or row crops. There has been no evident expansion of the El Toro Marine Corp Air Station. Access roads have been constructed and residential expansion is encroaching from the south and west.

Aerial Photograph Date: 1994 **Flyer: USGS** **Scale: 1"=666'**

The property and surrounding areas appeared under similar development as today. The citrus trees have all been removed and the Fields are planted to row crops or avocados. The infrastructure of main access roads are in place, however, the toll roads have yet to be constructed. The chicken ranches are no longer evident along “N” Street. Resolution of visual detail in this photograph is good.

4.3 Additional Record Sources

4.3.1 Orange County Agricultural Commission[5]

The Orange County Agricultural Commission (OCAC) maintains records of Restricted Agricultural Chemicals permitted for use and/or storage at agricultural facilities located throughout Orange County. Inventory information regarding restricted herbicides, pesticides, rodenticide, etc., is listed on Restricted Materials permits issued annually and archived within the OCAC database. OCAC records contained the following information pertaining to the individual growers leasing surface areas within the limits of the subject property for agricultural production during 2001:

Farmer	Restricted Permit #	Expiration
Bordier’s Nursery	30-01-300911	12/31/01
Gargiulo Farms	30-01-300917	12/31/01

4.3.2 Orange County Health Care Agency[6]

The Orange County Health Care Agency (OCHCA) maintains records of underground storage tanks (UST's) and incidents of unauthorized releases of hazardous materials from underground storage tanks at the subject site and surrounding areas. OCHCA records contained information pertaining to the windmachine USTs located in the Fields under review, the USTs removed from El Modena Gardens, and GE/EER and the Bordier's Nursery. Once AEC receives the hard copies of the OCHCA Records Review they will be forwarded as an addendum.

4.3.3 Orange County Fire Authority Records[7]

The Orange County Fire Authority, Hazardous Materials Bureau maintains inventory information and "Hazardous Materials Management Plans" (HMMP's) for facilities located within Orange County, California. AEC submitted written requests to the OCFD for documentation pertaining to the existing onsite facilities including El Modena Gardens, Griffith Company, Southern California Sandbags, Stice Construction, Nakae and Associates, Suchy Trenching, Tierra Verde Industries, GE/EER, and Aguinaga Company. When the information is made available AEC will prepare an addendum.

4.3.4 California Department of Conservation - Division of Oil & Gas[8]

No onsite oil or gas wells were identified during the site reconnaissance or within D.O.G. maps reviewed during this assessment. However, NMG Geotechnical, Inc. discovered the approximate locations of three abandoned oil wells drilled by Shell Oil Company during 1949 to 1950. Irvine Core Hole No. 1 is located west of the western boundary of the MCAS and east of the eastern boundary of Field 352. The well was reported to have a total depth of 893-feet bgs and was never a producer. The other two oil wells were located in the area of the GE/Energy Research Facility and additional information was not available.

5.0 INFORMATION FROM SITE RECONNAISSANCE AND INTERVIEWS

5.1 Hazardous Substances in Connection with Identified Uses

During the course of this study it was identified that the majority of agricultural chemical handling and storage, hydrocarbon fuel handling and storage, solvent use, battery storage, miscellaneous chemical storage, waste water creation, and waste oil and fluid storage all occur within the boundaries of the storage yards and maintenance shops. The Fields under cultivation only receive prescribed amounts of agricultural chemicals that dissipate quickly due to irrigation watering, the sun, and the chemical make-up.

Typical to each yard were ASTs and USTS containing diesel, gasoline, waste oil, and fertilizers. Also identified were 55-gallon drums of new oil, hydraulic oil, grease, and coolant. Agricultural chemicals in liquid, granular, and powdered form were always identified in locked containers. Welding gases including oxygen and acetylene are necessary for repair work of equipment and rolling stock. Most of these containers were labeled as to the correct contents.

5.2 Unidentified Substance Containers

Some drums at each of the yards reviewed in Planning Area I-06 were not labeled as to their contents. However, experience has shown that the majority of the contents will be a waste fluid consisting of waste oil, grease, hydraulic fluid, or coolant. The contents of these drums will be identified and “like” fluids will be consolidated for disposal.

5.3 Storage Tanks

Currently there are no active USTs in Planning Area I-06. However, there are many steel constructed ASTs used to store diesel, gasoline, and waste oil at each of the yards, and numerous poly-constructed tanks that store liquid fertilizer at each yard and at the irrigation/sand filter stations. It is the opinion of AEC that all USTs not currently in use have been removed from Planning Area I-06.

No other visual indications of existing aboveground or underground storage tanks used for past or present hazardous materials storage were identified during the course of this assessment.

5.4 Indications of PCB(s)

Electric transformers (both pad and pole mounted) are located at El Modena Gardens, and the northern extension of Jeffrey Road businesses. Also, transformers were identified at the “N” Street businesses. Electric transformers are owned and operated by Southern California Edison (SCE)[9]. According to information obtained from SCE, all transformers within the SCE power distribution network suspected of containing PCB's in concentrations exceeding 50 parts per million were removed and replaced by 1987. Manufacture of PCB-containing electric power transformers was discontinued in 1984.

PCB sampling and laboratory analysis is beyond the scope of this assessment.

5.5 Indications of Solid Waste Disposal

Miscellaneous trash and refuse is collected in bins located around the facilities and routinely removed for offsite disposal by a commercial waste hauler.

No indications of onsite solid waste disposal were identified on the subject property during the site reconnaissance portion of this assessment.

5.6 Indications of Waste Water Disposal

Onsite waste water generated during steam cleaning, or mixing of agricultural chemicals, generally follow the topographic gradient on the hard packed dirt as identified in the storage yards. El Modena Gardens has a series of ditches used for the collection of the excess irrigation water. The water is filtered and then recycled. Bordier’s Nursery uses overhead sprinklers on there plants being cultivated in pots at the leased Fields 311 and 352. The excess irrigation water drains into sumps, then pumped into a larger reservoir, filtered, then recycled. Pacific Coast Nursery and Village Nursery are primarily "box" nurseries and use drip irrigation to water the trees and shrubs. Sunny Slope Nursery uses drip and overhead sprinklers. Sanitary facilities at the office structures at The Irvine Company leased properties are typically composed of holding tanks that retain the solids and leach lines that drain the liquids. The holding tanks are pumped when necessary.

5.7 Physical Setting Analysis

5.7.1 Designated Wetlands[10]

Under U.S. Army Corps of Engineers (USACE) regulations, wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include swamps, marshes, bogs and similar areas such as sloughs, prairie potholes, wet meadows, river overflows, mud flats, and natural ponds.

Based on information provided to AEC within the EDR database survey report, areas within the boundaries of the subject property are not included within the 1994 edition of the National Wetlands Inventory listing.

5.8 Any Other Conditions of Concern

5.8.1 Radon[11]

Radon is a colorless, odorless, tasteless, naturally occurring radioactive gas formed by the decay of uranium in soil and bedrock. Because uranium and radon occur naturally in varying amounts within rocks and soils found throughout the United States, radon is present in all the air that we breathe. Long-term exposure to elevated concentrations of radon in confined areas has been associated with an increased risk of lung cancer. The present action levels require exposure to concentrations of at least four picocuries/liter (4 pCi/L) of radon over an extended period of time. The State of California Department of Health Services conducted radon surveys across portions of Orange County, during 1990. These surveys did not indicate the widespread presence of radon in concentrations exceeding 4 pCi/L within Orange County.

The United States Environmental Protection Agency (EPA) and the Surgeon General presently recommend that all homes in the United States be individually tested for radon. Radon is more commonly identified in granitic source terrain, not in areas of alluvial deposition, therefore, a low risk in the entire southern half of Planning Area I-06.

Radon sampling and laboratory analysis is beyond the scope of this site review.

5.8.2 Asbestos Containing Materials (ACM's)

Asbestos containing materials (ACM's) were commonly used in a wide variety of building products such as roofing shingles, composite siding, linoleum flooring, acoustic ceiling tiles, furnace and water heater exhaust piping and insulation, glues and mastics, stucco, joint compounds, and composite wallboards prior to 1980. ACM's can be divided into material considered friable (easily crumbled or reduced to powder) and nonfriable. Friable ACM's are regulated as hazardous materials due to the elevated long-term risk of developing lung cancer upon respiratory exposure and must be properly removed prior to renovation or demolition of any structure containing these materials. AEC recommends that the building owners conduct asbestos surveys prior to lease termination.

In addition to structures, ACM's have been historically used as "transite" irrigation piping within many agricultural parcels throughout California. Transite piping will probably be unearthed during the grading of the properties in row crop production.

AEC recommends consolidating all unused, and/or unearthed transite pipe and disposing the pipe at an approved acceptance facility.

Asbestos sampling and laboratory analysis is beyond the scope of this preliminary assessment.

5.8.3 Lead

According to information published by the United States Department of Housing and Urban Development (HUD), approximately three out of every four pre-1978 buildings contain lead-based paint[12]. Based on the apparent ages of the structures located within on the leased properties, there is a potential presence of lead-based plumbing and/or paints within the onsite structures.

Lead sampling and laboratory analysis is beyond the scope of this assessment.

6.0 FINDINGS AND CONCLUSION

On behalf of the Irvine Community Development Company, Advanced Environmental Concepts, Inc. (AEC) has prepared a Property Transfer Disclosure Report for agricultural and industrial developed parcels bordered partially on the south by Irvine Boulevard, the west by Jeffrey Road, and is bisected by Portola Parkway, and the Foothill Transportation Corridor. The property reviewed in Planning Area I-06 consists of agricultural land under permanent planting and row crop cultivation approximating 500-acres, properties leased for nursery plant production approximating 250 acres, native rangeland of approximately 900 acres, and industrially developed parcels approximating 70 acres.

The nurseries leasing property in Planning Area I-06 include the following

El Modena Gardens	11911 Jeffrey Road, Irvine, California
Bordier's Nursery	7231 Irvine Boulevard, Irvine, California
Sunny Slope Trees	3180 Glassell Street, Orange, California
Pacific Coast Nursery	7985 Irvine Boulevard, Irvine, California
Village Nursery	1589 North Main, Orange, California

The industrially developed parcels include businesses located in two main areas; contractors and landscape architects are at the northern extension of Jeffrey Road; "green waste" and fertilizer companies are along the east and west sides of "N" Street (Irvine Boulevard addresses). The Jeffrey Road businesses within Planning Area I-06 include the following:

California Labor Camp	11405 Jeffrey Road, Irvine, California
Nakae Landscape	11159 Jeffrey Road, Irvine, California

Stice Construction	10851 Jeffrey Road, Irvine, California
Suchy Trenching	11501 Jeffrey Road, Irvine, California
Griffith Construction	2020 South Yale, Santa Ana, California
Southern Cal Sandbags	12620 Bosley Lane, Corona, California

The "N" Street properties within Planning Area I-06 are as follows (addresses are on Irvine Boulevard):

Tierra Verde Industries	7982 Irvine Boulevard, Irvine, California
Aguinaga Fertilizers	7992 Irvine Boulevard, Irvine, California
GE/EER	8001 Irvine Boulevard, Irvine, California

The Irvine Company Fields include 301, 302, 303, 304, 305, 306, 307A, 307B, 308, 310, 311, 312A, 312B, and 313 and are farmed by either The Irvine Company as avocado orchards, or leased to tenants including Gargiulo Farms, D & D Farms, Custom Country Landscaping, and various nurseries.

Planning Area I-06 also includes approximately 900-acres of native chaparral that has not been previously developed. This property is in the rugged foothills north of Portola Parkway and bisected by the Eastern Transportation Corridor.

The area under study also includes the out of service Lambert Reservoir and active Siphon Reservoir. This assessment was performed during April, May, and June 2001. The purpose was to identify adverse environmental conditions and "hazardous" waste streams generated on-site that could potentially affect the human health and the environment, and to review if "hazardous" waste streams generated offsite could adversely affect the subject properties. These concerns include storage and use of agricultural chemicals categorized as pesticides, herbicides, fungicides, fertilizers, and surfactant. Other concerns include transite irrigation pipe which contains asbestos, the storage of new oils and hydraulic fluids, the generation and storage of waste oils, the storage of diesel and gasoline fuels in aboveground and underground storage tanks (ASTs and USTs), hydraulic floor lifts, effluent waste water from steam wash pads, and used batteries. It is the experience of AEC that these environmental concerns are typical within large-scale farming operations, and to the industrial businesses located on The Irvine Company properties. These environmental concerns are similar in nature to other large-scale farming and industrial operations found throughout California. It is also important to note that the majority of "hazardous" material, and waste generation are typically identified in the farming yards of the different tenants, and in the maintenance area of the service shops, which occupy the least amount of property. Therefore, numerous environmental issues are concentrated in a small area, whereas, the vast majority of the property is under cultivation, or used for open storage space, and can be considered mostly unencumbered.

Also, this report will review two specific facilities that are currently under review by the Orange County Health Care Agency (OCHCA) and Regional Water Quality Control Board (RWQCB) concerning releases of "hazardous" wastes that have adversely impacted soil and groundwater resources. These two facilities are the former Orange County Shooting and Training Center and the GE/EER Research Facility. Following is a brief description of the properties and structures in Planning Area I-06 and their associated recognized environmental conditions.

Description of the Tenants and Property Use

El Modena Gardens nursery is located north of Portola Parkway and parallels Jeffrey Road. The El Modena Gardens parcel thins in an east-west orientation and is elongated north-south. The property winds through the foothills adjacent to Jeffrey Road. Their main headquarters is central to the property on the east side of Jeffrey Road and consists of a series of modular wooden constructed office units. The entire area is unpaved and consists of hard-packed dirt overlain by crushed rock and gravel. South of the office units, across the hard-packed dirt and gravel access road is the former location of two underground fuel storage tanks (USTs).

These tanks were removed by AEC in 1999 and have been given a “no further action” designation by OCHCA. This fueling area has been replaced by a secondarily contained aboveground fuel storage tank (AST), also permitted and installed by AEC. Further south of the main office facilities are the storage warehouses for equipment and materials used in the nursery operation and the automotive and rolling stock maintenance shop. Adjacent to the north side of the maintenance shop is another secondarily contained AST permitted and installed by AEC. The relatively level quadrangular area formed by the main office complex to the north and warehouses and shops to the south is used as a staging, loading, and shipping area for the wide variety of plants cultivated at the facility.

El Modena Gardens wastewater treatment is approved by the RWQCB, however, they have taken a less conventional treatment approach. Instead of the overhead sprinkler application of water to the ornamental plants, El Modena Gardens has retrofitted the irrigation system with micro-jet and micro-fan sprinklers connected to timers which regulate the volume of water use per plant. This method serves two purposes; first it decreases overall water consumption; secondly allows implementation of an unique irrigation water treatment system. El Modena Gardens has installed a series of water collection ditches, and inside these ditches they have constructed screens that have the Canna plant attached. The Canna plant scrubs the elevated nutrient concentrations from the water and adequately cleans it for re-use, or acceptable for disposal in the stormwater drainage system.

At the north boundary of El Modena Gardens, on Jeffrey Road, is the California Labor Camp. This camp is part of the Statewide Labor Corporation, a business that provides housing to farm labor. The labor camp consists of trailer type living units, a group kitchen, and recreational/church facility. The gate was locked during the time of AECs visit, therefore, the inspection was conducted from the outside. The camp is on a septic system, and also has many portable toilets for use. Amenities are limited and the living conditions are rural.

Continuing north on Jeffrey Road is the Griffith Company sand and gravel plant. This area is used for recycling concrete and asphalt into re-usable base material. The facility maintains a portable office unit and the majority of the area is used for storage of import and export material.

To the northeast of Griffith Company is the Southern California Sandbag Company. This small lot houses another portable office trailer and yard space for filling sand bags.

At the terminus of Jeffrey Road, and bounded to the north and east by the Transportation Corridor are three businesses that have common borders. The Stice Construction yard consists of a chain-link fenced perimeter and a modular office unit, and storage yard for various “heavy” equipment used in the earthmoving construction industry. East of Stice Construction is the Nakae and Associates landscape business that consists of a chain-link fenced perimeter, modular office units, and storage yard for equipment and materials used in the landscape industry. Nakae also operates a diesel “trapwagon” fueling system. East of Nakae and Associates is Suchy Trenching Company. Suchy Trenching also has a chain-link fenced perimeter, and a newly constructed metal-roofed and sided building and storage yard for equipment and materials.

Griffith Company, Southern California Sandbags, Stice Construction, Nakae and Associates, and Suchy Trenching all have hard-packed dirt and crushed rock and gravel surfaces. They also occupy a portion of the former Orange County Shooting and Training Center (OCSTC).

Orange County Shooting and Training Center (OCSTC)

The OCSTC leased approximately 64-acres of native chaparral from The Irvine Company and operated a rifle, pistol, and shotgun range from the mid 1960's to December 1995. The OCSTC permitted public target shooting, provided firearm safety training, and served the needs of training qualifications for Federal, State, and Local Law Enforcement Agencies. The demise of the OCSTC was prompted by the construction of the Eastern Transportation Corridor which was positioned immediately adjacent to the firing lines and target areas of the OCSTC. The OCSTC operated as a not for profit corporation, therefore, had limited available funds for lead remediation. The Irvine Company became responsible for costs associated with the mitigation of areas of the shooting range directly affected by the construction of the Toll Road and the OCSTC attempted mitigation of the lead impacted areas outside the Toll Road boundaries on The Irvine Company's leased property. The OCSTC eventually declared bankruptcy, however, the majority of the remediation was accomplished.

Of the 64-acres leased by the OCSTC only 5-acres of actual shooting areas comprised the different firearm ranges. Man made abutments and natural terrain separated the different ranges. The current location of Griffith Company and Southern California Sandbags are within the former OCSTC rifle and pistol range. The current locations of Stice Construction, Nakae and Associates, and Suchy Trenching are positioned within the former skeet and trap range. The recognized environmental conditions associated with shooting ranges are the lead constructed shotgun pellets and pistol and rifle bullets. In a slightly acidic environment the lead degrades and becomes water soluble thereby creating "hazardous" concentrations of a California regulated waste material. Common mitigation procedures include resource recovery of the lead shot through a "mining" operation of the Major Impact Zones (MIZs). Briefly, the lead shot is collected using all, or combinations, of heavy equipment including scrapers, graders, dozers, and loaders. The lead shot is stockpiled, then screens and shakers are used to recover the lead shot and separate the accompanying soil and rock. Confirmation samples are collected from the excavated areas and analyzed for Total Lead by EPA Method 7420. AEC performed the lead shot mitigation in the area of the skeet and trap range and Environmental Contractors Inc. (ECO) conducted the mitigation of lead impacted soil at the rifle and pistol ranges. The majority of work performed was during April and May 1996. AEC was contracted to only excavate and stockpile all accessible lead impacted soil from the skeet and trap range, whereas, ECO conducted excavation, stockpiling, and resource recovery on both the pistol and rifle range, and skeet and trap range. AEC conducted our portion of the lead impacted soil mitigation and confirmation sampling under the direction of Mr. Luis Lodrigueza, Hazardous Materials Specialist, OCHCA. The results of AECs excavation, and subsequent confirmation soil sampling, indicated that all accessible lead shot was recovered from the skeet and trap range as evidenced by the acceptable concentrations of Total Lead within the confirmation samples. AEC stockpiled the lead impacted soil adjacent to the east flank of the foothill separating the skeet and trap range from the rifle and pistol range. In June 2000 AEC was contracted by The Irvine Company to arrange for loading, transportation, and disposal of the lead impacted soil to USPCI Landfill in Beatty, Nevada. AEC disposed of approximately 237.75-tons of lead impacted soil at the landfill under the supervision of Mr. Lodrigueza of OCHCA. Following the complete removal of the stockpiled soil, AEC then collected confirmation soil samples under OCHCA supervision and the soils exhibited acceptable Total Lead concentrations. AEC prepared a "request for closure" letter with the OCHCA and closure would have been granted based on the work performed except that the stockpile that AEC disposed of only contained 237.75-tons of lead impacted soil, not the 1,100 tons that was originally excavated and stockpiled by AEC in 1996. It has been theorized that the stockpiled soil was either added to ECOs stockpile and "mined" for lead shot recovery in 1996; became a part of the earthmoving process in building the Transportation Corridor Toll Road; or was a combination of the two processes. In any event, Mr. Lodrigueza is not able to issue "no further action" for this site because of the soil discrepancy. In a positive light, OCHCA is not continuing enforcement of the site and currently considers it a non issue.

East of the East Leg of State Route 133 (Toll Road) are agricultural grounds farmed by either The Irvine Company or tenants. Bordier's Nursery leases from the Navy an approximate 150-acre contiguous piece of property bounded by Irvine Boulevard to the south and Portola Parkway to the north. This property is not a part of this assessment. In addition, Bordier's Nursery also leases Field 311 and Field 352 from the Irvine Company. The nursery operation in Field 311 includes wind and sun netting growing areas, and open-air growing areas for many ornamental varieties of plants and shrubs. Field 352 is primarily used as a stockpiling area for soil mixing of material used in the potting of the plants. Field 352 was a former rifle range used by servicemen at the El Toro Marine Corp Air Station. The rifle range was only in use during an approximate 10 year period assumed to be between 1965 and 1975, however, it may also have a lead shot concern equivalent to the OCSTC. The nursery primarily waters the plants by overhead sprinklers and also incorporates drip and micro-jet irrigation. Excess irrigation water is collected at a topographic low at the southern portion of the property, pumped into a collection reservoir, filtered, then re-cycled as irrigation water. Bordier's Nursery has current RWQCB discharge permit #90-81.

North and east of the Bordier's Nursery Navy leased property are relatively contiguous Fields owned and farmed by The Irvine Company, or owned by The Irvine Company and leased to various tenants. Gargiulo leases Field 302 and is currently farming tomatoes. Field 303 is planted to strawberries, Field 304 is leased by Sunny Slope Nursery, Field 308 is planted to avocados and a portion of Field 308 is leased to Custom Country for composting, sand bag construction, and wood splitting. The Irvine Company farms avocados in Fields 301, portion of 304, 305, 306, 307A-B, 308, and 310. Village Nursery leases Field 312A-B and Pacific Coast Nursery leases property on the northeast side of "N" Street and east of the Lambert Reservoir (dry and out of service) identified as Field 313. They cultivate primarily large shrubs and ornamental trees and the irrigation is accomplished using a drip irrigation system connected to each box. Sunny Slope Trees operate a nursery north of Portola Parkway and south of the Corridor Toll Road identified as Field 304. The cultivated areas present minimal environmental concern, however, there are industrial facilities along "N" Street that have recognized environmental conditions.

Tierra Verde Industries operates a large scale composting and greenwaste acceptance facility at the intersection of Irvine Boulevard and "N" Street. On the west side of "N" Street Tierra Verde Industries operates a rectangular yard used for receiving primarily wood and cardboard products which are pulverized, chipped, and ground into wood chips and sawdust size particles. The Tierra Verde facility on the east side of "N" Street is used as a receiving facility for greenwaste, and has been improved with the construction of a scale house, maintenance shop, and offices. The structures are primarily concrete floored, and metal roofed and sided. Tierra Verde constructed the maintenance shop to service the heavy equipment used in the loading, chipping, and grinding of the greenwaste and previously manufactured wood products. The area leased by Tierra Verde Industries used to be a chicken ranch and the chicken coops are visible on the older aerial photographs. Tierra Verde Industries stores bulk new oil, hydraulic oil, grease, and coolant in 55-gallon drums and 5-gallon containers at the eastern facility. Diesel and gasoline are stored in ASTs. Waste oil is stored in a 500-gallon AST and picked up on a regular basis for recycling.

Roger Aguinaga leases approximately 21-acres on both sides of "N" Street from The Irvine Company. Aguinaga operates a composting facility on the eastern side of "N" Street and has modular offices, a maintenance shop, and used equipment and material storage on the west side of "N" Street. The area historically was used for chicken ranching. The Aguinaga storage yard on the west side of "N" Street is used for maintenance of heavy equipment and rolling stock, storage of bulk oil, hydraulic fluids, grease, coolant, diesel, and gasoline. The diesel and gasoline are stored in ASTs mounted on flatbed trailers that have secondary containment berms built around them. There are also numerous diesel and gasoline ASTs that are not secondarily contained. The new oil and grease are commonly stored in 55-gallon drums and waste oil is stored in 55-gallon drums and a waste oil AST.

General Electric/Energy and Environmental Research (GE/EER)

GE/EER operate a energy research plant on the east side of "N" Street. The 25-acre parcel is leased from The Irvine Company and is currently used as a test facility. GE/EER performs research and development for improved boiler combustion and emissions control testing. Site facilities include a main office trailer, a two story office/document storage structure, a machine shop, a combustion test area, an analytical laboratory, several storage sheds, and several outdoor storage areas. Operations at the facility include burners that simulate industrial boilers and other combustion facilities test fires to evaluate combustion emissions control designs. Also, fuel types and flow rates are controlled and modified to simulate different combustion conditions, and differing types of emission monitoring equipment are attached to the boiler to test and monitor improvements in the combustion engines.

Feedstock material historically used to fuel boilers and burners include natural gas, diesel, fuel oil, biomass, paper, cardboard, plastic, oil/water emulsion, and auto shredder waste. GE/EER personnel state that hazardous wastes have not been used to fuel the boilers and burners.

Four USTs that formerly contained gasoline, diesel, and crude oil were located in the northwest portion of the site. These tanks were removed in 1991 and 1992. Following onsite bioremediation and testing of hydrocarbon impacted soils from the area of the USTs, OCHCA approved the soils for placement as fill. Closure for the former UST emplacement was issued by OCHCA in November 1993.

The site has been a test facility since 1960, and prior to that it was a gravel quarry. Ford Motor Company/Philco Corporation operated a rocket engine, small missile, shape charge, flare, and separation testing area onsite from 1960 to 1966. Ultrasystems Inc. occupied the site beginning in 1975 and land use and occupancy between 1966 and 1975 are currently unknown. Ultrasystems Inc. tested various burner configurations for high efficiency, low emission commercial boilers and EER was formed from Ultrasystems.

As part of a lease agreement (Lease Amendment No. 7) with The Irvine Company GE/EER was required to conduct a baseline risk assessment. This assessment consisted of 71 soil borings, installations of six groundwater monitoring wells, and conducting quarterly sampling. The results of the subsurface investigation indicated elevated concentrations of solvents (TCE and 1,1 DCE) in the underlying groundwater identified between 40 and 55 feet bgs. The site is continuing to be investigated and is under the regulatory guidance of the OCHCA and the Santa Ana RWQCB.

Also, EER has conducted final remediation during 1999 at the boneyard, auto shredder area, fly ash storage area, process water pit, Combustion Test Bay, and paved containment area all which exhibited elevated concentrations of TRPH and/or PCBs. The soil was excavated, transported offsite for disposal, and samples were collected to confirm the adequate removal of the impacted soil. The results of the remediation and confirmation sampling indicate that the identified chemical constituents of concern have been removed from the site to the referenced clean-up concentrations of less than 100 mg/kg for TRPH and non-detectable concentrations of PCBs.

The Irvine Company Underground Storage Tanks (USTs)

The Irvine Company operated 280-gallon to 500-gallon capacity windmachine underground storage tanks in Avocado Fields 301 and 306. The one UST in Field 301 and the four USTs in Field 306 contained gasoline and were used to fuel engines that powered the fan on a windmachine for frost protection purposes. The USTs were typically steel constructed, had 2-inch diameter vent line and fill, and the product line consisted of 3/8-inch flexible copper tubing that was plumbed directly from the tank to the windmachine. The product delivery operated on a vacuum system, therefore, if there was a leak in the copper tubing the engine would not receive fuel, thus minimizing the potential for releases of any significant volume. AEC permitted the five windmachine gasoline USTs and removed the USTs, under OCHCA supervision, on June 14, 2001. The soil samples collected beneath the USTs exhibited non-detectable concentrations for TPH-gasoline, volatile aromatics, and full scan of oxygenates. AEC is awaiting a “no further action” letter from OCHCA. Once it is received, the letter will be forwarded for ICDC review and filing.

Agricultural Yards

Custom Country Landscape Yard: Surface soils in several small areas at the Custom Country Landscape Yard (Field 308) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with portable aboveground storage tanks seated in steel saddles and the waste oil stored in open-topped 5-gallon buckets. None of the tanks appeared to be leaking, and the small releases appear to be accidental during use.

D & D Yard: Surface soils in several small areas at the D & D Yard (Field 303) were observed to be stained with hydrocarbons during AECs site inspection. D & D also stores agricultural chemicals in a locked steel container equipped with a solid floor. Mixing of the chemicals is performed onsite using a hose bib. The mixing area is on hard-packed dirt.

Aguinaga Yard: Surface soils in several small areas at the Aguinaga Yard (Field 372) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with the ASTs that are located onsite. Aguinaga operates a 500 gallon gasoline AST, (2) 750 gallon diesel ASTs, one 1,000-gallon waste oil AST, and 8,000-gallon diesel and maintains approximately 13 unused ASTs. The yard also stores bulk quantities of new oil, hydraulic oil, grease, and coolant in 55-gallon drums and 5-gallon buckets. Bags of fertilizer are stored inside a steel container, and waste oil and waste filters are stored in 55-gallon drums and 5-gallon containers. Aguinaga also has a boneyard of miscellaneous used equipment and materials including two older model suction dispensers.

These agricultural storage and maintenance yards are a necessity to any farming operation and are used for the storage of agricultural chemicals, bulk oils, antifreeze, and diesel and gasoline fuels required to successfully operate and maintain farm equipment and agricultural land. Also, farmers want their storage yard adjacent to their Fields, therefore, it is common to cut out a 1 to 5 acre parcel of the agricultural land and convert it to a storage and maintenance yard, and because it used to be farmland it is very rare to find a yard that has been paved. The "hazardous" materials releases commonly associated with a farm operation rarely occur due to negligence, rather it is commonly from small leaks and spills associated with the handling of the materials on a daily basis. The releases are usually aboveground, small in quantity, and spill onto the dirt surface, therefore, vertical and lateral migration potential is limited.

Agricultural Chemicals

The Irvine Company, and the farmers that lease Irvine Company property all use agricultural chemicals to assist in the production of high yield and high quality produce. The chemicals used in Planning Area I-06 are categorized as pesticides, herbicides, fungicides, fertilizers, and surfactants. Following are a listing of the commonly used agricultural chemicals during the past year:

Pesticides	Herbicides	Fungicides	Fertilizers	Other
Pyrellin	Round-up	Copper Sulfate	Nutra-Sol	Ethanol
Diazinon	Glyphosate	Clamp	Tech Flo	Kaolin
Carbaryl		Tenn-Cop 5E	Simplot 21-0-0	Spray
Javelin		Dyrene	Ammonium Nitrate	
MVP II		Rovral	Phosphoric Acid	
AgroMEK		Thiolux Sulphur	Potassium Nitrate	
Xentari		Copper-Count-n	Ammonium Nitrate	
Danitol				

All the farmers are registered with the Orange County Agricultural Commissioners Office (OCACO) and provide proper notification prior to applying the chemicals to their fields. There have been no "Notice of Violations" (NOVs) issued by the OCACO for the misuse, or mishandling of the chemicals by the farmers in Planning Area I-06 during the past year. Also, each farmer has been issued a Restricted Materials Permit Number by the Agricultural Commissioners office and they are tabulated below:

Farmer	Restricted Permit #	Expiration
Orange County Produce	30-01-300805	12/31/01
Gargiulo Farms	30-01-300917	12/31/01
Bordier's Nursery	30-01-300911	12/31/01

All of these farmers use licensed Pest Control Advisors (PCAs) to evaluate agricultural chemical selection and volume of application. The chemicals are applied in accordance with labeled instructions on the original container, and then the containers are triple rinsed prior to disposal.

Asbestos Containing Materials

Varying diameters and lengths of "transite pipe" may be identified during grading of the different Fields. The transite pipe contains asbestos and as such is regulated when it becomes a "waste" product. If the pipe becomes unusable it should be loaded into a truck and transported to an approved acceptance facility in Los Angeles County (Orange County accepts no asbestos related material). Also, since the pipe is non-friable there is not a sense of urgency regarding the disposal.

Transition of Property to Non-Agricultural Uses

It is importa nt to note this assessment was conducted on property that will remain cultivated for a minimum of one more year, and possibly longer, and understanding that farming is a dynamic process the mitigation of these sites should proceed with common sense and in an orderly fashion. The initial aspect of this report is to identify the active work-related areas where repeated handling and use of chemicals classified as "hazardous" occurs. These areas, and the personnel working in these areas, will be studied to identify if the repetitive handling of chemicals is being conducted in a manner that will not cause an adverse impact to soil and water resources. Next, AEC will make recommendations regarding mitigation of the historical recognized environmental concerns, followed by remediation of any impacted soil. Once the agricultural leases have been terminated, and future land has been decided, AEC recommends conducting a Phase II Environmental Assessment. Recommendations will be formulated from the results of the Phase II Assessment and mitigation measures will need to be performed prior to the mass grading of the property in preparation for an alternate land use. Also, it is the professional opinion of AEC that there are no current recognized environmental concerns that would restrict the non-farm compound and non-industrial use areas from being converted from agricultural use to residential with the exception of the former Navy rifle range in Field 352.

No other recognized environmental conditions were identified at the subject property or on surrounding properties during this assessment.

7.0 REFERENCES

1) Geologic Map of California; State of California Resources Agency, Department of Conservation, Division of Mines and Geology.

2) United States Geological Survey - 7.5 Series Topographic Quadrangle Map Publications (Tustin, El Toro, Laguna Beach and San Juan Capistrano Quadrangles).

3) Soil Survey of Orange County and Western Part of Riverside County, California; United States Department of Agriculture, Soil Conservation Service; 1299 Colombia Avenue, Suite E5; Riverside, California 92507; (909) 683-7691.

4) EDR Environmental Information, Inc.; 3530 Post Road, Southport, Connecticut, 06490; (800) 352-0500; www.edrnet.com.

5) Orange County Agricultural Commission; 10852 Douglass Road, Building D; Anaheim, California 92806-6050; (714) 447-7100.

6) Orange County Health Care Agency; 2009 East Edinger Avenue; Santa Ana, California 92705; (714) 667-3700.

7) Orange County Fire Authority, Hazardous Materials Unit; 180 South Water Street; Orange, California 92866-2123; (714) 744-0400.

8) State of California Department of Conservation - Division of Oil & Gas; 4800 Stockdale Highway; Bakersfield, California 93309; (661) 322-4031.

9) Southern California Edison; P. O. Box 410; Long Beach, California 90802; (310) 491-2391.

10) Wetlands Law Tests Government Plan; Gregor I. McGregor, Esq.; Environmental Protection Volume 3, Number 9 - November 1992; Stevens Publishing Corporation; 225 North New Road; Waco, Texas 76710; (817) 776-9000.

11) California Statewide Radon Survey Screening Results; State of California Department of Health Services; 601 North 7th Street; Sacramento, California 95814; (916) 322-2040.

12) United States Department of Housing and Urban Development (HUD); 1615 West Olympic Boulevard; Los Angeles, California; (213)-251-7001.

8.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

Advanced Environmental Concepts, Inc. appreciates the opportunity to provide our professional assistance to Irvine Community Development Company on this project. If you have any questions regarding our report or if AEC can be of further service, please call us at (661) 831-1646.

Sincerely,

Advanced Environmental Concepts, Inc.

____
Jonathan L. Buck
Registered Environmental Assessor II #20017

DOC11RG

9.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

AEC staff are composed of one primary environmental professional that performs Preliminary Site Assessments on a routine basis. Qualifications profiles for this individual is provided in the following section.

Jonathan L. Buck

Mr. Buck received a Bachelor of Science degree in Geology from the University of California, Santa Barbara, in 1981 and was professionally engaged in the petroleum industry in various capacities through 1985. Mr. Buck joined the environmental industry in 1985 and formed **Advanced Environmental Concepts Inc.** in 1989. Since it's inception, **AEC** has been a full service environmental consulting firm specializing in Preliminary Site Assessments, UST programs, and soil and groundwater assessment and cleanup programs. Mr. Buck is a State of California Registered Environmental Assessor, Class II (#22017) and has performed numerous PSA's on diverse properties throughout California, Arizona, Oregon, and Washington.

Advanced Environmental Concepts, Inc. is pleased to present the following:

Property Transfer Disclosure Report

for

Irvine Community Development Company
Planning Area 8A
Agricultural Fields 219 and 225

South of Bryan Road, North of Trabuco Road and West of Jeffrey Road
Unincorporated Orange County, California

This report has been prepared for:

Mr. Ken Coulter
Irvine Community Development Company

Prepared: September 2001

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1.0 EXECUTIVE SUMMARY

On behalf of the Irvine Community Development Company, Advanced Environmental Concepts, Inc. (AEC) has prepared a Property Transfer Disclosure Report on agricultural parcels bordered on the north by Bryan Avenue, the east by Jeffrey Road, on the south by Trabuco Road, and on the west by a residential tract. The property consists entirely of agricultural row crop land currently planted to tomatoes. The field work associated with the preparation of this report was performed during May, June, and July 2001. Based on the results of this assessment, the following recognized environmental conditions were identified:

Field 219 and Field 225: Field 219 and Field 225 used to be planted to citrus. In an effort to protect the citrus crop from freezing The Irvine Company installed four windmachines in each field (approximate 10-acre centers). The engine that powered the shaft that turned the fan operated on gasoline supplied by 500-gallon underground storage tanks (USTs). The tanks were constructed of steel and the product delivery lines were 3/8-inch diameter copper tubing plumbed from the tanks directly to the engines. The four 500 gallon USTs located in Field 219 were removed by AEC on March 1, 2000 and the four 500 gallon USTs located in Field 225 were removed by AEC on March 16, 2000. The USTs were removed at staggered time frames due to access restrictions to Field 225 (crop rotation). Because of time constraints applied by the tenant (Gargiulo) the USTs were not removed under Orange County Health Care Agency (OCHCA) permits, and soil samples were not collected under their supervision, however, AEC performed the removal, sampling, and backfilling of the USTs in accordance with OCHCA guidelines. The soil samples collected from beneath each of the USTs exhibited non-detectable concentrations of TPH-gasoline, volatile aromatics (BTXE), and Methyl tertiary Butyl Ether (MTBE). Also, there was no hydrocarbon stain, or odor, associated with the UST removals. Refer to **Appendix 10.2** for the tank closure report documentation.

It is the opinion of AEC that the comfort level of a prospective developer, and subsequent future homeowner, is enhanced by having a "no further action" letter issued by OCHCA to The Irvine Company regarding independent third party evaluation of the tank removals. Therefore, AEC contacted Mr. Luis Lodrigueza, Hazardous Materials Specialist, OCHCA and received his approval for AEC to re-sample the former tank locations to obtain closure. AEC has submitted tank abandonment permits with the OCHCA, they have been approved, and the former windmachine UST locations were re-sampled under OCHCA supervision (Mr. Lodrigueza) on July 12, 2001. The analytical results of soil samples collected beneath each of the former windmachine gasoline UST locations exhibit non-detectable TPH-gasoline, volatile aromatic (BTXE) and MTBE concentrations. The laboratory reports for this most recent phase of sampling are included in **Appendix 10.2.**

Bulk Quantity Chemicals: Bulk quantities of liquid fertilizer are staged in large plastic aboveground storage tanks (ASTs) adjacent to the irrigation water supply piping at the northeast corner of Field 219 (Bryan Avenue and Jeffrey Road). The tanks observed appear to be in good condition and there did not appear to be any obvious releases of fertilizer on surface soil surrounding the ASTs.

The liquid fertilizer can pose a potential problem if elevated concentrations are able to migrate to groundwater, or if a large volume is released into an irrigation water collection area that has the ability to migrate to a surface water storage area. Even small releases over long time periods can result in persistent accumulation of nitrate concentrations. Therefore, AEC makes a blanket recommendation that all ASTs be placed in some form of secondary containment to minimize the risk of future contamination. The secondary containment can be as simple as 6 mil plastic overlain by a 6-inch soil blanket and a berm created using sandbags.

Asbestos: Transite pipe is being used as a drain for diverting irrigation tail water into a culvert along Trabuco Road near the western property border. Transite pipe is manufactured with Asbestos Containing Materials (ACMs). The transite pipe is considered a low environmental risk if the piping is identified as being in good shape and non-friable. The integrity of the pipe observed by AEC appeared very good and did not appear damaged in any way.

AEC recommends that the pipe remain in place. However, when the site is converted from agriculture to residential it will have to be removed and disposed of at an approved ACM disposal facility.

No other recognized environmental conditions were identified at the subject property or on surrounding properties during this Property Transfer Disclosure Assessment. It is the professional opinion of AEC that there are no recognized environmental concerns within Planning Area 8A that would restrict the conversion of the site from agricultural to residential.

2.0 INTRODUCTION

2.1 Purpose

The purpose of this assessment is to identify recognized environmental conditions located at the subject site or adjacent properties which could present material risk of harm to public health or to the environment. Recognized environmental conditions are defined as the presence or likely presence of any hazardous wastes and/or substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property.

2.2 Special Terms and Conditions

The information included in this report is intended for use exclusively as a preliminary assessment of potential environmental and human health concerns at the project site. Data was obtained through telephone conversations, personal interviews, public records, public information, general maps and aerial photographs. These services have been rendered by **Advanced Environmental Concepts, Inc.** (**AEC**) in accordance with generally accepted practices by professional hydrogeologists and environmental specialists. Because of the limited nature of this investigation, the firm is precluded from providing a warranty, expressed or implied, regarding the presence of hazardous materials that could potentially adversely affect the subject site.

This report is provided with the understanding that it is the responsibility of the owner to convey the information and recommendations contained herein, to the appropriate regulatory agencies, as required. The services performed in the scope of this project are for the sole use of our client. Others who seek to rely on the findings contained within this report have a duty to determine the adequacy of the information presented herein, for their time, location, and intended use.

2.3 Limitation and Exceptions of Assessment

This report presents the results of a Property Transfer Disclosure Assessment conducted by **Advanced Environmental Concepts, Inc.** (**AEC**) for Mr. Ken Coulter, Irvine Community Development Company (client), which is a subsidiary of The Irvine Company:

Irvine Community Development Company
Planning Area 8A
Agricultural Fields 219 and 225
South of Bryan Avenue, West of Jeffrey Road, North of Trabuco Road
Unincorporated Orange County, California

No other properties were included within the scope of this assessment except as required for the off-site reconnaissance and for the regulatory agency database and file review pertaining to potential sources of offsite recognized environmental concerns. Historical information regarding the subject parcels is limited to review of public documents, interviews with persons knowledgeable with the past and present uses and conditions of the property, and historic mapping and aerial photography review.

2.4 Limiting Conditions and Methodology

To evaluate the potential presence of recognized environmental conditions AEC conducted the following:

Contacting appropriate regulatory agencies for hazardous materials information concerning the subject site and surrounding areas located within an approximate ¼-mile radius of the site boundaries. Inquiries were made regarding documentation of: (a) toxic spills; (b) underground storage tanks; (c) the use, storage, generation, and/or disposal of hazardous materials; (d) the presence of disposal wells and/or leach fields, drain fields, and septic systems; and, (e) violations of applicable environmental control standards;

Conducting interviews with Key Site Managers; Mr. Peter Changala, Vice President, The Irvine Company Agricultural Division; and Mr. Dominic Etcheberria, General Manager, Irvine-Valencia Growers. AEC also researched historical site usage for information regarding past or present recognized environmental conditions;

Reviewing selected reports, maps, and aerial photographs for information pertaining to potential sources or visual indications of soil and groundwater contamination;

Conducting an on-site inspection and off-site reconnaissance to identify visible evidence of the generation, use, storage, release, or disposal of hazardous materials;

Evaluating investigational findings and the preparation of a detailed report inclusive of findings and recommendations.

3.0 SITE DESCRIPTION

3.1 Location

The subject property consists of approximately 75 acres of land developed as agricultural parcels currently planted to tomatoes. The site is located in unincorporated Orange County approximately one mile north of the Interstate 5 Freeway. Fields 219 and 225 are bordered by Trabuco Road to the south, Jeffrey Road to the east, Bryan Avenue forms the northern boundary, and the western property boundary is an established residential tract.

3.2 Site and Vicinity Characteristics

3.2.1 Physiographic Setting[1]

The subject property is within the Los Angeles-Orange County coastal plain of the eastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. The subject property is within the Tustin Plain, which is the largest area of Recent alluvial sedimentation. The Tustin Plain is composed of alluvial fans with elevations from 150 to 500 feet above mean sea level that formed along the southwest flank of the Santa Ana Mountains. The plain slopes regionally to the west and southwest with a topographic gradient of approximately 50 feet per mile and consists of approximately 1,400 feet of unconsolidated to semi-consolidated Holocene to Quaternary-age alluvial sediments [2].

The alluvial deposits of Holocene-Quaternary age that comprise the Tustin Plain consist mainly of sands, gravels, silts and clays. Generally, the coarse grained sediments are deposited near the inland hills as alluvial fans, whereas deposition of progressively finer grained sediments occurs towards the river flood-plains. The upper fan areas are interpreted as intake areas where recharge of the groundwater takes place. Hydraulic continuity may exist between alluvial sediments of the fan areas and certain water-bearing sediments of the central lowlands. Replenishment of groundwater occurs in the intake area by infiltration from major streams within their permeable channels and from irrigation water and rain. Shallow "perched" groundwater has been identified at a depth of 48.5 feet in the southeast corner of Field 225 during the geotechnical investigation conducted by Leighton & Associates on January 12, 2001. Regional groundwater is estimated at depths greater than 100-feet bgs.

The regional stratigraphy is comprised of interbedded silt, clay and sand that is typical of sediments deposited on alluvial fans during flood stages. Underlying the Holocene to Quaternary deposits are Tetiary bedrock units comprised of sandstone, siltstone, shale, and conglomerate that are several thousands of feet in thickness. Elevations of the subject property range from 186 feet at the eastern boundary to 170 feet at the western boundary. The property gently slopes in the westerly direction[3].

The site is not located within an Alquist-Priolo Special Studies Zone and no active faults are reported to underlie the subject property. The closest active faults are the Newport-Inglewood Fault (offshore) to the southeast and the Glenn Ivy-Elsinore to the northeast. is a major northwest-southeast trending strike slip fault that terminates near Costa Mesa. This fault does not appear to extend beneath the subject property. Several minor faults are located north and northeast of the property.

3.2.2 Soils Profile[4]

Surface sediments beneath the subject property are composed of two soil types:

(1)	**Sorrento Loam, 0 to 2% Slopes**	**(206)**
(2)	**Sorrento Clay Loam, 0 to 2% Slopes**	**(208)**

Sorrento Soil Series: This series consists of well drained soils found on alluvial fans and flood plains. Sorrento soil consists of moderately alkaline and calcareous loam with moderate permeability. Runoff is slow and erosion hazard is slight in areas which are not covered with protective vegetation. The typical profile consists of a brown and grayish brown loam surface layer to 12 inches. The next layers are light brownish gray, brown, and pale brown silty clay loam to a depth of 61 inches or more. Sorrento soils are used for irrigated crops, citrus, and more recently urban development.

3.3 Description of Structures, Roads, & Other Site Improvements

The subject property consists solely of areas developed for agricultural purposes currently planted to tomatoes. There are hard-packed dirt access roads that border the Fields and the two Fields are separated by a eucalyptus windbreak. The northeast corner of Field 219 is used as a staging area for three approximately 4,000-gallon poly constructed liquid fertilizer storage tanks. The poly tanks are in very good condition and there appears to be no visible signs of leaks around the base of the tanks. Adjacent to the poly tanks is the irrigation piping system. At the southeast corner of the eucalyptus windbreak is a hard-packed dirt storage area for wooden tomato stakes and plastic drip irrigation line. An irrigation water drainage ditch forms the western and southern boundaries of the site.

3.4 Environmental Liens

No indication of current environmental liens was provided to **AEC** by the user or obtained from any other informational source during this assessment.

3.5 Onsite Water Supply

Water for onsite use is obtained from the Irvine Ranch Water District distribution pipeline and feeder system.

3.6 Current Uses of the Property

The subject property is currently agricultural and planted to tomatoes.

3.7 Past Uses of the Property

Based on reviews of historical USGS maps and reviews of historical topographic maps beginning in 1901, and aerial photographs beginning in 1947, the subject property has been used solely for agricultural purposes since the area was first developed. Initially the property was used for native rangeland, followed by row crops planted in the mid 1940's. The citrus were planted during the mid 1960's. The flood and micro-sprinkler irrigated citrus were cultivated until encroaching urban development began to affect crop size and quality. The orchards in the general area were removed between 1994 and 1997 and the land was converted to drip system irrigated row crops primarily consisting of strawberries, beans, peppers, and tomatoes.

3.8 Current and Past Uses of Adjoining Properties

Prior to the recent urban development of the area beginning in the late 1970's, the site and surrounding areas were principally agricultural lands, grazing lands and undeveloped lands. The property was bordered on all sides by agriculturally developed properties until the late 1970's when the western border to Field 219 and Field 225 were developed with a residential tract. However, the north, south, and east boundaries of the property remained in similar agricultural commodity production. There have been widening improvements to Bryan Avenue, Trabuco Road, and Jeffrey Road over the past 20 years.

4.0 RECORDS REVIEW

4.1 Standard Federal and State Environmental Record Sources

AEC contracted **EDR Environmental Information, Inc.**[4] to perform searches of readily available Federal, State, and Local database information systems for the purpose of identifying known recognized environmental conditions present on nearby properties which have the potential to adversely impact the site being assessed in this study. There were no onsite facilities identified within the EDR survey. Also, there were no offsite facilities within a ½-mile judged to pose a threat to soil and/or groundwater resources beneath the subject property.

The complete report furnished by **EDR** is included in **Appendix 10.3** of the report.

4.2 Historical Use Information

4.2.1 Aerial Photograph and Historical USGS Map Review[4]

Historical aerial photograph coverage and USGS Map coverage of the site were reviewed in order to evaluate past site usage. Visual observations noted within these photographs and maps are described chronologically as follows:

Map Date: 1901 **Quadrangle: Santa Ana** **Scale: 1:62,500**

The subject property and surrounding areas appeared undeveloped and covered in native vegetation during 1901. Santa Ana was the only developed area and located to the west. The Surf Line Railroad ran near the subject property. No indications of onsite structures or other developments of the property were noted in the 1901 topographic survey.

Aerial Photograph Date: 1947 **Flyer: Jack Amman** **Scale: 1"=655'**

The subject property appears to be used for cover crop cultivation and the adjoining areas appear to be in permanent plantings of citrus. Resolution of visual detail is good.

Aerial Photograph Date: 1952 **Flyer: Pacific Air** **Scale: 1"=833'**

The subject property and adjoining areas on all sides appear to be agriculturally developed at the time of the 1952 aerial survey. The subject property appears to be planted to row crops, while surrounding areas are in permanent planting. Resolution of visual detail is good.

Aerial Photograph Date: 1968 **Flyer: Teledyne** **Scale: 1"=800'**

The subject property has been planted to citrus and the surrounding properties are all planted to citrus. No structures are evident on the subject sites and there are no other indications of significant land usage changes. Resolution of visual detail is good.

Map Date: 1972 **Quadrangle: Tustin** **Scale:1:24,000**

Advanced development of permanent access roads for the burgeoning population is evident during the time frame of this topographic map. Residential tracts are encroaching from the south and west. The subject site is in permanent planting of citrus.

Aerial Photograph Date: 1977 **Flyer: Teledyne** **Scale: 1"=666'**

The subject property, and surrounding properties are developed with citrus. There were no structures identified in this photograph. Resolution of visual detail in this photograph is good.

Aerial Photograph Date: 1989 Flyer: USGS Scale: 1"=666'

There were little change in this photograph from the previous 1977 photo. The area is still planted to citrus. The western adjacent to property is residentially developed. Resolution of visual detail in this photograph is good.

Aerial Photograph Date: 1994 Flyer: USGS Scale: 1"=666'

The property has had the citrus trees removed and appears to be in row crop production. The western boundary properties are fully developed housing tracts. Resolution of visual detail in this photograph is good.

4.3 Additional Record Sources

4.3.1 Orange County Agricultural Commission[5]

The Orange County Agricultural Commission (OCAC) maintains records of Restricted Agricultural Chemicals permitted for use and/or storage at agricultural facilities located throughout Orange County. Inventory information regarding restricted herbicides, pesticides, rodenticides, etc., is listed on Restricted Materials permits issued annually and archived within the OCAC database. OCAC records contained the following information pertaining to Gargiulo Farms leasing Fields 219 and 225.

Gargiulo Farms currently leases both Fields and has planted them with tomatoes. Gargiulo Farms has been issued Orange County restricted Materials Permit #30-01-300917.

4.3.2 Orange County Health Care Agency[6]

The Orange County Health Care Agency (OCHCA) maintains records of underground storage tanks (UST's) and incidents of unauthorized releases of hazardous materials from underground storage tanks at the subject site and surrounding areas. OCHCA records contained no information pertaining to past and present hazardous materials releases, or underground fuel storage tanks. Note that OCHCA was not aware of the windmachine USTs because they are exempt under the farm tank exemption regulation.

4.3.3 Orange County Fire Authority Records[7]

The Orange County Fire Authority, Hazardous Materials Bureau maintains inventory information and "Hazardous Materials Management Plans" (HMMP's) for facilities located within Orange County, California. OCFA had no files on record pertaining to Field 219 and Field 225.

4.3.4 California Department of Conservation - Division of Oil & Gas[8]

No onsite oil or gas wells were identified during the site reconnaissance or within D.O.G. maps reviewed during this assessment.

5.0 INFORMATION FROM SITE RECONNAISSANCE AND INTERVIEWS

5.1 Hazardous Substances in Connection with Identified Uses

The subject property operates and maintains three poly constructed ASTs containing liquid fertilizer. Also, the farm tenant applies various agricultural chemicals during normal preparation of the Fields and maintaining the crop. The agricultural chemicals are applied according to labeled instructions, and the used containers are triple-rinsed then appropriately disposed.

In March 2000 AEC removed eight 500 gallon USTs that formerly contained gasoline. Initial soil sampling conducted beneath the former tank locations exhibited non-detectable concentrations of gasoline-range hydrocarbons. Subsequent re-sampling of the former tank locations, under Orange County supervision, also identified no detectable concentrations of gasoline-range hydrocarbons. No additional hazardous materials were identified during the site inspection or during the interview process.

5.2 Unidentified Substance Containers

No unidentified hazardous substance containers were identified on the subject property during the site reconnaissance portion of this assessment.

5.3 Storage Tanks

Three large-capacity poly constructed liquid fertilizer aboveground storage tanks are located at the northeast corner of Field 219. Also, the site used to operate eight 500 gallon gasoline USTs for the operation of the engines to power the frost control windmachines. The USTs were removed by AEC in March 2000 and analytical results of soil samples collected beneath the USTs indicate non-detectable concentrations of gasoline range hydrocarbons. AEC re-sampled the former tank locations, under Orange County supervision, to confirm the absence of gasoline-range hydrocarbons on July 12, 2001.

No other visual indications of existing aboveground or underground storage tanks used for past or present hazardous materials storage were identified during the course of this preliminary site assessment.

5.4 Indications of PCB(s)

No electric transformers were identified within the subject property. Electric transformers are owned and operated by Southern California Edison (SCE)[9]. According to information obtained from SCE, all transformers within the SCE power distribution network suspected of containing PCB's in concentrations exceeding 50 parts per million were removed and replaced by 1987. Manufacture of PCB-containing electric power transformers was discontinued in 1984.

PCB sampling and laboratory analysis is beyond the scope of this preliminary assessment.

5.5 Indications of Solid Waste Disposal

Miscellaneous plastic and drip hose are located onsite awaiting disposal. Other than that no indications of onsite solid waste disposal were identified on the subject property during the site reconnaissance portion of this assessment.

5.6 Indications of Waste Water Disposal

Onsite irrigation waste water is diverted to the drainage culverts located on the western and southern property boundaries. There are no sanitary disposal systems.

5.7 Physical Setting Analysis

5.7.1 Designated Wetlands[10]

Under U.S. Army Corps of Engineers (USACE) regulations, wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include swamps, marshes, bogs and similar areas such as sloughs, prairie potholes, wet meadows, river overflows, mud flats, and natural ponds.

Based on information provided to AEC within the EDR database survey report, no areas within the boundaries of the subject property are included within the 1994 edition of the National Wetlands Inventory listing.

5.8 Any Other Conditions of Concern

5.8.1 Radon[11]

Radon is a colorless, odorless, tasteless, naturally occurring radioactive gas formed by the decay of uranium in soil and bedrock. Because uranium and radon occur naturally in varying amounts within rocks and soils found throughout the United States, radon is present in all the air that we breathe. Long-term exposure to elevated concentrations of radon in confined areas has been associated with an increased risk of lung cancer. The present action levels require exposure to concentrations of at least four picocuries/liter (4 pCi/L) of radon over an extended period of time. The State of California Department of Health Services conducted radon surveys across portions of Orange County, during 1990. These surveys did not indicate the widespread presence of radon in concentrations exceeding 4 pCi/L within Orange County.

The United States Environmental Protection Agency (EPA) and the Surgeon General presently recommend that all homes in the United States be individually tested for radon. Based on the past agricultural usage of the subject property, AEC does not recommend radon testing be performed at this site.

Radon sampling and laboratory analysis is beyond the scope of this preliminary site assessment.

5.8.2 Asbestos Containing Materials (ACM's)

Asbestos containing materials (ACM's) were commonly used in a wide variety of building products such as roofing shingles, composite siding, linoleum flooring, acoustic ceiling tiles, furnace and water heater exhaust piping and insulation, glues and mastics, stucco, joint compounds, and composite wallboards prior to 1980. ACM's can be divided into material considered friable (easily crumbled or reduced to powder) and nonfriable. Friable ACM's are regulated as hazardous materials due to the elevated long-term risk of developing lung cancer upon respiratory exposure and must be properly removed prior to renovation or demolition of any structure containing these materials. In addition to structures, ACM's have been historically used as "transite" irrigation piping within many agricultural parcels throughout California. Transite piping was visually identified during the site reconnaissance portion of this assessment in the southern drainage culvert. The transite pipe appeared in very good condition and does not pose an environmental concern. However, when the property is converted form agricultural to residential the pipe will have to be disposed of at an approved disposal facility.

Asbestos sampling and laboratory analysis is beyond the scope of this property transfer disclosure assessment.

5.8.3 Lead

According to information published by the United States Department of Housing and Urban Development (HUD), approximately three out of every four pre-1978 buildings contain lead-based paint[12]. Based on the lack of structures located within the subject property, there is limited presence of lead-based plumbing and/or paints.

Lead sampling and laboratory analysis is beyond the scope of this property transfer disclosure assessment.

6.0 FINDINGS AND CONCLUSION

AEC has prepared a Property Transfer Disclosure Report on agricultural parcels bordered on the north by Bryan Avenue, the east by Jeffrey Road, on the south by Trabuco Road, and on the west by a residential tract. The property consists entirely of agricultural row crop land currently planted to tomatoes. The field work was performed during May, June, and July 2001. Based on the results of this assessment, the following recognized environmental conditions were identified:

<u>Field 219 and Field 225</u>: Field 219 and Field 225 used to be planted to citrus. In an effort to protect the citrus crop from freezing The Irvine Company installed four windmachines in each field (approximate 10-acre centers). The engine that powered the shaft that turned the fan operated on gasoline supplied by 500-gallon underground storage tanks (USTs). The tanks were constructed of steel and the product delivery lines were 3/8-inch diameter copper tubing plumbed from the tanks directly to the engines. The four 500 gallon USTs located in Field 219 were removed by AEC on March 1, 2000 and the four 500 gallon USTs located in Field 225 were removed by AEC on March 16, 2000. The USTs were removed at staggered time frames due to access restrictions to Field 225 (crop rotation). Because of time constraints applied by the tenant (Gargiulo) the USTs were not removed under Orange County Health Care Agency (OCHCA) permits, and soil samples were not collected under their supervision, however, AEC performed the removal, sampling, and backfilling of the USTs in accordance with OCHCA guidelines. The soil samples collected from beneath each of

the USTs exhibited non-detectable concentrations of TPH-gasoline, volatile aromatics (BTXE), and Methyl tertiary Butyl Ether (MTBE). Also, there was no hydrocarbon stain, or odor, associated with the UST removals. Refer to **Appendix 10.2** for the tank closure report documentation.

It is the opinion of AEC that the comfort level of a prospective developer, and subsequent future homeowner, is enhanced by having a “no further action” letter issued by OCHCA to The Irvine Company regarding independent third party evaluation of the tank removals. Therefore, AEC contacted Mr. Luis Lodrigueza, Hazardous Materials Specialist, OCHCA and received his approval for AEC to re-sample the former tank locations to obtain closure. AEC has submitted tank abandonment permits with the OCHCA, they have been approved, and the former windmachine UST locations were re-sampled under OCHCA supervision (Mr. Lodrigueza) on July 12, 2001. The analytical results of soil samples collected beneath each of the former windmachine gasoline UST locations exhibit non-detectable TPH-gasoline, volatile aromatic (BTXE) and MTBE concentrations. The laboratory reports for this most recent phase of sampling are included in **Appendix 10.2.**

Bulk Quantity Chemicals: Bulk quantities of liquid fertilizer are staged in large plastic aboveground storage tanks (ASTs) adjacent to the irrigation water supply piping at the northeast corner of Field 219 (Bryan Avenue and Jeffrey Road). The tanks observed appear to be in good condition and there did not appear to be any obvious releases of fertilizer on surface soil surrounding the ASTs.

The liquid fertilizer can pose a potential problem if elevated concentrations are able to migrate to groundwater, or if a large volume is released into an irrigation water collection area that has the ability to migrate to a surface water storage area. Even small releases over long time periods can result in persistent accumulation of nitrate concentrations. Therefore, AEC makes a blanket recommendation that all ASTs be placed in some form of secondary containment to minimize the risk of future contamination. The secondary containment can be as simple as 6 mil plastic overlain by a 6-inch soil blanket and a berm created using sandbags.

Asbestos: Transite pipe is being used as a drain for diverting irrigation tail water into a culvert along Trabuco Road near the western property border. Transite pipe is manufactured with Asbestos Containing Materials (ACMs). The transite pipe is considered a low environmental risk if the piping is identified as being in good shape and non-friable. The integrity of the pipe observed by AEC appeared very good and did not appear damaged in any way.

AEC recommends that the pipe remain in place. However, when the site is converted from agriculture to residential it will have to be removed and disposed of at an approved ACM disposal facility.

No other recognized environmental conditions were identified at the subject property or on surrounding properties during this Property Transfer Disclosure Assessment. It is the professional opinion of AEC that there are no recognized environmental concerns within Planning Area 8A that would restrict the conversion of the site from agricultural to residential.

7.0 REFERENCES

1) Geologic Map of California; State of California Resources Agency, Department of Conservation, Division of Mines and Geology.

2) United States Geological Survey - 7.5 Series Topographic Quadrangle Map Publications (Tustin, El Toro, Laguna Beach and San Juan Capistrano Quadrangles).

3) Soil Survey of Orange County and Western Part of Riverside County, California; United States Department of Agriculture, Soil Conservation Service; 1299 Colombia Avenue, Suite E5; Riverside, California 92507; (909) 683-7691.

4) EDR Environmental Information, Inc.; 3530 Post Road, Southport, Connecticut, 06490; (800) 352-0500; www.edrnet.com.

5) Orange County Agricultural Commission; 10852 Douglass Road, Building D; Anaheim, California 92806-6050; (714) 447-7100.

6) Orange County Health Care Agency; 2009 East Edinger Avenue; Santa Ana, California 92705; (714) 667-3700.

7) Orange County Fire Authority, Hazardous Materials Unit; 180 South Water Street; Orange, California 92866-2123; (714) 744-0400.

8) State of California Department of Conservation - Division of Oil & Gas; 4800 Stockdale Highway; Bakersfield, California 93309; (661) 322-4031.

9) Southern California Edison; P. O. Box 410; Long Beach, California 90802; (310) 491-2391.

10) Wetlands Law Tests Government Plan; Gregor I. McGregor, Esq.; Environmental Protection Volume 3, Number 9 - November 1992; Stevens Publishing Corporation; 225 North New Road; Waco, Texas 76710; (817) 776-9000.

11) California Statewide Radon Survey Screening Results; State of California Department of Health Services; 601 North 7th Street; Sacramento, California 95814; (916) 322-2040.

12) United States Department of Housing and Urban Development (HUD); 1615 West Olympic Boulevard; Los Angeles, California; (213)-251-7001.

8.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

Advanced Environmental Concepts, Inc. appreciates the opportunity to provide our professional assistance to Irvine Community Development Company on this project. If you have any questions regarding our report or if AEC can be of further service, please call us at (661) 831-1646.

Sincerely,

Advanced Environmental Concepts, Inc.

Jonathan L. Buck
Registered Environmental Assessor II #20017

DOC11QJ.R

9.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

AEC staff is composed of one primary environmental professional that perform Preliminary Site Assessments on a routine basis. Qualifications profiles for this individual is provided in the following sections.

Jonathan L. Buck

Mr. Buck received a Bachelor of Science degree in Geology from the University of California, Santa Barbara, in 1981 and was professionally engaged in the petroleum industry in various capacities through 1985. Mr. Buck joined the environmental industry in 1985 and formed **Advanced Environmental Concepts Inc.** in 1989. Since it's inception, **AEC** has been a full service environmental consulting firm specializing in Preliminary Site Assessments, UST programs, and soil and groundwater assessment and cleanup programs. Mr. Buck is a State of California Registered Environmental Assessor, Class II (#22017) and has performed numerous PSA's on diverse properties throughout California, Arizona, Oregon, and Washington.

Advanced Environmental Concepts, Inc. is pleased to present the following:

Property Transfer Disclosure Report

for

Irvine Community Development Company
Planning Area I-09A
Agricultural and Commercially Developed Land

South of Portola Parkway, North of Trabuco Road,
East of Jeffrey Road, West of State Route 133
Unincorporated Orange County California

This report has been prepared for:

Mr. Ken Coulter
Irvine Community Development Company

Prepared: September 2001

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1.0 EXECUTIVE SUMMARY

On behalf of the Irvine Community Development Company (ICDC), Advanced Environmental Concepts, Inc. (AEC) has prepared a Property Transfer Disclosure Report on agricultural and commercially developed parcels bordered on the north by Portola Parkway, south by Trabuco Road, the west by Jeffrey Road, and the east by the eastern leg of State Route 133 (Toll Road). The property reviewed in Planning Area I-09A consists primarily of agricultural land approximating 1,170-acres and planted to a nursery, row crops rotating between strawberries, tomatoes, and beans; and commercially developed parcels totaling 80-acres including segments of the eastern portion of the Hines Nursery facility, the Northwood Golf Center/Orange County Flood Control Basin, and The Irvine Company's agricultural headquarters including the Irvine-Valencia Growers (IVG) packing facility, the strawberry packing and cooling facility, the tomato processing facility, and the avocado packing and processing facility. Also, associated with The Irvine Company's farm management headquarters are numerous storage buildings, and open ground leased to various growers and packers. This assessment was performed during April, May, and June 2001. The purpose was to identify adverse environmental conditions and "hazardous" waste streams generated on-site that could potentially affect the human health and the environment, and to review if "hazardous" waste streams generated offsite could adversely affect the subject properties. These concerns include storage and use of agricultural chemicals categorized as pesticides, herbicides, fungicides, fertilizers, and surfactant. Other concerns include transite irrigation pipe which contains asbestos, the storage of new oils and hydraulic fluids, the generation and storage of waste oils, the storage of diesel and gasoline fuels in aboveground and underground storage tanks (ASTs and USTs), hydraulic floor lifts, effluent waste water from steam wash pads, and used batteries. It is the experience of AEC that these environmental concerns are typical within a large-scale farming operation and are similar in nature to other large-scale farming operations found throughout California. It is also important to note that the majority of "hazardous" material, and waste generation are typically identified in the farming headquarters and storage yards of The Irvine Company, and their different farming tenants, which occupy the least amount of property. Therefore, numerous environmental issues are concentrated in a small area, whereas, the vast majority of the property is under cultivation, and can be considered mostly unencumbered. Following is a brief description of the properties and structures in Planning Area I-09A and their associated recognized environmental conditions.

The Irvine Company's Agricultural Headquarters

Irvine-Valencia Growers	13242 Jeffrey Road, Irvine
The Irvine Company - Irvine Farm Management	13256 Jeffrey Road, Irvine
The Irvine Company - Irvine Farm Management	13258 Jeffrey Road, Irvine
The Irvine Company - Irvine Packing and Cooling	13250 Jeffrey Road, Irvine
The Irvine Company - Irvine Packing and Cooling	13252 Jeffrey Road, Irvine

The Irvine Company's Agricultural headquarters is located on Packing House Way, however, all the structures have a Jeffrey Road address. The approximate 24-acre parcel has been cut out of Field 305, which during the time of the site inspection was planted to strawberries. The developed parcel consists of the original Irvine-Valencia Growers (IVG) facility (5-acres); the Vegetable Packing House (tomatoes) and the Avocado/Strawberry Packing House facility (10.5-acres), the Irvine Farm Management and Maintenance facility (6.5-acres) and open ground storage (2-acres).

The original IVG facility at 13242 Jeffrey Road was constructed in 1926 as an orange packing co-op and it was an active facility for citrus processing until 1996. The two-story citrus packing and cold storage facility is constructed of concrete with a wood roof. The insulation is cork in the older cold storage structure. The foundation is concrete and the second story floor is wood constructed. The offices adjoining the south side of the IVG facility were used through 2000, then they were also closed. The facility is currently used for box and other packaging material storage, and for equipment storage.

The Vegetable Packing House at 13250 Jeffrey Road was originally constructed in 1972 and was primarily used for the packing and cooling of corn, celery, and broccoli; then transitioned into a tomato packing shed in the early 1990's. The facility is currently leased to Gargiulo and is used for large-scale packaged tomato production.

The Avocado/Strawberry Packing House at 13250 Jeffrey Road was constructed in 1983 and used for strawberry cooling and packaging of avocados. Currently, the facility has contracted offsite avocado packaging services, and has expanded its strawberry production capabilities.

The Irvine Farm Management facility at 13256-13258 Jeffrey Road was constructed in 1999 as a replacement for the former Agricultural Main Yard located at 13042 Old Myford Road. The facility provides office space for Irvine Company agricultural employees, and farm equipment and vehicle maintenance/shop service capabilities.

Northwood Golf Center

Planning Area I-09A also contains the Northwood Golf Center which was constructed on former Field 226 in 1997. The golf driving range is built into a water retention basin that is under easement to the Orange County Flood Control District and the recreational easement is reserved by The Irvine Company with the rights assigned to the James Golf Development Corporation.

Hines Nursery

Hines Nursery leases approximately 185-acres on the east side of Jeffrey Road. The lease property was acquired by Hines Nursery around 1980. The property has been cultivated as citrus and cover crops prior to its use as nursery ground. Hines Nursery uses this acreage primarily for greenhouse, shade netting, and open-air cultivation of ornamental plants, and a smaller portion of the property has been developed with buildings including the agricultural chemical storage and mixing work station, a laboratory, pest control facility, corrugated metal-sided warehouse, and small team leader offices. Septic systems are associated with the structures and consist of holding tanks and leach lines. The holding tanks are pumped on an “as-needed” basis to remove solids and the effluent water drains into the leach lines. Also, excess irrigation water is collected in small holding areas then booster pumped beneath Jeffrey Road via pipeline and into the culvert collection system that drains into the collection reservoir.

The area of primary environmental concern is the agricultural storage and mixing work station. The agricultural chemicals are stored in a locked concrete floored storage room in various containers consisting of bags and plastic containers. The chemicals can be granular, powdered, or liquid. Some chemicals are sent from the manufacturing facility in pre-measured containers that are prepared by “just adding water”. Other chemicals require the spray technician to measure required volumes and carry the concentrated chemicals to the spray rig for mixing. The Hines Nursery mixing station is a steel-constructed open sided and concrete floored structure that has individual water bib locations that may accommodate numerous spray rigs at one time. The concrete pad was fitted with floor drains that would collect any spilled chemical/water mixture and then flow into a 10,000-gallon “pesticide rinseate” UST through subsurface piping. The UST was removed in 1990 by Hekimian and Associates and samples collected beneath the UST exhibited DDT concentrations which are currently below the Preliminary Remediation Goal (PRG) of 120 mg/kg established for “Industrial Soil” but exceed the 1.7 mg/kg concentration established for “Residential Soils”. Currently, the floor drains are capped, however, excess mixing water can also overflow the pad and onto the hard packed dirt surface surrounding the work station.

Of secondary concern is the laboratory building. It was reported to AEC that the most common chemical used in the laboratory is potassium hydroxide (base/oxidizer) and it is handled and disposed of according to labeled instructions. The remaining chemicals are commonly used for titration procedures to evaluate the pH of the irrigation water and have been described as inert.

Cultivated Areas

Planning Area I-09A also consists of land solely under agricultural use and cultivation and is divided into Fields. The Fields are leased to tenant farmers that primarily cultivate strawberries, tomatoes, and beans and are identified as Field 213, Field 220, Field 221, Field 222, Field 223, Field 227, Field 228, Field 229, Field 305, Field 307, Field, 308, Field 309, Field 310, Field 314, and Field 315. The tenant farmers have converted a small portion of their leased ground into agricultural storage and maintenance yards. It is within these yards that the majority of environmental concerns are normally discovered. Orange County Produce (OCP) operate two yards, one within Field 227 accessed via Trabuco Road, and one within Field 309 accessed via Sand Canyon Avenue. B & E Farms operates one yard within the study area in Field 315 and is accessed via Sand Canyon Avenue. DC Berry operates one yard adjacent to Field 305 and is accessed via Jeffrey Road. Etchandy Farms has a small yard in Field 213, Fujishige Farms has a storage yard in Field 307, and Wall Farms has small storage yard in Field 310. The majority of the Fields between Trabuco Road and Irvine Boulevard were initially planted to citrus, therefore, needed windmachines (USTs) for frost protection. The citrus was removed between 1994 and 1997 and the acreage converted to row crops.

Finally, there is a massive aboveground water storage tank constructed in a cut out area of Field 315. The water storage tank was installed in 1982 and operated by the Irvine Ranch Water District (IRWD).

Underground Storage Tanks (USTs)

The IVG facility formerly operated a 7,500-gallon gasoline UST that was removed by Kal-Vac in 1993. The UST was located to the east of the IVG corrugated metal-sided storage structures and paralleled Packing House Way. The UST was removed under Orange County Health Care Agency (OCHCA) permit and Orange County Fire Authority approval. Analytical results of soil samples collected beneath the UST indicated acceptable hydrocarbon concentrations. IVG also removed from the premises a 1,000-gallon gasoline UST and a 2,000-gallon gasoline UST on December 3, 1985. IVG also operates a double-walled fiberglass gasoline UST connected to a dispenser and covered by a canopy located in the central portion of the packing house property. The UST permits with OCHCA and South Coast Air Quality Management District (SCAQMD) are current. It has also been upgraded in accordance with the required regulations and issued permit # 08724.

The Irvine Company also operated 280-gallon to 500-gallon capacity windmachine underground storage tanks. These USTs contained gasoline and were used to fuel engines that powered the fan on a windmachine for frost protection purposes. The USTs were typically steel constructed, had 2-inch diameter vent line and fill, and the product line consisted of 3/8-inch flexible copper tubing that was plumbed directly from the tank to the windmachine. The product delivery operated on a vacuum system, therefore, if there was a leak in the copper tubing the engine would not receive fuel, thus minimizing the potential for releases of any significant volume. The windmachines were commonly placed on 10-acre centers. AEC has been involved with the majority of permitted windmachine UST removals on the agricultural parcels, however, windmachine USTs have also been inadvertently removed by the tenant farmers during the deep ripping of the fields. It has been communicated to AEC that when a farmer hit a tank with the shank, they either removed the steel UST and placed it within one of the eucalyptus windbreaks, or transported the tanks to a metal recycler. AEC identified two USTs in the eucalyptus windbreak separating Field 220 from the Northwood Golf Center that were devoid of any gasoline residues, however, it was impossible to confirm from which Fields the tanks originated. These USTs were triple-rinsed and disposed of at a metal recycling facility during July 2001.

AEC has been involved with the removal, and/or investigation of the majority of the windmachine gasoline USTs on The Irvine Company property. Following is a listing of underground storage tanks removed by AEC, or others, whether the tanks tested “clean” or gasoline impacted.

Field	Windmachine I.D.	Removal Contractor (Date)	Status
220	220-1	The Mark Group (10/17/89)	Was impacted. Need closure.
220	220-2	The Mark Group (10/17/89)	Was impacted. Need closure.
220	220-3	Tenant Farmer (unknown)	No history.
220	220-4	Tenant Farmer (unknown)	No history.
221	221-1	The Mark Group (10/17/89)	Was impacted. Need closure.
221	221-2	Tenant Farmer (unknown)	No history.
221	221-3	Tenant Farmer (unknown)	No history.
221	221-4	Tenant Farmer (unknown)	No history.
222	222-1	AEC (07/12/01)	“Clean”
222	222-2	AEC (07/12/01)	“Clean”
222	222-3	AEC (07/12/01)	“Clean”
222	222-4	AEC (07/12/01)	“Clean”
223	223-1	AEC (07/12/01)	“Clean”
223	223-2	The Mark Group (10/17/89)	Was impacted. Now “clean”
223	223-3	AEC (07/12/01)	“Clean”
223	223-4	AEC (07/12/01)	“Clean”
226	226-1	AEC (January 1994)	Closed
226	226-2	AEC (January 1994)	Closed
226	226-3	AEC (January 1994)	Closed
226	226-4	AEC (January 1994)	Closed
227	227-1	Tenant farmer (unknown)	No history
227	227-2	The Mark Group (10/17/89)	Was impacted. Need closure
227	227-3	Tenant Farmer (unknown)	No history
227	227-4	Tenant Farmer (unknown)	No history
228	228-1	Tenant Farmer (unknown)	No history

Field	**Windmachine I.D.**	**Removal Contractor (Date)**	**Status**
305A	305A-1	AEC (7/30/98)	Closed
305A	305A-2	AEC (7/30/98)	Closed

The windmachine related gasoline impacted UST locations were investigated by either GeoAudit, and/or AEC.

Following is a tabulation of the analytical results, in parts per million (ppm) from the initial drilling that occurred at each site. Subsequent investigatory borings indicated the plume migration was limited in a lateral direction.

Sample I.D	**TPH-g**	**Benzene**	**Toluene**	**Xylenes**	**Ethylbenzene**
220-1 (Geo Audit)					
Tank bottom-7'	8,700	NA	NA	NA	NA
B1 @ 40'	4	0.2	0.2	ND	ND
B1 @ 55'	4	0.1	0.2	ND	ND
B1 @ 70'	3	0.3	0.5	0.2	ND
B1 @ 80'	ND	ND	ND	ND	ND
220-2 (GeoAudit)					
Tank Bottom-7'	11,000	NA	NA	NA	NA
B1 @ 40'	1,396	2.6	6.2	2.9	2.7
B1 @ 60'	10	1.2	1.0	0.5	0.2
B1 @ 70'	12	0.4	0.6	0.3	ND
B1 @ 80'	ND	ND	ND	ND	ND
221-1 (AEC)					
Tank Bottom-7'	15,000	ND	720	1,900	270
B1 @ 15'	4,700	180	630	630	140
B1 @ 20'	ND	ND	0.010	ND	ND
B1 @ 30'	ND	ND	ND	ND	ND
B1 @ 35'	ND	ND	0.0051	ND	ND
B1 @ 40'	ND	ND	ND	ND	ND
223-2 (AEC)					
Tank Bottom-7'	14,000	ND	200	930	150
B1 @ 15'	6,600	210	720	670	140
B1 @ 25'	5,400	89	260	660	60
B1 @ 30'	10	0.49	1.0	2.95	0.054
B1 @ 40'	ND	ND	ND	ND	ND
B1 @ 50'	2.8	0.040	0.078	0.307	0.013
B1 @ 55'	ND	ND	ND	0.0062	ND
B1 @ 60'	ND	ND	0.0055	0.0151	ND
227-2 (GeoAudit)					
Tank Bottom-7'	NA	NA	NA	NA	NA
B1 @ 10'	2,511	NA	NA	NA	NA
B1 @ 25'	791	NA	NA	NA	NA
B1 @ 30'	41	5.7	6.9	2.9	0.9
B1 @ 45'	12	2.2	2.5	0.9	0.2
B1 @ 50'	13	3.2	3.5	1.2	0.3

Sample I.D	TPH-g	Benzene	Toluene	Xylenes	Ethylbenzene
227-2 (GeoAudit)					
B1 @ 55'	19	5.3	6.1	2.1	0.6
B1 @ 70'	3	0.9	1.2	ND	ND
B1 @ 80'	4	ND	ND	ND	ND

AEC was contracted by Treasure Farms (farming entity that leased the majority of The Irvine Company's property during the mid 1980's to the early 1990's) to prepare a Risk Assessment (January 29, 1993) for the gasoline impacted windmachine tank sites. AEC was then retained to prepare a Vapor Extraction Workplan (September 1993). The reports were submitted to OCHCA and it was decided to treat the gasoline impacted soil via vapor extraction. Between September 1993 and November 1993 the leaking tank sites were remediated using a portable vapor extraction machine and mobile carbon units. The vapor extraction machine operated until the Lower Explosive Limit (LEL) approached 1% to 2%. AEC was able to complete the mitigation of the former tank sites, however, closure was not obtained because Treasure Farms declared bankruptcy during the latter stages of the remediation therefore, the project was tabled. Also, a 4-inch diameter groundwater monitoring well was installed at former windmachine UST location 227-2 in February 1990 by GeoAudit. The results of the groundwater sampling indicate non-detectable concentrations of gasoline. The depth to water is approximately 85-feet bgs. Current status of the well is unknown.

Recommendations for the UST Locations

AEC has contacted Mr. Luis Lodrigueza, Hazardous Materials Specialist, OCHCA, to obtain closure for these former leaking UST locations. Former leaking UST locations 221-1 and 227-2 will be drilled and sampled, through the former center of the plume to confirm the presence, or absence, of gasoline range hydrocarbons. The confirmation samples will be analyzed for TPH-gasoline, volatile aromatics, and MTBE by EPA Methods 8015 and 8021. If the sites test "clean" then The Irvine Company will be issued "no further action" letters for the former leaking UST locations. The subsurface confirmation investigations are tentatively scheduled for October-November 2001. AEC will also prepare an addendum report to this Phase I Assessment summarizing the prior and current environmental work conducted at each UST site and final dispensation.

On July 12, 2001 AEC conducted confirmation sampling of former leaking windmachine location 223-2 under the supervision of Mr. Luis Lodrigueza, Hazardous Materials Specialist, OCHCA. Three confirmation borings were advanced between 30 and 35-feet bgs at the site to confirm the presence, or absence of residual gasoline range hydrocarbons. The results of AECs drilling and sampling indicated trace to non-detectable concentrations of gasoline-range hydrocarbons, therefore, final issuance of a "no further action" letter for this site appears to be a formality. Once closure has been obtained from OCHCA the letter will be immediately forwarded for review by ICDC.

Agricultural Yards

Orange County Produce Trabuco Yard: Surface soils in several small areas at the Orange County Produce (OCP) Trabuco Yard (Field 227) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with portable abovegound storage tanks referred to as "trapwagons". The tanks hold either gasoline, or diesel, and are prone to spillage during use. None of the tanks appeared to be leaking, and the small releases appear to be accidental during use. The storage of waste oil is in a 500-gallon AST that is secondarily contained. OCP has regular pickups of its waste oil by Golden Oil Company. Other concerns are associated with the used battery storage. It is recommended that the batteries be removed from the site within 90 days of being taken out of service. Also, the effluent water generated during steam cleaning needs to be collected and recycled, it should not be allowed to migrate unchecked over the dirt surface. OCP also stores and mixes agricultural chemicals onsite. The agricultural chemicals are stored in a locked enclosed storage container that has a floor in very good condition.

Orange County Produce Sand Canyon Yard: Surface soils in several small areas at the Orange County Produce Sand Canyon Yard (Field 223) were observed to be stained with diesel and waste oil during AECs site inspection. These areas are primarily associated with the trapwagon aboveground storage tanks and small containers of waste oil. OCP also maintains large volume (approximately 3 to 4,000-gallon) poly tanks that hold liquid fertilizer.

Fujishige Farms Sand Canyon Yard: Surface soils in several small areas at the Fujishige Sand Canyon Yard (Field 307) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with saddle-mounted aboveground storage tanks and portable aboveground storage tanks referred to as "trapwagons". The tanks hold either gasoline, or diesel, and are prone to spillage during use. None of the tanks appeared to be leaking, and the small releases appear to be accidental during use. The storage of waste oil is in 5-gallon buckets and 55-gallon drums that are stored on pallets or surface soil. Also, Fujishige Farms operates a wash rack and agricultural chemical mixing area at the north side of the yard. The effluent water generated during steam cleaning needs to be collected and recycled, it should not be allowed to migrate unchecked over the dirt surface. The agricultural chemicals are stored in a locked enclosed wooden storage container that is in poor condition.

Etchandy Farms Sand Canyon Yard: Surface soils in several small areas at the Etchandy Farms Sand Canyon Yard (Field 213) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with the ASTs that are located onsite. Etchandy Farms operates a 500 gallon gasoline, 1,00-gallon gasoline, and 1,000- gallon diesel ASTs located in secondary containment. Waste oil was identified in a 55 gallon drum adjacent to the diesel AST and in additional 55-gallon drums outside the fenced yard to the north. The storage of the agricultural chemicals are in the wooden constructed shed equipped with a solid floor. Mixing of the chemicals are performed onsite.

B & E Farms Sand Canyon Yard: Surface soils in several small areas at the B & E Farms Sand Canyon Yard (Field 315) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with the ASTs that are located onsite. B & E Farms operates a 500 gallon gasoline, 300 gallon diesel, and 500 gallon diesel ASTs located in secondary containment. Waste oil was identified in 55 gallon drums and 5 gallon buckets. The storage of the agricultural chemicals are in the steel container equipped with a solid floor. Mixing of the chemicals are performed onsite using the hose bib located at the southeast corner of the steel container. The effluent water is allowed to migrate into the concrete-lined drainage culvert paralleling Sand Canyon Avenue. B & E farms also perform rolling stock maintenance in their open sided shed that has a dirt floor. Waste oil was observed on the dirt floor beneath the truck undergoing repairs. B & E Farms have regular pickups of waste oil by Starlite Reclamation Company.

Hiramatsu Sand Canyon Yard: The Hiramatsu Sand Canyon Yard (Field 309) was constructed in 1999 and is very neat and orderly. There was new oil (hydraulic and lubrication) identified in 55-gallon drums within the compound but no staining. The agricultural chemicals are stored in an open-sided structure in the western portion of Field 309 and it is also very clean and orderly. Hiramatsu Farms stores its gasoline and diesel in secondarily contained ASTs near the eucalyptus windbreak separating Field 309 from Fields 222 and 223. There were also 55-gallon drums of waste oils stored near the windbreak.

DC Berry Jeffrey Yard: Surface soils in several small areas at the DC Berry Jeffrey Yard (Field 305) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. The waste oil was primarily stored in 5-gallon buckets and 55-gallon drums. The diesel and waste oil fuel were either in trapwagons, or secondarily contained ASTs. Agricultural chemical storage is in a locked shed with a competent floor.

The Irvine Company - Irvine Farm Management: The corrugated metal-sided structure with the 13258 Jeffrey Road address stores waste oil in an AST, and 5-gallon buckets, used oil filters, and antifreeze (Field 305). There is some surface staining of the soil. Also, on the east side of the structure are several 55-gallon drums labeled “hazardous waste” from a clean-up on April 23, 2001. These drums are stored on wooden pallets. The shop building with the 13256 Jeffrey Road address conducts maintenance on The Irvine Company farm vehicles. There is a new hydraulic hoist in the service bay. A steam wash pad is located on the east side of the building and the clean-out consists of a three chambered clarifier on the west side of the building. There are also several trapwagons containing diesel fuel in the storage yard to the south, and further south at the end of the storage yard is another wash area for equipment.

Agricultural Chemicals

The Irvine Company, and the farmers that lease Irvine Company property all use agricultural chemicals to assist in the production of high yield and high quality produce. The chemicals used in Planning Area I-09A are categorized as pesticides, herbicides, fungicides, fertilizers, and surfactants. Following are a listing of the commonly used agricultural chemicals during the past year:

Pesticides	Herbicides	Fungicides	Fertilizers	Other
Pyrellin	Round-up	Copper Sulfate	Nutra-Sol	Ethanol
Diazinon	Glyphosate	Clamp	Tech Flo	Kaolin
Carbaryl		Tenn-Cop 5E	Simplot 21-0-0	Spray
Javelin		Dyrene	Ammonium Nitrate	
MVP II		Rovral	Potassium Nitrate	
AgroMEK		Thiolux Sulphur	Phosphoric Acid	
Xentari		Copper-Count-n		
Danitol				

All the farmers are registered with the Orange County Agricultural Commissioners Office (OCACO) and provide proper notification prior to applying the chemicals to their fields. There have been no “Notice of Violations” (NOVs) issued by the OCACO for the misuse, or mishandling of the chemicals by the farmers in Planning Area I-09A during the past year. Also, each farmer has been issued a Restricted Materials Permit Number by the Agricultural Commissioners office and they are tabulated below:

Farmer	Restricted Permit #	Expiration
Orange County Produce	30-01-300805	12/31/01
Wall Farms	30-01-300910	12/31/01
B & E Farms	30-01-300515	12/31/01
Hiramatsu Farms	30-01-300503	12/31/01
Gargiulo Farms	30-01-300917	12/31/01
Hines Nursery	30-01-300901	12/31/01
Fujishige Farms	30-01-300823	12/31/01
Etchandy Farms	30-01-331541	12/31/01

All of these farmers use licensed Pest Control Advisors (PCAs) to evaluate agricultural chemical selection and volume of application. The chemicals are applied in accordance with labeled instructions on the original container, and then the containers are triple rinsed prior to disposal.

Asbestos Containing Materials

Varying diameters and lengths of "transite pipe" was identified in the eucalyptus windbreak separating Field 309 from Field 222. The transite pipe contains asbestos and is regulated when it becomes a "waste" product. Since this pipe is not in use it should be loaded into a truck and transported to an approved acceptance facility in Los Angeles County (Orange County accepts no asbestos related material). Also, since the pipe is non-friable there is not a sense of urgency regarding the disposal.

Transition to Non-Agricultural Use

It is important to note this assessment was conducted on property that will remain in agricultural production for at least one more year, and understanding that farming is a dynamic process the mitigation of these sites should proceed with common sense and in an orderly fashion. The initial aspect of this report is to identify the active work-related areas where repeated handling and use of chemicals classified as "hazardous" occurs. These areas, and the personnel working in these areas, will be studied to identify if the repetitive handling of chemicals is being conducted in a manner that will not cause an adverse impact to soil and water resources. Next, AEC will make recommendations regarding mitigation of the historical recognized environmental concerns, followed by remediation of any impacted soil. Once the agricultural leases have been terminated, and future land use has been decided, AEC recommends conducting a Phase II Environmental Assessment. Recommendations will be formulated from the results of the Phase II Assessment and mitigation measures will need to be conducted prior to the mass grading of the property in preparation for an alternate land use.

No other recognized environmental conditions were identified at the subject property or on surrounding properties during this PSA. It is the professional opinion of AEC that there are no current recognized environmental concerns in the cultivated portions of the property that would restrict Planning Area I-09A from being converted from agricultural use to residential.

2.0 INTRODUCTION

2.1 Purpose

The purpose of this assessment is to identify recognized environmental conditions located at the subject site or adjacent properties which could present material risk of harm to public health or to the environment. Recognized environmental conditions are defined within ASTM Designation E-1527 as the presence or likely presence of any hazardous wastes and/or substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property.

2.2 Special Terms and Conditions

The information included in this report is intended for use exclusively as a preliminary assessment of potential environmental and human health concerns at the project site. Data was obtained through telephone conversations, personal interviews, public records, public information, general maps and aerial photographs. These services have been rendered by **Advanced Environmental Concepts, Inc.** (**AEC**) in accordance with generally accepted practices by professional hydrogeologists and environmental specialists. Because of the limited nature of this investigation, the firm is precluded from providing a warranty, expressed or implied, regarding the presence of hazardous materials that could potentially adversely affect the subject site.

This report is provided with the understanding that it is the responsibility of the owner to convey the information and recommendations contained herein, to the appropriate regulatory agencies, as required. The services performed in the scope of this project are for the sole use of our client. Others who seek to rely on the findings contained within this report have a duty to determine the adequacy of the information presented herein, for their time, location, and intended use.

2.3 Limitation and Exceptions of Assessment

This report presents the results of a Property Transfer Disclosure Assessment conducted by **Advanced Environmental Concepts, Inc.** (**AEC**) for Irvine Community Development Company (client),subsidiary of The Irvine Company on the following property:

Irvine Community Development Company
Planning Area I-09A
Agricultural and Commercially Developed Land
South of Portola Parkway, North of Trabuco Road,
East of Jeffrey Road, West of State Route 133
Unincorporated Orange County California

No other properties were included within the scope of this assessment except as required for the off-site reconnaissance and for the regulatory agency database and file review pertaining to potential sources of offsite recognized environmental concerns. Historical information regarding the subject parcels is limited to review of public documents, interviews with persons knowledgeable with the past and present uses and conditions of the property, and historic mapping and aerial photography review.

2.4 Limiting Conditions and Methodology

To evaluate the potential presence of recognized environmental conditions, this preliminary investigation consisted of the following:

Contacting appropriate regulatory agencies for hazardous materials information concerning the subject site and surrounding areas located within an approximate ¼-mile radius of the site boundaries. Inquiries were made regarding documentation of: (a) toxic spills; (b) underground storage tanks; © the use, storage, generation, and/or disposal of hazardous materials; (d) the presence of disposal wells and/or leach fields, drain fields, and septic systems; and, (e) violations of applicable environmental control standards;

Conducting interviews and researching historical site usage for information regarding past or present recognized environmental conditions;

Reviewing selected reports, maps, and aerial photographs for information pertaining to potential sources or visual indications of soil and groundwater contamination;

Conducting an on-site inspection and off-site reconnaissance to identify visible evidence of the generation, use, storage, release, or disposal of hazardous materials;

Evaluating investigational findings and the preparation of a detailed report inclusive of findings and recommendations.

3.0 SITE DESCRIPTION

3.1 Location[1]

Planning Area I-09A consists of approximately 1,010 acres of land currently developed as agricultural parcels, the Northwood Golf Center, eastern portion of Hines Nursery, and The Irvine Company Farm Management and Packing House Complex. Planning Area I-09A is located approximately one mile north of the Interstate 5 Freeway, and is bordered on the south by Trabuco Road, the north by Portola Parkway, the east by the Eastern Leg of the Transportation Corridor (State Route 133), and to the west by Jeffrey Road.

3.2 Site and Vicinity Characteristics

3.2.1 Physiographic Setting

The subject property is within the eastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province. At the easternmost portion of the Los Angeles Basin is the Tustin Plain, located south and adjacent to the Downey Plain, which is the largest area of Recent alluvial sedimentation. The Tustin Plain is composed of alluvial fans with elevations from 150 to 500 feet above mean sea level that formed along the southwest flank of the Santa Ana Mountains. The plain slopes regionally to the west and southwest with a topographic gradient of approximately 75 - 100 feet per mile[2].

The alluvial deposits of Holocene-Quaternary age that comprise the Tustin Plain consist mainly of sands, gravels, silts and clays. Generally, the coarse grained sediments are deposited near the inland hills as alluvial fans, whereas deposition of progressively finer grained sediments occurs towards the river flood-plains. The upper fan areas are interpreted as intake areas where recharge of the groundwater takes place. Hydraulic continuity may exist between alluvial sediments of the fan areas and certain water-bearing sediments of the central lowlands. Replenishment of groundwater occurs in the intake area by infiltration from major streams within their permeable channels and from irrigation water and rain. Groundwater is found in area irrigation wells at a depth of 100 feet or more below ground surface (bgs), however, first unconfined groundwater has been identified at approximately 50-feet bgs near the intersection of Trabuco Road and Jeffrey Road; and 110-feet bgs near Portola Parkway and Jeffrey Road.

The regional stratigraphy is comprised of interbedded silt, clay and sand that is typical of sediments deposited on alluvial fans during flood stages. Elevations of the subject property range from 320 feet at the northeastern boundary to 186 feet at the southwestern boundary. The property gently slopes in the westerly direction.

The Newport-Inglewood Fault is a major northwest-southeast trending strike-slip fault that terminates near Costa Mesa. This fault does not appear to extend beneath the subject property. Several minor faults including the Peralta Hills Fault and El Modeno fault are located northwest and north of the property and are not considered to be seismically active or potentially active.

3.2.2 Soils Profile[3]

Surface sediments beneath the subject property are composed of two soil types:

(1) Sorrento Loam, 0 to 2% Slopes (206)
(2) Sorrento Clay Loam, 0 to 2% Slopes (208)

Sorrento Soil Series: This series consists of well drained soils found on alluvial fans and flood plains. Sorrento soil consists of moderately alkaline and calcareous loam with moderate permeability. Runoff is slow and erosion hazard is slight in areas which are not covered with protective vegetation. The typical profile consists of a brown and grayish brown loam surface layer to 12 inches. The next layers are light brownish gray, brown, and pale brown silty clay loam to a depth of 61 inches or more. Sorrento soils are used for irrigated crops, citrus, and more recently urban development.

3.3 Description of Structures, Roads, & Other Site Improvements

The subject property consists of areas developed for agricultural purposes and commercially developed property. Also, the Irvine Company's agricultural produce Packing House Complex is located within the study area and are assigned the following addresses.

Irvine-Valencia Growers	13242 Jeffrey Road, Irvine
The Irvine Company - Irvine Farm Management	13256 Jeffrey Road, Irvine
The Irvine Company - Irvine Farm Management	13258 Jeffrey Road, Irvine
The Irvine Company - Irvine Packing and Cooling	13250 Jeffrey Road, Irvine
The Irvine Company - Irvine packing and Cooling	13252 Jeffrey Road, Irvine

The Irvine Company's Agricultural headquarters are located on Packing House Way, however, all the structures have a Jeffrey Road address. The approximate 24-acre parcel has been cut out of Field 305, which during the time of the site inspection was planted to strawberries. The developed parcel consists of the original Irvine-Valencia Growers (IVG) facility (5-acres); the Vegetable Packing House (tomatoes) and the Avocado/Strawberry Packing House facility (10.5-acres), the Irvine Farm Management and Maintenance facility (6.5-acres) and open ground storage (2-acres).

The original IVG facility at 13242 Jeffrey Road was constructed in 1926 as an orange packing co-op and it was an active facility for citrus processing until 1996. The two-story citrus packing and cold storage facility is constructed of concrete with a wood roof. The insulation is cork in the older cold storage structure. The foundation is concrete and the second story floor is wood constructed. The offices adjoining the south side of the IVG facility were used through 2000, then they were also closed. The facility is currently leased to Weyerhauser and used for box storage, material packaging storage, and for equipment storage. The area surrounding the IVG facility is paved with asphalt, except around the corrugated metal storage sheds that are currently leased by Gargiulo which consists of hard packed dirt and gravel. These sheds are used for the storage of spray equipment and irrigation supplies.

The Vegetable Packing House at 13250 Jeffrey Road was originally constructed in 1972 and was primarily used for the packing and cooling of corn, celery, and broccoli; then transitioned into a tomato packing shed in the early 1990's. The facility is currently leased to Gargiulo and is used for large-scale packaged tomato production. Gargiulo has upgraded the facility into an automated receiving, sorting, and packing system that is located in side the main facility and beneath the open-sided structure. The floor of the facility is cement and this are is surrounded by asphalt paving.

The Avocado/Strawberry Packing House at 13250 Jeffrey Road was constructed in 1983 and used for strawberry cooling and packaging of avocados. Currently, the facility has contracted offsite avocado packaging services, and has expanded its strawberry production capabilities.

The Irvine Farm Management facility at 13256-13258 Jeffrey Road was constructed in 1999 as a replacement for the former Agricultural Main Yard located at 13042 Old Myford Road. The facility provides office space for Irvine Company agricultural employees maintenance and shop services capabilities. The northern portion of the building contains the offices and the central and southern portion of the building is used for storage of equipment and primarily vehicle maintenance and repair. The service bays are concrete floored and equipped with hydraulic lifts. On the eastern side of the service bays is a concrete constructed wash rack with a sloped collection drain. The effluent water drains to the west beneath the building and is collected in a three-stage clarifier. When full, the clarifier is pumped out and the water disposed. Further east of the Office/Shop complex is an open-sided corrugated metal constructed storage area having a gravel floor. This area is used for the storage of spray rigs and tractor. A waste oil AST, 55-gallon drums of used filters, and some used 12-volt batteries are located along the northern interior wall of the structure. Along the north eastern exterior wall are drums labeled "hazardous waste" from a spill on April 23, 2001. Also in this area is a drum labeled "toxic" and containing ethylene glycol (antifreeze) and some additional waste oil and filters. Further south of the Offices/Service Shop building is a fenced storage yard containing two diesel trapwagons and at the southern end of the yard is another wash pad area.

Planning Area I-09A also consists of the Northwood Golf Center which was constructed on former Field 226 beginning in 1997. The golf driving range is built into a retention basin that is under easement to the Orange County Flood Control District and the recreational easement is reserved by The Irvine Company with the rights assigned to the James Golf Development Corporation. The Northwood Golf Center consists of a clubhouse, paved parking area, practice ranges and putting greens. The facility also consists of a metal Quonset type storage shed, and a rectangular metal container used for storage. The Quonset shed is used for equipment and material storage and the metal container stores small volumes of agricultural chemicals. An equipment wash area has been established by the southeast corner of the Quonset shed. The wash pad is on a dirt surface and has been used to wash engine parts.

Hines Nursery leases approximately 185-acres on the east side of Jeffrey Road in Planning Area I-09A. The lease property was acquired by Hines Nursery around 1980. The property has been cultivated as citrus and cover crops prior to its use as nursery ground. Hines Nursery uses this acreage primarily for greenhouse, shade netting, and open-air cultivation of ornamental plants, and a smaller portion of the property has been developed with buildings including the agricultural chemical storage and mixing work station, a laboratory, pest control facility, corrugated metal-sided warehouse, and small team leader offices. Septic systems are associated with the structures and consist of holding tanks and leach lines. The holding tanks are pumped on an "as-needed" basis to remove solids and the effluent water drains into the leach lines. Also, excess irrigation water is collected in small holding areas then booster pumped beneath Jeffrey Road via pipeline and into the culvert collection system that drains into the collection reservoir.

Planning Area I-09A also consists of land solely under agricultural use and cultivation and are divided into Fields. The Fields are leased to tenant farmers that primarily cultivate strawberries, tomatoes, and beans and are identified as Field 213, Field 220, Field 221, Field 222, Field 223, Field 227, Field 228, Field 229, Field 305, Field 307, Field, 308, Field 309, Field 310, Field 314, and Field 315. The tenant farmers have converted a small portion of their leased ground into agricultural storage and maintenance yards. It is within these yards that the majority of environmental concerns are normally discovered. Orange County Produce (OCP) operate two yards, one within Field 227 accessed via Trabuco Road, and one within Field 309 accessed via Sand Canyon Avenue. Fujishige Farms operate a storage yard in Field 307, Etchandy Farms operates a small storage yard in Field 213, and Wall Farms have a storage yard in Field 310, all accessed via Sand Canyon Avenue. B & E Farms operates one yard within the study area in Field 315 and is accessed via Sand Canyon Avenue. DC Berry operates one yard adjacent to Field 305 and is accessed via Jeffrey Road. The majority of these Fields were initially planted to citrus, therefore, needed windmachines for frost protection. The citrus was pulled out between 1994 and 1997 and the acreage was converted to row crops.

The farm yards usually consist of little pavement, primarily the surface is hard-packed dirt. At the OCP Trabuco Yard there are numerous rectangular metal containers used for equipment storage and agricultural chemical storage. Also, there are mobile homes that have been converted to offices, and they have created a covered work place for vehicle maintenance and repair. The maintenance area has a concrete floor. OCP operates a wash rack on the west side of the storage sheds, and stores diesel and gasoline fuels in trapwagon ASTs. Waste oil is stored in secondarily contained AST and the used filters are stored in 55-gallon drums.

The OCP Sand Canyon Yard is hard-packed dirt, fenced, and is primarily used solely as a storage yard for farm equipment and materials. The yard is subleased to a portable toilet contractor, and a masonry contractor, each of who store their materials onsite. To the south of the storage yard, outside of the fenced area is a drum storage location.

The B & E Farms Yard is located off of Sand Canyon Avenue and consists of hard packed dirt surface. There is a mobile office onsite, an open-sided wood constructed building used for vehicle maintenance, and a metal constructed container used for agricultural chemical storage. B & E has constructed secondary containment for one diesel and one gasoline AST. Waste oil is stored in drums, as are the used filters. The agricultural chemicals are kept locked inside the metal container. On the southeast corner of the container there is a hose bib used for mixing the agricultural chemicals. There is also a drainage path cut into the soil from this hose bib to the drainage culvert that parallels Sand Canyon Avenue. Another secondarily contained diesel AST is located alongside the east wall of the metal container.

The Hiramatsu farms Yard is located on the west side of Sand Canyon Avenue. The yard is relatively new (2000) and is extremely neat and orderly. The floor of the open-sided sheds are cement, with wood framing. The storage portion of the yard is hard packed dirt.

The Fujishige Farms storage compound is located adjacent to Sand Canyon Avenue and north of Irvine Boulevard. The yard consists of hard packed dirt surface. There are two dilapidated wooden sheds used for the storage of new oils, hydraulic fluids, and agricultural chemicals. A large portion of the yard is used for storage of used farming equipment. There is one diesel and one gasoline AST mounted in steel saddles. Waste oil is stored in drums and 5-gallon buckets, as are the used filters. Near the ASTS is the hose bib used for mixing the agricultural chemicals and washing down farm equipment.

The Etchandy Farms storage compound is located adjacent to Sand Canyon Avenue and south of Portola Parkway. The yard consists of hard packed dirt surface. There are two wooden sheds used for the storage of farm materials and agricultural chemicals. A large portion of the yard is used for storage of rolling stock. There is one diesel and two gasoline ASTs enclosed with secondary containment. Waste oil is stored in a 55-gallon drum.

The Wall Farms storage compound is located adjacent to Sand Canyon Avenue and south of Portola Parkway. The yard consists of hard packed dirt surface and is cut out from a hillside. There are two modular units used as office space and steel containers used for the storage of agricultural chemicals. A large portion of the yard is used for storage of used rolling stock and equipment. There are diesel and gasoline ASTs and trapwagons. Waste oil and used filters are stored in a 55-gallon drums on pallets.

Finally, there is a massive aboveground water storage tank located in a cut out area of Field 315. The water storage tank was installed in 1982 and is operated by the Irvine Ranch Water District (IRWD).

3.4 Environmental Liens

No indication of current environmental liens was provided to **AEC** by the user or obtained from any other informational source during this assessment.

3.5 Onsite Water Supply

Water for onsite use is obtained via pipeline from the Irvine Ranch Water District (IRWD) supply wells.

3.6 Current Uses of the Property

The majority of the subject property is currently used as agricultural farmland (approximately 1,170-acres) used for aboveground cultivation of nursery plants or planted to rotational crops of strawberries, tomatoes, and beans. The Irvine Company's Packing House Facility occupies approximately 24-acres and provides office space, shop services, and packing and cooling facilities for the farm property. The Northwood Golf Center/Orange County Flood Control Basin occupies approximately 45-acres and is used as a golf practice range.

3.7 Past Uses of the Property

Based on reviews of historical USGS maps and reviews of Historical topographic maps beginning in 1901, and aerial photographs beginning in 1946, the subject property has been used for agricultural, and agricultural related services since the area was first developed. The majority of the properties were in citrus development from 1946 to 1994. The citrus trees were removed from production and the land was converted from permanent plantings to row crop usage.

3.8 Current and Past Uses of Adjoining Properties

Prior to the recent urban development of the area beginning in the late 1970's, the site and surrounding areas were principally agricultural lands, grazing lands and undeveloped lands. The property is bordered on the north by Portola Parkway, the south by Trabuco Road, to the west by Jeffrey Road, and to the east by the East Leg of the Transportation Corridor and El Toro Marine Air Station.

The El Toro Marine Corps Air Station (MCAS) was established in 1943 and serves as the center for marine aviation operations on the Pacific Coast. The facility occupies 4,700-acres comprising hangars, flight lines, maintenance areas, housing, and recreation including a golf course. Open land is also leased to local farmers for nursery and row crop use. The MCAS was listed on the National Priorities List (NPL) in 1990 because of past disposal practices that have contaminated soil and ground water.

The MCAS has identified at least 22 on-station sites that are undergoing investigation and remediation. The contaminants are varied and consist of heavy metals, solvents, incinerator ash, paint residues, refined hydrocarbons, PCBs, battery acids, and effluent sludge. The majority of the contaminated sites are in the southeast and southwest portion of the airbase, therefore, are the greatest distance from the subject property under review. A few of the landfill sites of solvent and fuel waste are adjacent to the Borrego Canyon Wash and Agua Chinon Wash, however, the topographic and hydraulic gradient are southwest thus minimizing offsite impact to the subject property under review. The MCAS has been under regulatory scrutiny since 1985 and has been undergoing subsurface investigations and remediation to control the offsite migration of contaminants.

4.0 RECORDS REVIEW

4.1 Standard Federal and State Environmental Record Sources

AEC contracted **EDR Environmental Information, Inc.**[4] to perform searches of readily available Federal, State, and Local database information systems for the purpose of identifying known recognized environmental conditions present on nearby properties which have the potential to adversely impact the site being assessed in this study. The information provided by EDR gives a brief summary of any onsite target properties, and/or surrounding properties that may have environmental concerns. The databases researched include the following:

NPL, CERCLIS, CORRACTS: The National Priority List database, CERCLIS database, and CORRACTS, are also known as Superfund, and Superfund associated Corrective Action. Listed in this database is the El Toro Marine Air Corp Station. USMC Air Station El Toro has been a long term discharger of solvents, fuels, and other hydrocarbons to soil and groundwater resources. The property remains under close scrutiny, and remedial investigation by appropriate agencies including the EPA, Regional Water Quality Control Board (RWQCB), Department of Toxic Substance Control (DTSC), and others. There are reported cases where the contamination from the air base has impacted irrigation wells in the surrounding area. AEC has not identified which irrigation wells are impacted, however, a letter has been written to the RWQCB requesting review of the information. Upon its availability, the information will be forwarded in an addendum.

RCRIS: The Resource Conservation and Recovery Act database includes sites that generate, store, treat, or dispose of hazardous waste. Again, the only site listed is the USMC Air Station El Toro.

ERNS: The Emergency Response Notification System records and stores information on reported releases of oil and hazardous substances. The system revealed three ERNS sites. The first is listed at Sand Canyon Avenue and Irvine Boulevard, however, this is inaccurate since the release occurred at the Bee Canyon Landfill and does no appear as a threat to the subject property; the second and third are at the UNOCAL Station at 14886 Sand Canyon Avenue. Apparently the gasoline release was great enough to have free product on the water table. This site is downgradient from the subject site therefore, not a major concern.

CAL-SITES: This database contains both known and potential hazardous substance sites. The site recognized is at 15000 Sand Canyon Avenue and is the former Orange County International Raceway. The site is downgradient, therefore, considered a minor concern.

CORTESE: This database identifies drinking water wells with detectable levels of contamination, and sites with USTs having reportable releases. This database identified the UNOCAL at 14886 Sand Canyon Avenue, the EXXON at 14781 Sand Canyon Avenue, and the Irvine Unified School District Maintenance Facility at 14600 Sand Canyon Avenue. Again all these sites are downgradient from the subject property.

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking USTs. The three sites listed above are again identified in this database. There are other sites also identified, but again they are all downgradient, therefore, assigned a low risk.

UST: The Underground Storage Tank database lists registered USTs. The above listed sites are again identified. The only upgradient site listed is El Modena Gardens, however, those USTs were removed by AEC in 1998 and received "clean" closure.

CA FID: This database identifies inactive UST facilities of which El Modena Gardens, Irvine Unified School District, and Orange County Transit Authority are listed.

HMIRS: The Hazardous Materials Incident Report System contains information pertaining to hazardous spill incidents. The only site reported was at 15029 Sand Canyon Avenue which is downgradient therefore, a minor concern.

PADS: The PCB activity database identifies generators, transporters, and commercial storers of PCBs. The USMC Air Station El Toro is listed in this database.

WDS: The Resource Water Board provides information on sites with Waste Discharge Systems for water. El Modena Gardens Nursery was listed.

HAZNET: This database contains information of wastes that were manifested each year. The only upgradient site is El Modena Gardens.

Having worked for The Irvine Company, and other local businesses AEC is aware of sites that were not identified in these databases. For example, The Irvine Company, IVG, Hines Nursery, et. al. have had active and leaking USTs, disposed of materials by manifest, require Waterwaste Discharge approval, yet they did not show up in this EDR report. However, AEC, in co-operation with The Irvine Company will continue to identify areas of onsite environmental concerns and implement corrective measures. The complete report furnished by **EDR** is included in **Appendix 10.2** of the report.

4.2 Historical Use Information

4.2.1 Aerial Photograph and Historical USGS Map Review[4]

Historical aerial photograph coverage and USGS Map coverage of the site were reviewed in order to evaluate past site usage. Visual observations noted within these photographs and maps are described chronologically as follows:

Map Date: 1901 **Quadrangle: Santa Ana** **Scale: 1:62,500**

The subject property and surrounding areas appeared undeveloped and covered in native vegetation during 1901. The Southern California Surf Railroad Line was the only obvious development. Santa Ana and Tustin were established towns. No indications of onsite structures or other developments of the property were noted in the 1901 USGS survey.

Aerial Photograph Date: 1952 **Flyer: Pacific Air** **Scale: 1"=833'**

The IVG Facility was evident. The northwest corner of Field 305 was in citrus production, and the remaining portion of 305 was planted to row crops. Fields 213, 220, 221, 222, 223, west portion of 226, 227, 229, 308, 309, 314, and 315 were all planted to row crops. The east portion of Field 226 and all of 228 were planted to citrus. There is a house at the current location of OCP's Trabuco Yard, one in the northeast corner of Field 305 and northwest portion of Field 308. The eucalyptus windbreaks have all been planted. Adjoining areas on all sides appear under similar development at the time of the 1952 aerial survey. Resolution of visual detail is good.

Map Date: 1965 **Quadrangle: Tustin, El Toro** **Scale: 1:24,000**

IVG is identified as the Atchison, Topeka, and Santa Fe Railroad siding. The Fields are planted to citrus, or row crops. The Trabuco house is identified as having a well. I-5 Freeway has been constructed by this time. The El Toro Marine Corp Air Station is evident and borders the locations of Fields 314 and 315.

Aerial Photograph Date: 1968 **Flyer: Teledyne** **Scale: 1"=800'**

By 1968 all of Fields 220, 221, 222, 223, 226, 227, 228, and 229 were planted to citrus. The northwest corner of Field 305 was still planted to citrus. Fields 213, 305, 307, 308, 309, 314, and 315 remain in cover crop production. The houses in Fields 227, 308, and 305 remain evident. Resolution of visual detail is good.

Aerial Photograph Date: 1977 **Flyer: Teledyne** **Scale: 1"=666'**

The subject property, and surrounding Fields appear the same. Resolution of this photograph is very good. The El Toro Marine Corp Air Station is clearly evident adjacent to Fields 314 and 315.

Map Date: 1981 **Quadrangle: Tustin, El Toro** **Scale: 1:24,000**

IVG is still identified as the Atchison, Topeka, and Santa Fe Railroad siding. The Fields are planted to citrus, or row crops. There has been no evident expansion of the El Toro Marine Corp Air Station. The Trabuco house is still evident and identified as having a well, and the house in Field 308 is still evident. Jeffrey Road has not been widened, however, Sand Canyon Avenue is a main north-south thoroughfare. Hines Nursery occupies the east side of Jeffrey Road.

Aerial Photograph Date: 1994 **Flyer: USGS** **Scale: 1"=666'**

The property and surrounding areas appeared under similar development as today. The citrus trees have all been removed and the Fields are planted to row crops. The IVG facility has been expanded to include tomato and berry processing and cold storage. The Irvine Farm Management Building has not yet been constructed. No significant land use changes were noted. Resolution of visual detail in this photograph is good.

4.3 Additional Record Sources

4.3.1 Orange County Agricultural Commission[5]

The Orange County Agricultural Commission (OCAC) maintains records of Restricted Agricultural Chemicals permitted for use and/or storage at agricultural facilities located throughout Orange County. Inventory information regarding restricted herbicides, pesticides, rodenticide, etc., is listed on Restricted Materials permits issued annually and archived within the OCAC database. OCAC records contained the following information pertaining to the individual growers leasing surface areas within the limits of the subject property for agricultural production during 2001 (see Appendix 10.3):

Farmer	Restricted Permit #	Expiration
Orange County Produce	30-01-300805	12/31/01
Wall Farms	30-01-300910	12/31/01
B & E Farms	30-01-300515	12/31/01
Hiramatsu Farms	30-01-300503	12/31/01
Gargiulo Farms	30-01-300917	12/31/01
Hines Nursery	30-01-300901	12/31/01
Fujishige Farms	30-01-300823	12/31/01
Etchandy Farms	30-01-331541	12/31/01

4.3.2 Orange County Health Care Agency[6]

The Orange County Health Care Agency (OCHCA) maintains records of underground storage tanks (UST's) and incidents of unauthorized releases of hazardous materials from underground storage tanks at the subject site and surrounding areas. OCHCA records contained information pertaining to the windmachine USTs located in the Fields under review, and the USTs removed from IVG. Once AEC receives the hard copies of the OCHCA Records Review they will be forwarded as an addendum.

4.3.3 Orange County Fire Authority Records[7]

The Orange County Fire Authority, Hazardous Materials Bureau maintains inventory information and "Hazardous Materials Management Plans" (HMMP's) for facilities located within Orange County, California. AEC submitted written requests to the OCFD for documentation pertaining to the existing onsite facilities including The Irvine Company's Packing House facilities, Northwood Golf Center, and all of the Farm Yards. When the information is made available AEC will prepare an addendum.

4.3.4 California Department of Conservation - Division of Oil & Gas[8]

No onsite oil or gas wells were identified during the site reconnaissance or within D.O.G. maps reviewed during this assessment.

5.0 INFORMATION FROM SITE RECONNAISSANCE AND INTERVIEWS

5.1 Hazardous Substances in Connection with Identified Uses

During the course of this assessment it was identified that the majority of agricultural chemical handling and storage, hydrocarbon fuel handling and storage, solvent use, battery storage, miscellaneous chemical storage, waste water creation, and waste oil and fluid storage all occur within the boundaries of the storage yards and maintenance shops. The Fields under cultivation only receive prescribed amounts of agricultural chemicals that dissipate quickly due to irrigation watering, the sun, and the chemical composition.

Typical to each yard were ASTs and USTS containing diesel, gasoline, waste oil, and fertilizers. Also identified were 55-gallon drums of new oil, hydraulic oil, grease, and coolant. Agricultural chemicals in liquid, granular, and powdered form were identified in locked containers. Welding gases including oxygen and acetylene are necessary for repair work of equipment and rolling stock. Most of these containers were labeled as to the correct contents.

5.2 Unidentified Substance Containers

Some drums at each of the yards reviewed in Planning Area I-09A were not labeled as to their contents. However, experience has shown that the majority of the contents will be a waste fluid consisting of waste oil, grease, hydraulic fluid, or coolant. The contents of these drums will be identified and "like" fluids will be consolidated for disposal.

5.3 Storage Tanks

IVG operates the only active UST in Planning Area I-09A. This double-walled tank is permitted for gasoline and is in full compliance. There are many steel constructed ASTs used to store fuel at each of the yards, and numerous poly-constructed tanks that store liquid fertilizer at each yard and at the irrigation/sand filter stations. It is the opinion of AEC that all USTs not currently in use have been removed from Planning Area I-09A.

No other visual indications of existing aboveground or underground storage tanks used for past or present hazardous materials storage were identified during the course of this preliminary site assessment.

5.4 Indications of PCB(s)

Electric transformers (both pad and pole mounted) are located at the Northwood Golf Center, IVG, Irvine Farm Management facility, and the storage yards within Planning Area I-09A. Electric transformers are owned and operated by Southern California Edison (SCE)[9]. According to information obtained from SCE, all transformers within the SCE power distribution network suspected of containing PCB's in concentrations exceeding 50 parts per million were removed and replaced by 1987. Manufacture of PCB-containing electric power transformers was discontinued in 1984.

PCB sampling and laboratory analysis is beyond the scope of this preliminary assessment.

5.5 Indications of Solid Waste Disposal

Miscellaneous trash and refuse is collected in bins located around the facilities and routinely removed for offsite disposal by a commercial waste hauler.

No indications of onsite solid waste disposal were identified on the subject property during the site reconnaissance portion of this assessment.

5.6 Indications of Waste Water Disposal

Onsite waste water generated during steam cleaning, or mixing of agricultural chemicals, generally follow the topographic gradient on the hard packed dirt as identified in the storage yards. The water drains into the concrete lined drainage culverts that parallel Sand Canyon Avenue and Jeffrey Road. Effluent water at IVG and The Irvine Company Yards are collected in clarifiers, then pumped out when full. Sanitary effluent from restroom facilities at the site is also discharged into septic tanks and leach fields. Irrigation water at the eastern portion of the Hines Nursery is collected in small sumps at the southwest corner of the property then pumped through an underground pipeline to the western portion of the facility where it is diverted into drainage ditches to the irrigation water collection reservoir.

5.7 Physical Setting Analysis

5.7.1 Designated Wetlands[10]

Under U.S. Army Corps of Engineers (USACE) regulations, wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include swamps, marshes, bogs and similar areas such as sloughs, prairie potholes, wet meadows, river overflows, mud flats, and natural ponds.

Based on information provided to AEC within the EDR database survey report, areas within the boundaries of the subject property are not included within the 1994 edition of the National Wetlands Inventory listing.

5.8 Any Other Conditions of Concern

5.8.1 Radon[11]

Radon is a colorless, odorless, tasteless, naturally occurring radioactive gas formed by the decay of uranium in soil and bedrock. Because uranium and radon occur naturally in varying amounts within rocks and soils found throughout the United States, radon is present in all the air that we breathe. Long-term exposure to elevated concentrations of radon in confined areas has been associated with an increased risk of lung cancer. The present action levels require exposure to concentrations of at least four picocuries/liter (4 pCi/L) of radon over an extended period of time. The State of California Department of Health Services conducted radon surveys across portions of Orange County, during 1990. These surveys did not indicate the widespread presence of radon in concentrations exceeding 4 pCi/L within Orange County. Radon is more commonly identified in granitic source terrain, and not in areas of alluvial deposition, therefore, a very low risk in Planning Area I-09A.

The United States Environmental Protection Agency (EPA) and the Surgeon General presently recommend that all homes in the United States be individually tested for radon. Radon sampling and laboratory analysis is beyond the scope of this assessment.

5.8.2 Asbestos Containing Materials (ACM's)

Asbestos containing materials (ACM's) were commonly used in a wide variety of building products such as roofing shingles, composite siding, linoleum flooring, acoustic ceiling tiles, furnace and water heater exhaust piping and insulation, glues and mastics, stucco, joint compounds, and composite wallboards prior to 1980. ACM's can be divided into material considered friable (easily crumbled or reduced to powder) and nonfriable. Friable ACM's are regulated as hazardous materials due to the elevated long-term risk of developing lung cancer upon respiratory exposure and must be properly removed prior to renovation or demolition of any structure containing these materials. In addition to structures, ACM's have been historically used as "transite" irrigation piping within many agricultural parcels throughout California. Transite piping was visually identified during the site reconnaissance portion of this assessment at the Irvine Farm Management Yard and in the windbreak between Field 309 and Field 222.

AEC recommends consolidating all unused transite pipe and disposing the pipe at an approved acceptance facility.

Asbestos sampling and laboratory analysis is beyond the scope of this assessment.

5.8.3 Lead

According to information published by the United States Department of Housing and Urban Development (HUD), approximately three out of every four pre-1978 buildings contain lead-based paint[12]. Based on the apparent ages of the structures located within the IVG structure, there is a potential presence of lead-based plumbing and/or paints within the onsite structures.

Lead sampling and laboratory analysis is beyond the scope of this assessment.

6.0 FINDINGS AND CONCLUSION

On behalf of the Irvine Community Development Company (ICDC), Advanced Environmental Concepts, Inc. (AEC) has prepared a Property Transfer Disclosure Report on agricultural and commercially developed parcels bordered on the north by Portola Parkway, south by Trabuco Road, the west by Jeffrey Road, and the east by the eastern leg of State Route 133 (Toll Road). The property reviewed in Planning Area I-09A consists primarily of agricultural land approximating 1,170-acres and planted to a nursery, row crops rotating between strawberries, tomatoes, and beans; and commercially developed parcels totaling 80-acres including segments of the eastern portion of the Hines Nursery facility, the Northwood Golf Center/Orange County Flood Control Basin, and The Irvine Company's agricultural headquarters including the Irvine-Valencia Growers (IVG) packing facility, the strawberry packing and cooling facility, the tomato processing facility, and the avocado packing and processing facility. Also, associated with The Irvine Company's farm management headquarters are numerous storage buildings, and open ground leased to various growers and packers. This assessment was performed during April, May, and June 2001. The purpose was to identify adverse environmental conditions and "hazardous" waste streams generated on-site that could potentially affect the human health and the environment, and to review if "hazardous" waste streams generated offsite could adversely affect the subject properties. These concerns include storage and use of agricultural chemicals categorized as pesticides, herbicides, fungicides, fertilizers, and surfactant. Other concerns include transite irrigation pipe which contains asbestos, the storage of new oils and hydraulic fluids, the generation and storage of waste oils, the storage of diesel and gasoline fuels in aboveground and underground storage tanks (ASTs and USTs), hydraulic floor lifts, effluent waste water from steam wash pads, and used batteries. It is the experience of AEC that these environmental concerns are typical within a large-scale farming operation and are similar in nature to other large-scale farming operations found throughout California. It is also important to note that the majority of "hazardous" material, and waste generation are typically identified in the farming headquarters and storage yards of The Irvine Company, and their different farming tenants, which occupy the least amount of property. Therefore, numerous environmental issues are concentrated in a small area, whereas, the vast majority of the property is under cultivation, and can be considered mostly unencumbered. Following is a brief description of the properties and structures in Planning Area I-09A and their associated recognized environmental conditions.

The Irvine Company's Agricultural Headquarters

Irvine-Valencia Growers	13242 Jeffrey Road, Irvine
The Irvine Company - Irvine Farm Management	13256 Jeffrey Road, Irvine
The Irvine Company - Irvine Farm Management	13258 Jeffrey Road, Irvine
The Irvine Company - Irvine Packing and Cooling	13250 Jeffrey Road, Irvine
The Irvine Company - Irvine Packing and Cooling	13252 Jeffrey Road, Irvine

The Irvine Company's Agricultural headquarters is located on Packing House Way, however, all the structures have a Jeffrey Road address. The approximate 24-acre parcel has been cut out of Field 305, which during the time of the site inspection was planted to strawberries. The developed parcel consists of the original Irvine-Valencia Growers (IVG) facility (5-acres); the Vegetable Packing House (tomatoes) and the Avocado/Strawberry Packing House facility (10.5-acres), the Irvine Farm Management and Maintenance facility (6.5-acres) and open ground storage (2-acres).

The original IVG facility at 13242 Jeffrey Road was constructed in 1926 as an orange packing co-op and it was an active facility for citrus processing until 1996. The two-story citrus packing and cold storage facility is constructed of concrete with a wood roof. The insulation is cork in the older cold storage structure. The foundation is concrete and the second story floor is wood constructed. The offices adjoining the south side of the IVG facility were used through 2000, then they were also closed. The facility is currently used for box and other packaging material storage, and for equipment storage.

The Vegetable Packing House at 13250 Jeffrey Road was originally constructed in 1972 and was primarily used for the packing and cooling of corn, celery, and broccoli; then transitioned into a tomato packing shed in the early 1990's. The facility is currently leased to Gargiulo and is used for large-scale packaged tomato production.

The Avocado/Strawberry Packing House at 13250 Jeffrey Road was constructed in 1983 and used for strawberry cooling and packaging of avocados. Currently, the facility has contracted offsite avocado packaging services, and has expanded its strawberry production capabilities.

The Irvine Farm Management facility at 13256-13258 Jeffrey Road was constructed in 1999 as a replacement for the former Agricultural Main Yard located at 13042 Old Myford Road. The facility provides office space for Irvine Company agricultural employees, and farm equipment and vehicle maintenance/shop service capabilities.

Northwood Golf Center

Planning Area I-09A also contains the Northwood Golf Center which was constructed on former Field 226 in 1997. The golf driving range is built into a water retention basin that is under easement to the Orange County Flood Control District and the recreational easement is reserved by The Irvine Company with the rights assigned to the James Golf Development Corporation.

Hines Nursery

Hines Nursery leases approximately 185-acres on the east side of Jeffrey Road. The lease property was acquired by Hines Nursery around 1980. The property has been cultivated as citrus and cover crops prior to its use as nursery ground. Hines Nursery uses this acreage primarily for greenhouse, shade netting, and open-air cultivation of ornamental plants, and a smaller portion of the property has been developed with buildings including the agricultural chemical storage and mixing work station, a laboratory, pest control facility, corrugated metal-sided warehouse, and small team leader offices. Septic systems are associated with the structures and consist of holding tanks and leach lines. The holding tanks are pumped on an “as-needed” basis to remove solids and the effluent water drains into the leach lines. Also, excess irrigation water is collected in small holding areas then booster pumped beneath Jeffrey Road via pipeline and into the culvert collection system that drains into the collection reservoir.

The area of primary environmental concern is the agricultural storage and mixing work station. The agricultural chemicals are stored in a locked concrete floored storage room in various containers consisting of bags and plastic containers. The chemicals can be granular, powdered, or liquid. Some chemicals are sent from the manufacturing facility in pre-measured containers that are prepared by “just adding water”. Other chemicals require the spray technician to measure required volumes and carry the concentrated chemicals to the spray rig for mixing. The Hines Nursery mixing station is a steel-constructed open sided and concrete floored structure that has individual water bib locations that may accommodate numerous spray rigs at one time. The concrete pad was fitted with floor drains that would collect any spilled chemical/water mixture and then flow into a 10,000-gallon “pesticide rinseate” UST through subsurface piping. The UST was removed in 1990 by Hekimian and Associates and samples collected beneath the UST exhibited DDT concentrations which are currently below the Preliminary Remediation Goal (PRG) of 120 mg/kg established for “Industrial Soil” but exceed the 1.7 mg/kg concentration established for “Residential Soils”. Currently, the floor drains are capped, however, excess mixing water can also overflow the pad and onto the hard packed dirt surface surrounding the work station.

Of secondary concern is the laboratory building. It was reported to AEC that the most common chemical used in the laboratory is potassium hydroxide (base/oxidizer) and it is handled and disposed of according to labeled instructions. The remaining chemicals are commonly used for titration procedures to evaluate the pH of the irrigation water and have been described as inert.

Cultivated Areas

Planning Area I-09A also consists of land solely under agricultural use and cultivation and is divided into Fields. The Fields are leased to tenant farmers that primarily cultivate strawberries, tomatoes, and beans and are identified as Field 213, Field 220, Field 221, Field 222, Field 223, Field 227, Field 228, Field 229, Field 305, Field 307, Field, 308, Field 309, Field 310, Field 314, and Field 315. The tenant farmers have converted a small portion of their leased ground into agricultural storage and maintenance yards. It is within these yards that the majority of environmental concerns are normally discovered. Orange County Produce (OCP) operate two yards, one within Field 227 accessed via Trabuco Road, and one within Field 309 accessed via Sand Canyon Avenue. B & E Farms operates one yard within the study area in Field 315 and is accessed via Sand Canyon Avenue. DC Berry operates one yard adjacent to Field 305 and is accessed via Jeffrey Road. Etchandy Farms has a small yard in Field 213, Fujishige Farms has a storage yard in Field 307, and Wall Farms has small storage yard in Field 310. The majority of the Fields between Trabuco Road and Irvine Boulevard were initially planted to citrus, therefore, needed windmachines (USTs) for frost protection. The citrus was removed between 1994 and 1997 and the acreage converted to row crops.

Finally, there is a massive aboveground water storage tank constructed in a cut out area of Field 315. The water storage tank was installed in 1982 and operated by the Irvine Ranch Water District (IRWD).

Underground Storage Tanks (USTs)

The IVG facility formerly operated a 7,500-gallon gasoline UST that was removed by Kal-Vac in 1993. The UST was located to the east of the IVG corrugated metal-sided storage structures and paralleled Packing House Way. The UST was removed under Orange County Health Care Agency (OCHCA) permit and Orange County Fire Authority approval. Analytical results of soil samples collected beneath the UST indicated acceptable hydrocarbon concentrations. IVG also removed from the premises a 1,000-gallon gasoline UST and a 2,000-gallon gasoline UST on December 3, 1985. IVG also operates a double-walled fiberglass gasoline UST connected to a dispenser and covered by a canopy located in the central portion of the packing house property. The UST permits with OCHCA and South Coast Air Quality Management District (SCAQMD) are current. It has also been upgraded in accordance with the required regulations and issued permit # 08724.

The Irvine Company also operated 280-gallon to 500-gallon capacity windmachine underground storage tanks. These USTs contained gasoline and were used to fuel engines that powered the fan on a windmachine for frost protection purposes. The USTs were typically steel constructed, had 2-inch diameter vent line and fill, and the product line consisted of 3/8-inch flexible copper tubing that was plumbed directly from the tank to the windmachine. The product delivery operated on a vacuum system, therefore, if there was a leak in the copper tubing the engine would not receive fuel, thus minimizing the potential for releases of any significant volume. The windmachines were commonly placed on 10-acre centers. AEC has been involved with the majority of permitted windmachine UST removals on the agricultural parcels, however, windmachine USTs have also been inadvertently removed by the tenant farmers during the deep ripping of the fields. It has been communicated to AEC that when a farmer hit a tank with the shank, they either removed the steel UST and placed it within one of the eucalyptus windbreaks, or transported the tanks to a metal recycler. AEC identified two USTs in the eucalyptus windbreak separating Field 220 from the Northwood Golf Center that were devoid of any gasoline residues, however, it was impossible to confirm from which Fields the tanks originated. These USTs were triple-rinsed and disposed of at a metal recycling facility during July 2001.

AEC has been involved with the removal, and/or investigation of the majority of the windmachine gasoline USTs on The Irvine Company property. Following is a listing of underground storage tanks removed by AEC, or others, whether the tanks tested "clean" or gasoline impacted.

Field	Windmachine I.D.	Removal Contractor (Date)	Status
220	220-1	The Mark Group (10/17/89)	Was impacted. Need closure.
220	220-2	The Mark Group (10/17/89)	Was impacted. Need closure.
220	220-3	Tenant Farmer (unknown)	No history.
220	220-4	Tenant Farmer (unknown)	No history.
221	221-1	The Mark Group (10/17/89)	Was impacted. Need closure.
221	221-2	Tenant Farmer (unknown)	No history.
221	221-3	Tenant Farmer (unknown)	No history.
221	221-4	Tenant Farmer (unknown)	No history.
222	222-1	AEC (07/12/01)	"Clean"
222	222-2	AEC (07/12/01)	"Clean"
222	222-3	AEC (07/12/01)	"Clean"
222	222-4	AEC (07/12/01)	"Clean"
223	223-1	AEC (07/12/01)	"Clean"
223	223-2	The Mark Group (10/17/89)	Was impacted. Now "clean"
223	223-3	AEC (07/12/01)	"Clean"
223	223-4	AEC (07/12/01)	"Clean"
226	226-1	AEC (January 1994)	Closed
226	226-2	AEC (January 1994)	Closed
226	226-3	AEC (January 1994)	Closed
226	226-4	AEC (January 1994)	Closed
227	227-1	Tenant farmer (unknown)	No history
227	227-2	The Mark Group (10/17/89)	Was impacted. Need closure
227	227-3	Tenant Farmer (unknown)	No history
227	227-4	Tenant Farmer (unknown)	No history
228	228-1	Tenant Farmer (unknown)	No history
305A	305A-1	AEC (7/30/98)	Closed
305A	305A-2	AEC (7/30/98)	Closed

The windmachine related gasoline impacted UST locations were investigated by either GeoAudit, and/or AEC.

Following is a tabulation of the analytical results, in parts per million (ppm) from the initial drilling that occurred at each site. Subsequent investigatory borings indicated the plume migration was limited in a lateral direction.

Sample I.D	TPH-g	Benzene	Toluene	Xylenes	Ethylbenzene
220-1 (Geo Audit)					
Tank bottom-7'	8,700	NA	NA	NA	NA
B1 @ 40'	4	0.2	0.2	ND	ND
B1 @ 55'	4	0.1	0.2	ND	ND
220-1 (Geo Audit)					
B1 @ 70'	3	0.3	0.5	0.2	ND
B1 @ 80'	ND	ND	ND	ND	ND
220-2 (GeoAudit)					
Tank Bottom-7'	11,000	NA	NA	NA	NA
B1 @ 40'	1,396	2.6	6.2	2.9	2.7
B1 @ 60'	10	1.2	1.0	0.5	0.2
B1 @ 70'	12	0.4	0.6	0.3	ND
B1 @ 80'	ND	ND	ND	ND	ND
221-1 (AEC)					
Tank Bottom-7'	15,000	ND	720	1,900	270
B1 @ 15'	4,700	180	630	630	140
B1 @ 20'	ND	ND	0.010	ND	ND
B1 @ 30'	ND	ND	ND	ND	ND
B1 @ 35'	ND	ND	0.0051	ND	ND
B1 @ 40'	ND	ND	ND	ND	ND
223-2 (AEC)					
Tank Bottom-7'	14,000	ND	200	930	150
B1 @ 15'	6,600	210	720	670	140
B1 @ 25'	5,400	89	260	660	60
B1 @ 30'	10	0.49	1.0	2.95	0.054
B1 @ 40'	ND	ND	ND	ND	ND
B1 @ 50'	2.8	0.040	0.078	0.307	0.013
B1 @ 55'	ND	ND	ND	0.0062	ND
B1 @ 60'	ND	ND	0.0055	0.0151	ND
227-2 (GeoAudit)					
Tank Bottom-7'	NA	NA	NA	NA	NA
B1 @ 10'	2,511	NA	NA	NA	NA
B1 @ 25'	791	NA	NA	NA	NA
B1 @ 30'	41	5.7	6.9	2.9	0.9
B1 @ 45'	12	2.2	2.5	0.9	0.2
B1 @ 50'	13	3.2	3.5	1.2	0.3
B1 @ 55'	19	5.3	6.1	2.1	0.6
B1 @ 70'	3	0.9	1.2	ND	ND
B1 @ 80'	4	ND	ND	ND	ND

AEC was contracted by Treasure Farms (farming entity that leased the majority of The Irvine Company's property during the mid 1980's to the early 1990's) to prepare a Risk Assessment (January 29, 1993) for the gasoline impacted windmachine tank sites. AEC was then retained to prepare a Vapor Extraction Workplan (September 1993). The reports were submitted to OCHCA and it was decided to treat the gasoline impacted soil via vapor extraction. Between September 1993 and November 1993 the leaking tank sites were remediated using a portable vapor extraction machine and mobile carbon units. The vapor extraction machine operated until the Lower Explosive Limit (LEL) approached 1% to 2%. AEC was able to complete the mitigation of the former tank sites, however, closure was not obtained because Treasure Farms declared bankruptcy during the latter stages of the remediation therefore, the project was tabled. Also, a 4-inch diameter groundwater monitoring well was installed at former windmachine UST location 227-2 in February 1990 by GeoAudit. The results of the groundwater sampling indicate non-detectable concentrations of gasoline. The depth to water is approximately 85-feet bgs. Current status of the well is unknown.

Recommendations for the UST Locations

AEC has contacted Mr. Luis Lodrigueza, Hazardous Materials Specialist, OCHCA, to obtain closure for these former leaking UST locations. Former leaking UST locations 221-1 and 227-2 will be drilled and sampled, through the former center of the plume to confirm the presence, or absence, of gasoline range hydrocarbons. The confirmation samples will be analyzed for TPH-gasoline, volatile aromatics, and MTBE by EPA Methods 8015 and 8021. If the sites test "clean" then The Irvine Company will be issued "no further action" letters for the former leaking UST locations. The subsurface confirmation investigations are tentatively scheduled for October-November 2001. AEC will also prepare an addendum report to this Phase I Assessment summarizing the prior and current environmental work conducted at each UST site and final dispensation.

On July 12, 2001 AEC conducted confirmation sampling of former leaking windmachine location 223-2 under the supervision of Mr. Luis Lodrigueza, Hazardous Materials Specialist, OCHCA. Three confirmation borings were advanced between 30 and 35-feet bgs at the site to confirm the presence, or absence of residual gasoline range hydrocarbons. The results of AECs drilling and sampling indicated trace to non-detectable concentrations of gasoline-range hydrocarbons, therefore, final issuance of a "no further action" letter for this site appears to be a formality. Once closure has been obtained from OCHCA the letter will be immediately forwarded for review by ICDC.

Agricultural Yards

Orange County Produce Trabuco Yard: Surface soils in several small areas at the Orange County Produce (OCP) Trabuco Yard (Field 227) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with portable aboveground storage tanks referred to as "trapwagons". The tanks hold either gasoline, or diesel, and are prone to spillage during use. None of the tanks appeared to be leaking, and the small releases appear to be accidental during use. The storage of waste oil is in a 500-gallon AST that is secondarily contained. OCP has regular pickups of its waste oil by Golden Oil Company. Other concerns are associated with the used battery storage. It is recommended that the batteries be removed from the site within 90 days of being taken out of service. Also, the effluent water generated during steam cleaning needs to be collected and recycled, it should not be allowed to migrate unchecked over the dirt surface. OCP also stores and mixes agricultural chemicals onsite. The agricultural chemicals are stored in a locked enclosed storage container that has a floor in very good condition.

Orange County Produce Sand Canyon Yard: Surface soils in several small areas at the Orange County Produce Sand Canyon Yard (Field 223) were observed to be stained with diesel and waste oil during AECs site inspection. These areas are primarily associated with the trapwagon aboveground storage tanks and small containers of waste oil. OCP also maintains large volume (approximately 3 to 4,000-gallon) poly tanks that hold liquid fertilizer.

Fujishige Farms Sand Canyon Yard: Surface soils in several small areas at the Fujishige Sand Canyon Yard (Field 307) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with saddle-mounted aboveground storage tanks and portable aboveground storage tanks referred to as "trapwagons". The tanks hold either gasoline, or diesel, and are prone to spillage during use. None of the tanks appeared to be leaking, and the small releases appear to be accidental during use. The storage of waste oil is in 5-gallon buckets and 55-gallon drums that are stored on pallets or surface soil. Also, Fujishige Farms operates a wash rack and agricultural chemical mixing area at the north side of the yard. The effluent water generated during steam cleaning needs to be collected and recycled, it should not be allowed to migrate unchecked over the dirt surface. The agricultural chemicals are stored in a locked enclosed wooden storage container that is in poor condition.

Etchandy Farms Sand Canyon Yard: Surface soils in several small areas at the Etchandy Farms Sand Canyon Yard (Field 213) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with the ASTs that are located onsite. Etchandy Farms operates a 500 gallon gasoline, 1,00-gallon gasoline, and 1,000- gallon diesel ASTs located in secondary containment. Waste oil was identified in a 55 gallon drum adjacent to the diesel AST and in additional 55-gallon drums outside the fenced yard to the north. The storage of the agricultural chemicals are in the wooden constructed shed equipped with a solid floor. Mixing of the chemicals are performed onsite.

B & E Farms Sand Canyon Yard: Surface soils in several small areas at the B & E Farms Sand Canyon Yard (Field 315) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. These areas are primarily associated with the ASTs that are located onsite. B & E Farms operates a 500 gallon gasoline, 300 gallon diesel, and 500 gallon diesel ASTs located in secondary containment. Waste oil was identified in 55 gallon drums and 5 gallon buckets. The storage of the agricultural chemicals are in the steel container equipped with a solid floor. Mixing of the chemicals are performed onsite using the hose bib located at the southeast corner of the steel container. The effluent water is allowed to migrate into the concrete-lined drainage culvert paralleling Sand Canyon Avenue. B & E farms also perform rolling stock maintenance in their open sided shed that has a dirt floor. Waste oil was observed on the dirt floor beneath the truck undergoing repairs. B & E Farms have regular pickups of waste oil by Starlite Reclamation Company.

Hiramatsu Sand Canyon Yard: The Hiramatsu Sand Canyon Yard (Field 309) was constructed in 1999 and is very neat and orderly. There was new oil (hydraulic and lubrication) identified in 55-gallon drums within the compound but no staining. The agricultural chemicals are stored in an open-sided structure in the western portion of Field 309 and it is also very clean and orderly. Hiramatsu Farms stores its gasoline and diesel in secondarily contained ASTs near the eucalyptus windbreak separating Field 309 from Fields 222 and 223. There were also 55-gallon drums of waste oils stored near the windbreak.

DC Berry Jeffrey Yard: Surface soils in several small areas at the DC Berry Jeffrey Yard (Field 305) were observed to be stained with diesel, waste oil, and gasoline during AECs site inspection. The waste oil was primarily stored in 5-gallon buckets and 55-gallon drums. The diesel and waste oil fuel were either in trapwagons, or secondarily contained ASTs. Agricultural chemical storage is in a locked shed with a competent floor.

The Irvine Company - Irvine Farm Management: The corrugated metal-sided structure with the 13258 Jeffrey Road address stores waste oil in an AST, and 5-gallon buckets, used oil filters, and antifreeze (Field 305). There is some surface staining of the soil. Also, on the east side of the structure are several 55-gallon drums labeled "hazardous waste" from a clean-up on April 23, 2001. These drums are stored on wooden pallets. The shop building with the 13256 Jeffrey Road address conducts maintenance on The Irvine Company farm vehicles. There is a new hydraulic hoist in the service bay. A steam wash pad is located on the east side of the building and the clean-out consists of a three chambered clarifier on the west side of the building. There are also several trapwagons containing diesel fuel in the storage yard to the south, and further south at the end of the storage yard is another wash area for equipment.

Agricultural Chemicals

The Irvine Company, and the farmers that lease Irvine Company property all use agricultural chemicals to assist in the production of high yield and high quality produce. The chemicals used in Planning Area I-09A are categorized as pesticides, herbicides, fungicides, fertilizers, and surfactants. Following are a listing of the commonly used agricultural chemicals during the past year:

Pesticides	Herbicides	Fungicides	Fertilizers	Other
Pyrellin	Round-up	Copper Sulfate	Nutra-Sol	Ethanol
Diazinon	Glyphosate	Clamp	Tech Flo	Kaolin
Carbaryl		Tenn-Cop 5E	Simplot 21-0-0	Spray
Javelin		Dyrene	Ammonium Nitrate	
MVP II		Rovral	Potassium Nitrate	
AgroMEK		Thiolux Sulphur	Phosphoric Acid	
Xentari		Copper-Count-n		
Danitol				

All the farmers are registered with the Orange County Agricultural Commissioners Office (OCACO) and provide proper notification prior to applying the chemicals to their fields. There have been no "Notice of Violations" (NOVs) issued by the OCACO for the misuse, or mishandling of the chemicals by the farmers in Planning Area I-09A during the past year. Also, each farmer has been issued a Restricted Materials Permit Number by the Agricultural Commissioners office and they are tabulated below:

Farmer	Restricted Permit #	Expiration
Orange County Produce	30-01-300805	12/31/01
Wall Farms	30-01-300910	12/31/01
B & E Farms	30-01-300515	12/31/01
Hiramatsu Farms	30-01-300503	12/31/01
Gargiulo Farms	30-01-300917	12/31/01
Hines Nursery	30-01-300901	12/31/01
Fujishige Farms	30-01-300823	12/31/01
Etchandy Farms	30-01-331541	12/31/01

All of these farmers use licensed Pest Control Advisors (PCAs) to evaluate agricultural chemical selection and volume of application. The chemicals are applied in accordance with labeled instructions on the original container, and then the containers are triple rinsed prior to disposal.

Asbestos Containing Materials

Varying diameters and lengths of "transite pipe" was identified in the eucalyptus windbreak separating Field 309 from Field 222. The transite pipe contains asbestos and is regulated when it becomes a "waste" product. Since this pipe is not in use it should be loaded into a truck and transported to an approved acceptance facility in Los Angeles County (Orange County accepts no asbestos related material). Also, since the pipe is non-friable there is not a sense of urgency regarding the disposal.

Transition to Non-Agricultural Use

It is important to note this assessment was conducted on property that will remain in agricultural production for at least one more year, and understanding that farming is a dynamic process the mitigation of these sites should proceed with common sense and in an orderly fashion. The initial aspect of this report is to identify the active work-related areas where repeated handling and use of chemicals classified as "hazardous" occurs. These areas, and the personnel working in these areas, will be studied to identify if the repetitive handling of chemicals is being conducted in a manner that will not cause an adverse impact to soil and water resources. Next, AEC will make recommendations regarding mitigation of the historical recognized environmental concerns, followed by remediation of any impacted soil. Once the agricultural leases have been terminated, and future land use has been decided, AEC recommends conducting a Phase II Environmental Assessment. Recommendations will be formulated from the results of the Phase II Assessment and mitigation measures will need to be conducted prior to the mass grading of the property in preparation for an alternate land use.

No other recognized environmental conditions were identified at the subject property or on surrounding properties during this PSA. It is the professional opinion of AEC that there are no current recognized environmental concerns in the cultivated portions of the property that would restrict Planning Area I-09A from being converted from agricultural use to residential.

7.0 REFERENCES

1) Geologic Map of California; State of California Resources Agency, Department of Conservation, Division of Mines and Geology.

2) United States Geological Survey - 7.5 Series Topographic Quadrangle Map Publications (Tustin and El Toro Quadrangles).

3) Soil Survey of Orange County and Western Part of Riverside County, California; United States Department of Agriculture, Soil Conservation Service; 1299 Colombia Avenue, Suite E5; Riverside, California 92507; (909) 683-7691.

4) EDR Environmental Information, Inc.; 3530 Post Road, Southport, Connecticut, 06490; (800) 352-0500; www.edrnet.com.

5) Orange County Agricultural Commission; 1750 S. Douglass Road, Building D; Anaheim, California 92806-6050; (714) 447-7100.

6) Orange County Health Care Agency; 2009 East Edinger Avenue; Santa Ana, California 92705; (714) 667-3700.

7) Orange County Fire Authority, Hazardous Materials Unit; 180 South Water Street; Orange, California 92866-2123; (714) 744-0400.

8) State of California Department of Conservation - Division of Oil & Gas; 4800 Stockdale Highway; Bakersfield, California 93309; (661) 322-4031.

9) Southern California Edison; P. O. Box 410; Long Beach, California 90802; (310) 491-2391.

10) Wetlands Law Tests Government Plan; Gregor I. McGregor, Esq.; Environmental Protection Volume 3, Number 9 - November 1992; Stevens Publishing Corporation; 225 North New Road; Waco, Texas 76710; (817) 776-9000.

11) California Statewide Radon Survey Screening Results; State of California Department of Health Services; 601 North 7th Street; Sacramento, California 95814; (916) 322-2040.

12) United States Department of Housing and Urban Development (HUD); 1615 West Olympic Boulevard; Los Angeles, California; (213)-251-7001.

8.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

Advanced Environmental Concepts, Inc. appreciates the opportunity to provide our professional assistance to Irvine Community Development Company on this project. If you have any questions regarding our report or if AEC can be of further service, please call us at (661) 831-1646.

Sincerely,

Advanced Environmental Concepts, Inc.

Jonathan L. Buck
Registered Environmental Assessor II #20017

DOC11QK.R

9.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

AEC staff are composed of one primary environmental professional that performs Preliminary Site Assessments on a routine basis. Qualifications profiles for this individual is provided in the following section.

Jonathan L. Buck

Mr. Buck received a Bachelor of Science degree in Geology from the University of California, Santa Barbara, in 1981 and was professionally engaged in the petroleum industry in various capacities through 1985. Mr. Buck joined the environmental industry in 1985 and formed **Advanced Environmental Concepts Inc.** in 1989. Since it's inception, **AEC** has been a full service environmental consulting firm specializing in Preliminary Site Assessments, UST programs, and soil and groundwater assessment and cleanup programs. Mr. Buck is a State of California Registered Environmental Assessor, Class II (#22017) and has performed numerous PSA's on diverse properties throughout California, Arizona, Oregon, and Washington.

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SECTION 1- INTRODUCTION

1.1 PROJECT DESCRIPTION

The project involves the preparation of a comprehensive ***Master Plan of Drainage (MPD)*** for the Irvine Community Development Company's (ICDC) Protocol Planning Area located in the City of Irvine and unincorporated Orange County. The Protocol Planing Area encompasses land which generally surrounds the former El Toro Marine base on the northern and western sides. The Protocol Area is generally bounded by Jeffrey Road to the west, the Eastern/Foothill Transportation Corridor (Sr-241) to the north, the El Toro Marine Base to the east, and Trabuco Road to the south. The project area is made up of portions of Irvine Planning Areas 5, 6, 8, and 9. The location and boundaries of the Protocol Area are illustrated on Figure 1.1, Project Location Map.

This master plan of drainage is intended to document current pre-development watershed conditions, and mitigate planned development runoff through identification of appropriate backbone infrastructure to accommodate issues of regional flood protection and local drainage requirements. This masterplan of the recommended drainage infrastructure is based on the most current information for the project watershed, including proposed conceptual land use plans, recent drainage facility improvements, and previous engineering studies of the watershed area.

The Master Plan of Drainage is intended to serve as the first part of a comprehensive Runoff Management Plan (ROMP) to be developed for the Protocol Planning Area. The three main parts of the ROMP are anticipated to include: 1.) Master Plan of Drainage, 2.) Water Quality Control Plan, and 3.) Water Quality Monitoring Plan. The primary focus of this MPD is to develop a backbone drainage system which will provide the necessary level of flood protection while ensuring that the "baseline" watershed hydrologics are maintained to the extent possible.

The Protocol Planning Area is located within the San Diego Creek Watershed. A regional flood control master plan for the San Diego Creek watershed has been previously developed by the Cities of Irvine and Tustin, and The Irvine Company. The *"Flood Control Master Plan for San Diego Creek,"* (FCMPSDC) prepared by John M. Tettemer & Associates, was adopted by the Orange County Board of Supervisors in 1989. A subsequent update to the San Diego Creek Master Plan was prepared by John M. Tettemer & Associates for a portion of the Peters Canyon watershed. The report titled, *"San Diego Creek Flood Control Master Plan, Peters Canyon Wash Update,"* was approved by the County of Orange in August, 1996. The Peters Canyon Wash Update encompasses the Protocol Planning Area, and was prepared to reflect changes in the planned watershed development and adjustments to the Eastern Transportation Corridor alignments.

This master plan of drainage is intended to update the previous reports based on more detailed information for the Protocol Planning Area. The updated discharges in this report are limited to the area tributary to the Protocol Planning Area. The masterplan identifies the recommended backbone infrastructure to intercept and convey both regional and local storm water runoff from the Protocol Planning Area in compliance with the guidelines established in the FCMPSDC, and which will mitigate project hydrologic impacts to the appropriate levels and avoid adverse impacts to existing downstream facilities.

The following key elements and objectives of the project have been specifically identified for evaluation in the *Master Plan of Drainage*:

- Establish and quantify "baseline" watershed hydrologic conditions extending to the project boundary limits and includes the offsite tributary areas. The baseline hydrologic characteristics include surface drainage patterns, drainage area delineations, and determination of peak flowrates.
- Provide inventory and identify existing public storm drain systems within the project development watershed and those drainage facilities immediately downstream of the development which are influenced by the project watershed surface hydrology.
- Analyze the available hydraulic capacities of the existing drainage facilities within the development area or immediately downstream, based upon available record improvement drawings and design reports. The analysis to include identification of hydraulic deficiencies or limitations.
- Review the hydrology and hydraulics associated with the previous design of the existing "Transportation Corridor" drainage facilities, Trabuco Retarding Basin, and Marshburn Retarding Basin.
- Review hydrology and hydraulics of the MCAS El Toro and determine any tributary drainage impacting the Protocol Area and the Marshburn Channel.
- Develop a recommended drainage infrastructure program for the primary backbone drainage facilities within the Protocol Planning Area based on current land use plans.
- Prepare an updated developed condition watershed hydrologic analysis which reflects the most current land use planning for the watershed tributary to the Protocol Planning Area.
- Compare the current watershed hydrology analysis to regional watershed masterplans or hydrology studies which have been previously prepared for the San Diego Creek watershed or municipal drainage masterplans which encompass the project area.
- Identify impacts from the development of the Protocol Planning Area, and evaluate the hydrologic effects for implementation of stormwater detention basins or offsite improvements to mitigate increased peak runoff from the development.
- Prepare preliminary construction cost estimates for the recommended backbone drainage facilities to serve the planning area, and develop a phasing and prioritization schedule for implementation of the master plan improvements.
- Prepare a comprehensive document which summarizes the hydrologic conditions for the watershed, outlines the recommended infrastructure drainage program, and anticipated operation of the watershed.

1.2 GENERAL OVERVIEW - Master Plan of Drainage

The objective of the comprehensive *Master Plan of Drainage* will be to establish an updated framework for implementation of the required drainage facilities within the Protocol Planning Area. The master plan is intended to be used for the following purposes:

1. Prepare a drainage plan which reflects the most recent land use planning, and satisfies current standards for flood protection for existing and planned development.
2. Identify drainage patterns, alignments, and configurations for regional and master plan level drainage facilities.

3. Develop storm water discharges to be used for the design of regional and master plan level drainage improvements within the Protocol Planning Area.
4. Identify deficient existing drainage facilities serving the Protocol Planning Area, and determine appropriate mitigation measures to be implemented with the planned development.

1.2.1 LIMITATIONS

This masterplan was developed based on the most current land use plan available at the time of preparation. Modifications to the proposed land uses or circulation plan may require changes to the masterplan.

The hydrology calculations included in the masterplan are intended for use in the final design of the regional and masterplan level drainage facilities. Peak flow rates were calculated at major confluence points along the proposed drainage system alignments. Relocation of storm drain laterals or installation of additional side drains may impact the peak flow rate calculations, and require modifications to the design discharges.

The hydraulic calculations prepared in this study to estimate drainage facility sizes were based on normal depth calculations, and are not intended for final design. Detailed engineering analyses will be required for the final design of all facilities included in this masterplan.

Figure 1.1, Project Location Map

SECTION 2 - EXISTING WATERSHED AND FLOOD PROTECTION ASSESSMENT

2.1 BACKGROUND

The proposed planned development of the Protocol Area encompasses approximately 3,538 acres of land within the City of Irvine area of influence in unincorporated Orange County. The project includes the development of four separate Planning Areas (PA) within the Protocol Area. The Planning Areas include; 5B, 6, 8A, and 9. The location of the planning areas are illustrated on Figure 2.1, Conceptual Land Plan for Developed Drainage System.

The entire area is located within the tributary watershed to the San Diego Creek channel. Within the San Diego Creek watershed, there are three distinct sub-basins which encompass the Protocol Planning Area. The three sub-basins include the Trabuco Channel Basin, Marshburn Channel Basin, and the Agua Chinon Basin.

2.2 PREVIOUS STUDIES

Numerous hydrology and hydraulic studies have been completed on and within portions of the San Diego Creek watershed. Portions of these studies were used where applicable to update or document the “baseline” drainage condition, delineate existing condition drainage boundaries, or to assess impacts to existing drainage facilities, and to ensure conformance with previously developed master plans. These studies include:

Flood Control Masterplan for San Diego Creek, Prepared by John M. Tettemer & Associates (JMTA), April 1989.

San Diego Creek Flood Control Master Plan, Peters Canyon Wash Update, prepared by JMTA, July 1996.

Final Design Report, Marshburn Retarding Basin, prepared by JMTA, August 21, 1997.

Final Design, Marshburn Channel Improvement, prepared by CH2M Hill, April 15, 1996.

Final Hydrology and Hydraulic Analyses for a Conditional Letter of Map Revision for ETC Related Work within Marshburn Watershed, prepared by CH2M Hill, April 1998.

Application/Certification Forms to Obtain a Letter of Map Revision for Aqua Chinon Retarding Basin, Agua Chinon Wash in Orange County, California, prepared by JMTA, November 2000.

Hydrology Report for Jeffrey Road, Sand Canyon Avenue, Portola Parkway PS&E, prepared by Van Dell and Associates, Inc (Van Dell), April 1990.

Hydraulic Report for Portola Parkway, Jeffrey Road, Sand Canyon Avenue, prepared by Van Dell, October 1991.

Hydraulic Report for Portola Parkway, Station 71+75 to Station 185+36, prepared by Van Dell, April 1992.

Hydrology and Hydraulics Report for Alteration of Lambert Reservoir, prepared by Tetra Tech ASL, October 2000.

2.3 FLOODPLAIN MAPPING

The Federal Emergency Management Agency (FEMA) has published Flood Insurance Rate Maps (FIRMs) for Orange County, California and incorporated areas. The FIRMs delineate areas of special flood hazards within a community. The Protocol Planning Area is located within Panels 40, 41, and 50 of 81 dated September 15, 1989, and Panel 49 of 81 dated January 3, 1997. The FIRMs indicate that portions of the Protocol Planning Area are within Flood Hazard Zone “A”. The remainder of the site is located in Flood Hazard Zone “X” (unshaded).

Flood Hazard Zone “A” has been identified in the community flood insurance study as an area subject to inundation by the 100-year flood event. Base flood elevations and flood hazard factors have not been determined for this area. Flood insurance within Zone “A” is mandatory.

Flood Hazard Zone “X” has been identified in the community flood insurance study as an area of moderate or minimal hazard from the principal source of flooding in the area. However, buildings in this zone could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local stormwater drainage systems are not normally considered in the community’s Flood Insurance Study. The failure of a local drainage system creates areas of high flood risk within this zone. Flood insurance is available in participating communities but is not required by regulation in this zone.

A Conditional Letter of Map Revision (CLOMR) has been prepared as part of the Eastern Transportation Corridor improvements to revise the floodplain limits resulting from the Corridor improvements. The CLOMR, Case No. 98-09-640R was approved by FEMA on June 4, 1998. A CLOMR is an approved letter from FEMA indicating that if the proposed improvements identified in the CLOMR application are constructed in accordance with the plans, then the floodplain limits will be revised as shown in the approved application. However, the floodplain limits are not officially revised until the improvements are completed, and record drawings are submitted to FEMA, at which time a Letter of Map Revision (LOMR) will be issued. No LOMR has been issued for these revisions, and therefore, the FIRMs have not been officially revised.

A LOMR is currently being processed to revise the floodplain limits along the Aqua Chinon Wash. The proposed floodplain revisions extend from the Aqua Chinon Basin downstream to the Metrolink Railroad tracks. The application, if approved, will revise the floodplain limits to be contained within the existing channel from the basin to the MCAS El Toro base boundary.

Upon final approval of the currently requested flood plain modifications (CLOMR and LOMR applications), the majority of the existing Zone “A” flooding in the Protocol Planning Area will be eliminated. The remaining Zone “A” flooding limits will be located along the existing earthen channel between Irvine Boulevard and Jeffrey Road, and along the natural drainage course downstream of the Round Canyon Retarding Basin to the Marshburn Retarding Basin.

The effective FEMA flood plain limits and zoning designations are illustrated on Figure 2.2.

2.4 WATERSHED DESCRIPTION

Protocol Planning Area is predominately undeveloped and agriculture land use comprised of moderately steep upper canyons northerly of the Eastern/Foothill Transportation Corridors, with reduced gradients towards the lower elevations. North of the Corridor, the natural vegetative growth is limited primarily to annual and scrub grasses with generally good to poor cover. South of the Corridor, the land is predominately used for agricultural and nursery operations. The primary hydrologic soil group classification is type “B,” with minor areas of types “A,” “C” and “D”.

The planning area is located within the watershed for the San Diego Creek Channel. The project site watershed can be divided into three primary sub-basins within the San Diego Creek watershed. The first watershed basin is tributary to the Trabuco Channel, and is shown on the hydrology maps as the “T” areas. This area can be further divided into three smaller sub-basins. Each of the basins is eventually tributary to the Trabuco Channel. The main area, “T1" is directly tributary to the exiting Trabuco Retarding Basin located at the northeast corner of Jeffrey Road and Trabuco Road. The regional flood control detention basin was constructed in 1996. The second sub area, “T2,” is located north of Irvine Boulevard and west of Jeffrey Road. This area currently drains to an existing 42 inch storm drain system located in Irvine Boulevard. The third area, “T3,” is located north of Trabuco Road and west of Jeffrey Road. This area drains directly to the Trabuco Channel. At this location the Trabuco Channel is a grass-lined trapezoidal channel originally constructed in 1977.

The second watershed basin is tributary to the Marshburn Retarding Basin and the Marshburn Channel, and is shown as the “M” areas on the hydrology maps. Approximately 90% of this watershed basin discharges directly to the Marshburn Retarding Basin. The basin is a regional flood control detention basin constructed in 1997. The remaining 10% of the watershed discharges to the Marshburn Channel downstream of the detention basin. The Marshburn Channel downstream of the basin, from Irvine Boulevard to Trabuco Road, is within the limits of the Protocol Planning Area. This existing facility is a concrete-lined trapezoidal channel. Previous studies estimated the capacity of this reach of channel at 300 cfs. This existing facility is not constructed to the ultimate configuration. Downstream of Trabuco Road, the Marshburn Channel is either constructed or in the process of being constructed to the ultimate configuration.

The final watershed basin is tributary to the Agua Chinon Wash. The project site drains to an existing storm drain system located at the boundary with the former MCAS El Toro Base. Approximately one-third of the project site discharges to the Agua Chinon Basin, located south of the Foothill Transportation Corridor. The lower two-thirds of the project area drain to the existing channel downstream of the basin.

2.5 CONCEPTUAL LAND USE PLAN

This master plan is based on a conceptual land use plan for the area provided to RBF Consulting in February 2001 by The Irvine Company. The Protocol Planning Area is expected to include a mixture of land uses including; residential, retail, industrial, schools, parks and dedicated open space. A summary of the conceptual land uses is included in Table 2.1.

2.5.1 Planning Area 5B

PA 5B is located north of Irvine Boulevard and west of Jeffrey Road. This area includes the development of residential, institutional, and neighborhood park land uses. The existing site is currently used for agriculture and nursery purposes. This area drains to an existing 42 inch storm drain system within Irvine Boulevard, and is tributary to the Trabuco Channel.

2.5.2 Planning Area 6

The PA 6 development area is generally located south of the Foothill Transportation Corridor (SR-241), east of the Eastern Transportation Corridor (SR-133), and northerly of Irvine Boulevard. This area is proposed to include residential, institutional, industrial/office, commercial, neighborhood and community parks, and dedicated open space. The existing land uses on the project site include agriculture, nursery, and open space. This planning area spans all three watershed basins, and runoff is tributary to the Trabuco, Marshburn, and Aqua Chinon Retarding Basins.

2.5.3 Planning Area 8A

PA 8A is located north of Trabuco Road and west of Jeffrey Road. This area includes the development of residential, and neighborhood park land uses. The existing site is undeveloped and currently used for agriculture purposes. This planning area drains directly to the Trabuco Channel downstream of the Trabuco Retarding Basin.

2.5.4 Planning Area 9

PA 9 is located between Jeffrey Road to the west, Portola Parkway to the north, State Route 133 to the east, and Trabuco Road to the south. Development of the site is proposed to include residential, institutional, commercial, industrial/office, neighborhood parks, and open space land uses. This existing land on the project site is currently used agriculture purposes. Runoff from this planning area is tributary to the Trabuco Retarding Basin.

The conceptual land uses utilized for the development of the master plan are illustrated on Figure 2.1, Conceptual Land Plan for Developed Drainage System.

Table No. 2.1 - Protocol Area Conceptual Land Plan (February 2001)

Planning Area	Land Use	Approx. Acreage

5B	Residential	319
8A	Residential	73
9	Residential Retail Industrial	867 50 309
6	Residential Retail Industrial Open Space/Parks	953 14 953 852
Project Total by Land Use	Residential Retail Industrial Open Space/Parks	2,212 64 1,262 852
Project Totals		**4,390**

Figure 2.1 Conceptual Land Plan for Developed Drainage System

Figure 2.2 Effective FEMA Flood Zone Map

SECTION 3 - REGULATORY REQUIREMENTS AND DESIGN CRITERIA

3.1 FLOOD PROTECTION REQUIREMENTS

The goal of the master plan is to provide a 100-year level of protection for all habitable structures in accordance with the guidelines established in the County of Orange, *Local Drainage Manual*, and the City of Irvine, *Standards and Design Manual*. The County criteria for level of protection is based on the concept that local runoff from a 100-year storm event can be conveyed in a combination of street flow and storm drain capacity. Regional drainage facilities shall be designed to convey the entire runoff from a 100-year storm event.

The regional flood control systems within the Protocol Planning Area development will be designed so they could be owned and maintained by the County of Orange through an agreement with the developer. The smaller storm drain systems (non-regional) outlined in the Master Plan of Drainage facilities are proposed to be maintained by the City of Irvine. Section 13 - Facilities Maintenance of this report provides additional discussion on suggested typical maintenance responsibilities for the flood control infrastructure.

3.2 DESIGN CRITERIA

The criteria for the development of the master plan drainage facilities is based on the guidelines established in the County of Orange *Local Drainage Manual,* and the *Flood Control Design Manual.* The final design of all facilities should be completed in accordance with the requirements of these manuals and the City of Irvine *Standards and Design Manual*.

The following summarizes the basic criteria used for the preliminary design of the master plan drainage facilities shown in this MPD:

1. Return Frequencies:
   Regional Facilities (Serving greater than 640 acres) - 100 year storm event
   Master Planned Storm Drain Systems (Serving less than 640 acres) - 25 year storm event

A. Freeboard Requirements:
   a. Regional Channels: 1.5' Subcritical Channels
   3.0' Stable Supercritical Channels

   b. Master Planned Storm Drains: Approx 2-3' below existing grades (Mainline)
   0.5' at Catch Basins (Laterals)

SECTION 4 - DESCRIPTION OF EXISTING DRAINAGE FACILITIES

The major drainage courses within the site are characterized by relatively steep incised channels in the upper canyons and foothills northerly of Portola Parkway. South of Portola Parkway, the land is generally characterized by mild gradients on the gently sloping plains at the base of the foothills. Agricultural channels installed on the plains dictate much of the drainage patterns south of Portola Parkway. Numerous regional flood control and local drainage systems have been constructed within the project area. A summary of existing drainage improvements within the Protocol Planning Area is discussed in the following sections.

4.1 EXISTING CULVERTS AND STORM DRAIN FACILITIES

4.1.1 EASTERN/FOOTHILL TRANSPORTATION CORRIDOR FACILITIES

The construction of the Eastern/Foothill Transportation Corridors (SR-133 and SR 241) were completed in October 1998. As a result of the construction, numerous drainage facilities were constructed to convey offsite flows from one side of the road to the other, as well as drain the roadway itself. The roadway drainage systems are designed to convey a 25-year storm event. The cross-culvert facilities are designed to convey a 100-year storm event.

4.1.2 PORTOLA PARKWAY

Portola Parkway full street improvements have been completed from Jeffrey Road to the intersection with the Foothill Transportation Corridor. These improvements included installation of cross drainage culverts to convey offsite runoff. Local drainage crossings were designed for a 10-year storm event. Cross culverts for the Bee and Round Canyon water courses were designed for a 100-year storm event.

4.1.3 JEFFREY ROAD

Jeffrey Road is a major arterial road which traverses the Protocol Area from north to south. Local drainage improvements have been completed with the roadway improvements. These drainage facilities generally include local storm drain systems to intercept roadway runoff, and cross-culverts at major street intersections.

A earthen trapezoidal channel (F05S05) parallels Jeffrey Road from Irvine Boulevard to Trabuco Road. At the location of the existing packaging plant (north of Bryan Avenue), the channel flow is intercepted and conveyed within the street section in 2 parallel 54-inch pipes. South of Bryan Avenue, the channel has been recently improved as part of the Trabuco Retarding Basin improvements. The channel in this reach is a composite section with an earthen bottom and concrete-lined side slopes. Immediately upstream of the Trabuco Basin, the channel section is also designed to function as the emergency spillway for the basin. Flows in excess of the basin design capacity (35,000-year storm event) would overtop the channel along this reach, and flow downstream along Jeffrey Road.

4.1.4 SAND CANYON AVENUE

Sand Canyon Avenue is major north-south arterial roadway adjacent to State Route 133. No major drainage facilities are constructed within the road. The drainage facilities in Sand Canyon Avenue include cross-culverts at the intersections with Trabuco Road, Irvine Boulevard, and Portola Parkway.

4.1.5 TRABUCO ROAD

Trabuco Road is an east-west roadway along the southern boundary of the Protocol Planning Area. No drainage facilities are constructed within Trabuco Road along the project area. West of Jeffrey Road, the Central-Irvine Channel is constructed adjacent to Trabuco Road. An existing earthen ditch along the north side of Trabuco Road between Jeffrey Road and Sand Canyon Avenue conveys runoff from the tributary agricultural fields to the Trabuco Retarding Basin.

4.1.6 IRVINE BOULEVARD

Irvine Boulevard is a major east-west arterial roadway through the Protocol Area. Storm Drain Facility F25P03 is the only major longitudinal storm drain system within the street section. This existing system varies from 36 to 42 inches along the project site. The system was designed in 1977 to convey a peak runoff of 174 cfs from PA 5B. Existing cross-culverts are located within the roadway for the existing agricultural ditch between Jeffrey Road and Sand Canyon Avenue, Marshburn Channel, and the Bee Canyon Wash.

4.2 EXISTING CHANNEL FACILITIES

4.2.1 CENTRAL-IRVINE CHANNEL

The existing Central-Irvine Channel (Facility No. F25) extends from the Peters Canyon Channel to Jeffrey Road, and terminates at the Trabuco Retarding Basin. This channel is the major drainage facility to convey runoff from the western portion of the Protocol Planning Area. The channel has been improved in various stages, with the current improvements constructed between 1977 and 1996. The channel improvements constructed in 1977 and 1983 extend from Culver Drive to Jeffrey Road, and were original designed to convey a 25-year storm event. These reaches of channel were designed and constructed prior to the preparation of the FCMPSDC. The calculated design discharges for these improvements did not account for detention basins proposed and constructed as part of the FCMPSDC. Subsequent improvements by Caltrans, from Culver Drive west to the Peters Canyon Wash, and improvements at Jeffrey Road constructed in conjunction with the basin improvements, were designed to convey the 100-year design discharge. These later improvements were designed using peak discharges determined from the FCMPSDC. The existing channel from west of Jeffrey Road to west of Culver Drive is not capable of conveying the tributary 100-year storm water runoff under the existing conditions.

4.2.2 MARSHBURN CHANNEL

Marshburn Channel (Facility F16) is a concrete lined trapezoidal channel which flows north to south along the eastern side of State Route 133 from Irvine Boulevard to the project limits at Trabuco Road. The channel along this reach has not been constructed to the ultimate configuration. Previous studies by Silverado Constructors indicate that the existing channel at Irvine Boulevard has the capacity to convey approximately 300 cfs. Downstream of Trabuco Road to Irvine Center Drive, the Marshburn Channel has been constructed to the ultimate configuration. The segment from Irvine Center Drive to the outlet at San Diego Creek is designed and expected to complete construction in mid-summer 2001.

4.2.3 AQUA CHINON WASH

Aqua Chinon Wash (Facility F18) is an improved earthen channel with concrete drop structures from the outlet of the retarding basin to approximately 2,000 feet downstream. Below this point, the wash is a natural incised channel to the boundary with the Marine Base. The LOMR application for the wash indicates that the existing and improved channel generally has the capacity to convey the discharge from a 100-year storm event.

4.3 EXISTING RESERVOIRS AND FLOOD CONTROL FACILITIES

4.3.1 TRABUCO RETARDING BASIN

A critical element in the flood control system for the planning area is the Trabuco Retarding Basin, Facility No. F25B01. The basin constructed in 1996 is within a flood control easement and is operated and maintained by Orange County Flood Control District (OCFCD). The basin is excavated below ground and has an earthen embankment located at the northeast corner of Jeffrey Road and Trabuco Boulevard. The basin has three primary inflow systems and a double 6.5' x 6' outlet conduit. The earthen dam has a storage capacity of approximately 270 acre-feet below the spillway crest and is under the jurisdiction of the State of California Department of Water Resources Division of Safety of Dams (DSOD).

The Trabuco Basin is a major impoundment which receives tributary drainage and runoff from the proposed development watershed. The original design of the basin will dictate the ultimate drainage patterns for the development of the tributary area. Three inflow collector systems were installed with the basin, and drainage patterns for the tributary area must be designed to conform to the assumptions made for the original basin design. The FCMPSDC identified a 100-year ultimate condition peak outflow from the basin of 952 cfs.

4.3.2 MARSHBURN RETARDING BASIN

The Marshburn basin (Facility No. F16B01) was recently constructed within the watershed as part of the Eastern Transportation Corridor improvements. The basin is located north of Irvine Boulevard, approximately 2,500 feet east of Sand Canyon Avenue. The overall basin was designed and constructed to accommodate the future ultimate condition drainage, however, the inflow collector systems and outflow discharge line were constructed for the interim condition only. The interim condition configuration for the basin was designed such that the interim discharge from the basin would not exceed the capacity of the existing downstream Marsburn Channel. Reconstruction of the collector system and outflow line will be required to accommodate ultimate development of the watershed.

The *“Final Design Report, Marshburn Retarding Basin,”* prepared by John M. Tettemer & Associates, dated August 21, 1997 was approved by the County of Orange on August 19,

1998. The report, prepared for the design of the basin, developed ultimate condition flow rates and drainage patterns which differed from the original patterns in the FCMPSDC. The Marshburn Channel was designed for an 100-year ultimate condition peak inflow rate of 4,086 cfs, with a corresponding peak outflow of 901 cfs. Proposed drainage patterns for the Protocol Planning Area should be designed to follow the assumptions used for the design of the basin.

4.3.3 BEE and ROUND CANYON DETENTION BASINS

These two major drainage facilities were constructed on the northern side of the State Route 241 (Eastern/Foothill Transportation Corridors) in 1994. These two jurisdictional sized dams provide storm water detention for the watershed tributary to the Marshburn Channel. These existing facilities will not be impacted by the development of the Protocol Planning Area. Peak outflow from these basins shall be used for the design of downstream drainage improvements. The FCMPSDC identified a 100-year ultimate condition peak inflow and outflow from the Bee Canyon Retarding basin of 2,027 cfs and 94 cfs, respectively. The FCMPSDC identified a 100-year ultimate condition peak inflow and outflow from the Round Canyon Retarding basin of 2,293 cfs and 182 cfs, respectively.

4.3.4 AGUA CHINON RETARDING BASIN

The Agua Chinon Basin (Facility F16B01) is a regional storm water detention basin constructed within the eastern limits of the Protocol Planning Area. The earthen dam has a storage capacity of approximately 250 acre-feet below the spillway crest and is under the jurisdiction of the DSOD. The FCMPSDC identified a 100-year ultimate condition peak inflow and outflow from the basin of 2,433 cfs and 275 cfs, respectively.

SECTION 5 - WATERSHED HYDROLOGY

5.1 SURFACE HYDROLOGY CHARACTERISTICS

5.1.1 PRECIPITATION

Precipitation data for the various hypothetical storm frequencies used in the watershed hydrology analyses were taken from the Orange County Hydrology Manual. Precipitation intensities (inches/hour) were obtained from Figure B-3 in the Orange County Hydrology Manual for determining peak discharges using the rational method. The Orange County 100-year, 24-hour duration rainfall pattern was used for the development of the unit hydrograph calculations.

5.1.2 SURFACE FLOODING AND FLOW PATHS

The effective FIRM's which include the Protocol Planning Area indicate that a portion of the site is currently subject to regional flooding. Flood plain revision applications currently being processed with FEMA will eliminate the majority of the effective flood plain limits. However, regional flooding will remain along the existing earthen ditch which extends from Irvine Boulevard to Jeffrey Road, and along the natural drainage canyon downstream of the Round Canyon Retarding Basin.

Many of the drainage courses within the Protocol Planning Area are agricultural ditches, and are not capable of conveying the required design discharge. Effective flood plain limits are not identified along these ditches due to the small size of the tributary watershed.

The development of the master plan of drainage will generally flow the existing flow patterns within the project site. No net diversions between the three watersheds are proposed. Minor modifications within the watershed are required to conform with the conceptual land use plan, and resulting from previous drainage assumptions used in the development of the Trabuco and Marshburn Retarding Basins. These basins included the installation of ultimate inlet structures which will govern the ultimate condition drainage patterns tributary to the basins.

5.1.3 WATERSHED CHARACTERISTICS

Figure 2.1, shows the conceptual land use plan for each of the planning areas within the Protocol Area project site. Generally, the proposed development plan consists mostly of residential development, retail and industrial uses, institutional, and parks and dedicated Open Space. Table No. 5.1 indicates the existing and proposed land uses, densities and assumed imperviousness associated with each category used for the development of the hydrology analysis.

Ultimate condition land uses for tributary drainage areas outside of the Protocol Planning Area limits were taken from the previous land use assumptions used as part of the FCMPSDC.

Table No. 5.1 - Conceptual Land Plan Summary

Land Use	Density/Hydrologic Land Use [1]	% Impervious
Dedicated Open Space	Natural	0
Agriculture	Natural	0
Nursery Plant Areas Buildings/Green Houses	 Natural 5-7 Dwellings/acre	 0 50
Village Park Neighborhood Park	Public Park	15
Institutional	School	40
Single Family Residential	5-7 Dwellings/acre 8-10 Dwellings/acre 10+ Dwellings/acre	50 60 80
Reatil Industrial	Commercial	90

Notes:
1. Designation per Figure C-4 OCPF&RD Hydrology Manual, 1986

5.2 WATERSHED MODEL DEVELOPMENT

Hydrologic calculations to evaluate surface runoff associated with the 25- and 100-year hypothetical design storm frequencies from the project watershed were performed using the rational method or unit hydrograph method based upon the relative size of the watershed. The rational method is a surface hydrology procedure which allows evaluation of the peak discharge generated from a watershed area. This method only evaluates peak discharge and does not analyze runoff volumes or the time variation of runoff. Unit hydrographs are the other procedure which were utilized to evaluate peak discharges from larger drainage areas, and develop runoff volume for the inflows to the detention basins.

The watershed subbasin boundaries outside the project site were delineated utilizing available topographic mapping of the area. Hydrologic parameters used in this analysis such as rainfall and soil classification areas presented in *Orange County Hydrology Manual* were identified. A hydrology analysis was performed to evaluate the anticipated runoff generated from the proposed development. The hydrology analysis of the proposed development included determining a conceptual storm drain collection system which corresponds to the development drainage patterns. The drainage areas and subarea boundaries within the study area were delineated based on the conceptual land plan for developed drainage system.

5.2.1 WATERSHED PARAMETERS/CHARACTERIZATION

The watershed parameters used in the hydrologic calculations include soil type, infiltration rates, and rainfall intensity-duration curves. The following paragraphs discuss each of the watershed parameters.

The Rational Method hydrology includes the effects of infiltration caused by soil surface characteristics. Soils maps from Orange County Environmental Management Agency Hydrology Manual indicate the Soil Types A through D are representative of the project location. The prominent soil type in the Protocol Area watershed are is “B”. Hydrologic soil ratings are based on a scale of “A” through “D,” where “D” is the least pervious, providing greatest storm runoff.

The infiltration rate is also affected by the type of vegetation or ground cover and percentage of impervious surfaces. The runoff coefficients used were based on the proposed land use layout.

Standard rainfall intensity-duration curve data was taken from the *County of Orange Hydrology Manual* dated October 1986.

Figure 2.1, shows the conceptual land plan for the Protocol Planning Area. Generally, residential land uses dominate the developed portion of the project site. Areas north of the Eastern Transportation Corridor, and north of Portola Parkway west of the Corridor are proposed to be undeveloped, or dedicated open space. The remainder of the land use is dominated by residential land uses with land use densities expected to range from 5 dwelling units per acre to 10+ dwellings per acre. The majority of the residential land uses are expected at 5 to 7 dwelling units per acre. A portion of the project also consists of retail/industrial land uses. Four potential school sites are also located on the property.

5.2.2 DESIGN RAINFALL

Per the City and County’s requirements for master plan and regional drainage systems, the hydrologic analysis is required to analyze the 25-, and 100-year storms. The 25-year storm is used for preliminary sizing of the master plan level storm drain system. The 100-year storm was used for sizing of regional flood control facilities and storm water detention basins.

5.2.3 RATIONAL METHOD

The hydrologic calculations to determine the 25-, and 100-year design discharges were performed using the County of Orange Rational Method from the *County of Orange Hydrology Manual*, dated October 1986. The Rational Method is an empirical computation procedure for developing a peak runoff rate (discharge) for watersheds less than 640 acres and storms of a given recurrence interval. This procedure is the most common method for small area urban drainage design since the peak discharge is generally the only required parameter for hydraulic design of drainage facilities. The Rational Method equation is based on the assumption that the peak flowrate is directly proportional to the drainage area, rainfall intensity, and a loss coefficient related to land use and soil type. The peak discharge from a drainage area using the rational method occurs at a critical time when the entire drainage area is contributing runoff known as the “time of concentration” for the watershed area. The design discharges were computed by generating a hydrologic “link-node” model which divides the analysis area into drainage subareas, each tributary to a concentration point or hydrologic “node” point determined by existing terrain.

The hydrology analysis was performed for two specific watershed conditions (1) pre-development, and (2) proposed development. The rational method time of concentration results were used to compute that lag times used in the Unit Hydrograph analysis.

5.2.4 UNIT HYDROGRAPH (UH)

For large drainage areas, the absence of depth-area adjustments in the Rational Method can result in significant differences in the estimate of the average depth of catchment point rainfalls. While the Rational Method provides only peak discharges, the UH method provides a time distribution of watershed runoff. The UH method is a statistically based model which assumes that watershed discharge is related to the total volume of runoff, and that the time factors which affect the unit hydrograph shape are invariant, and that watershed discharge storm rainfall runoff relationships are characterized by watershed area, slope and shape factors. The UH method is used to estimate the time distribution of watershed runoff in drainage basins where stream gage information is unavailable.

For the study area, 100-year design discharges were computed by generating a “link-node” model for the watershed tributary to the concentration points. Link-node models and concentration point locations were prepared based on previous models developed for the watersheds in the SDCFCMP and the Peters Canyon Wash Update. These previous models were revised to reflect current flowpaths and land use patterns. Similar to the previous studies, the HEC-1 computer program was used to perform the unit hydrograph calculations. The following assumptions/guidelines were applied for use of the Unit Hydrograph Method:

1. Lag time was set equal to 80 percent of the Time of Concentration (Tc) determined from the Rational Method analysis.

2. The Orange County Valley Undeveloped and Developed S-graphs were selected to represent watershed runoff response to unit rainfall. For subareas with both developed and undeveloped areas, a combination of the valley developed and undeveloped S-graphs were used

3. Hydrographs were generated for each subarea using the U.S. Army Corps of Engineers (Corps) LAPRE1 program. The program is a preprocesser to the Corps HEC-1 computer program.

4. 100-year rainfall data was taken from the Orange County Hydrology Manual (October, 1986).

5. The UH Method includes the effects of infiltration caused by soil surface characteristics. The soils map from the Orange county Hydrology Manual indicates that the study area consists of soil types “B. C and D”. The dominant soil type at the project site is “B”. Hydrologic soil ratings are based on a scale of A through D, where D is the least pervious, providing greatest storm runoff.

6. The infiltration rate of a given soil type is also affected by the type of vegetation or ground cover and percentage of impervious surfaces. Loss rates were determined using the formulas in the Hydrology Manual.

7. Depth-area factors were used to reduce rainfall amounts based on the tributary watershed sizes in accordance with Hydrology Manual procedures. Tributary areas are different at each concentration point, therefore, separate depth-area factors are required to generate the peak discharge at each concentration point. Hydrograph models were processed multiple times adjusting the depth-area factors to calculated peak flow rates at major concentration points.

5.2.5 CONCENTRATION POINTS USED FOR COMPARISON

Several key concentration points were used for comparison of the computed discharges between the existing baseline condition and the proposed developed condition. These key locations are as follows:

- Discharge to existing Storm Drain Facility F25P03 in Irvine Boulevard, west of Jeffrey Road.
- Outflow from existing Trabuco Retarding Basin.
- Outflow from existing Marshburn Retarding Basin.
- Discharge to Marshburn Channel at Irvine Boulevard.
- Marshburn Channel Discharge at Trabuco Road.
- Outflow from existing Agua Chinon Retarding Basin.
- Discharge to existing culvert at Marine Corps Boundary (Agua Chinon Wash).

5.3 EXISTING BASELINE WATERSHED ANALYSIS

The pre-development hydrology was established for the project watershed which will serve as the "benchmark" for comparison and evaluation of the magnitude of hydrologic impacts from the development. The baseline hydrology will allow quantifying the "pre-development" watershed runoff values.

Pre-development hydrology calculation were performed using the guidelines established in the Orange County Hydrology Manual, 1986 Edition. The Rational Method was used to calculate discharges for areas with less than 1 square mile of tributary area, the Unit Hydrograph method was used for tributary areas greater than 1 square mile. The Rational method was used to estimate watershed lag times for the Unit Hydrograph procedure and to tabulate the maximum watershed loss rate. Rational Method and Unit Hydrograph calculations were performed for the 25-, and 100-year return frequencies per OCPFRD requirements. Existing condition hydrology for the Marshburn and Agua Chinon watersheds was taken from previous studies recently performed for these watersheds. The Existing Condition Hydrology Map is included as Exhibit B in this report.

5.3.1 TRABUCO WATERSHED

The majority of runoff from the Protocol Planning Area within the Trabuco watershed is tributary to the Trabuco Retarding Basin at the north-east corner of Jeffrey Road and Trabuco Road.

Runoff from PA 5B is tributary to the existing 42 inch storm drain system (Facility F25P03) in Irvine Boulevard, and runoff from PA 8A is flows directly to the Central-irvine Channel west of Jeffrey Road. An existing condition hydrologic analysis was prepared to determine the peak flow rates to these facilities under the pre-development land use condition, using the current County hydrology criteria.

Two recent hydrology studies have been previously prepared for the area. These studies include the FCMPSDC, and the Peters Canyon Wash Update. The Peters Canyon Wash Update was prepared in 1996 to revise the design flow rates in the FCMPSDC based on changes to the watershed as a result of land use changes and modifications to the Eastern Transportation Corridor alignment. The interim condition flow rates in the Peters Canyon Wash Update Report were intended to represent the existing condition after the completion of the Eastern Transportation Corridor improvements. A detailed review of the watershed boundaries in the Peters Canyon Wash Update within the Protocol Area was performed to determine if the analysis accurately reflects the current pre-development condition of the watershed. Minor variations to the watershed boundaries were identified based on a field survey of the watershed, and a detailed review of record drawings for street and drainage improvements. The modifications to the drainage patterns include:

- The Update Report was completed prior to the completion of the final Corridor improvements, and does not reflect corridor runoff north of Portola Parkway which discharges to the Trabuco watershed via a storm drain system discharging south of Portola Parkway.
- Runoff north of Trabuco Road and east of Sand Canyon Avenue is conveyed across Sand Canyon Avenue via an existing 45 inch storm drain pipe and is included in the Trabuco watershed. A portion of this area was not included in the Trabuco watershed in the Update Report.
- A small drainage area north of Portola Parkway and west of Jeffrey Road is shown in the Update Report as draining to PA 5B. Portola Parkway record drawings indicate that this area discharges directly to the Hicks Canyon Channel.

A updated existing condition hydrology study for the Trabuco watershed within the Protocol Planning Area was prepared as part of this master plan of drainage report. Peak discharges were calculated at the three concentration points where runoff from the project site is discharged to existing drainage facilities. These discharges will be used as the baseline condition to assess the condition of existing drainage facilities, and determine impacts from the proposed planned development. Table 5.2 includes a summary of existing condition runoff from the Protocol Planning Area within the Trabuco watershed.

Table No. 5.2 - Existing Condition (Baseline) Hydrology Summary
Trabuco Watershed

Concentration Point	Location	MPD Analysis		Peters Canyon Wash Update (1)	
		Q_{100} (cfs)	Area (acres)	Q_{100} (cfs)	Area (acres)
447	PA 5B discharge to Fac. F25P03	642.4	316.5	706.4	312.4
409	Inflow/Outflow from Trabuco Basin	2,502/839 (113 ac-ft) (3)	1,696	2,075/794 (96 ac-ft) (3)	1,581
60	PA 8A discharge to Central-Irvine Channel	103.1	70.9	— (2)	---

Notes:
1. Interim Condition Flow Rate from "San Diego Creek Flood Control Master Plan, Peters Canyon Wash Updated."
2. "—" indicates that flow rates were not identified in the Peters Canyon Wash Update.
3. Peak storm volume in basin during the design storm event.

Concentration Point 447 discharges to an existing storm drain (Facility F25P03) within Irvine Boulevard. The design discharge for the storm drain system, taken from the available record drawings, indicated that the 42 inch pipe was designed to convey 174 cfs. The existing drainage system is significantly undersized, and the resulting overflow is conveyed west along Irvine Boulevard to Yale Avenue. At Yale Avenue, a portion of the water is conveyed southerly down Yale, and the remaining flow continues west in Irvine Boulevard.

Runoff at concentration point 409 discharges to the Trabuco Retarding Basin (Facility F25B01). Outflow from the basin is conveyed to the existing Central-Irvine Channel. The Central-Irvine Channel downstream of the detention basin was original sized to convey runoff from a 25-year storm event. The original design discharge in the existing channel at Jeffrey Road is 990.4 cfs as indicated on the "Construction Plans for the Improvements of Jeffrey/Trabuco Drainage Facilities and Monroe Crossing," approved August 1, 1983. The FCMPSDC did not identify improvements to the Central-Irvine Channel between Jeffrey Road and Culver Drive. Therefore, it is believed that the FCMPSDC intended to use the existing Central-Irvine Channel by mitigating upstream discharges to the design capacity of the existing facility. The 100-year peak outflow from the Trabuco Retarding Basin for the ultimate condition was determined to be 952 cfs in the Update Report. This peak outflow is less than the original channel design capacity for the downstream channel. However, since the original channel was designed for a 25-year storm event, increased discharges in the channel as the runoff proceeds downstream, resulting from lateral inflow between Jeffrey Road and Culver Drive was based on a 25-year event. Current criteria requires that regional channels be designed for a 100-year storm event. Assuming 100-year runoff from the tributary area between Jeffrey Road and Culver Drive (approximately 1,090 acres) is to be intercepted and conveyed by the channel, the available capacity upstream at Jeffrey Road will be significantly reduced.

Concentration Point 60 discharges directly to the Central-Irvine Channel approximately 1,300 feet west of Jeffrey Road. As previously indicated, the Central-Irvine Channel was designed for a 25-year storm event. The existing channel does not have the capacity to convey the runoff from a 100-year storm event under the current conditions even with the recent construction of the Trabuco Retarding Basin.

5.3.2.1 CENTRAL-IRVINE CHANNEL CAPACITY

A detailed hydraulic analysis of the existing Central-Irvine Channel was performed from downstream of Culver Drive to the Trabuco Retarding Basin. The purpose of the analysis was to verify the capacity of the existing facility, and determine the maximum outflow from the Trabuco Retarding Basin that will allow the channel to function in accordance with current criteria to convey a 100-year storm event. The 100-year lateral inflow to the channel was determined by subarea proration method. An ultimate condition peak discharge at Culver Drive (2,517 cfs) was determined using the HEC-1 hydrograph model from the Peters Canyon Wash Update, revised to reflect the new confluence with the Freeway drain downstream of Culver Drive. The design discharge from the Trabuco Retarding Basin was then subtracted from the Culver Drive peak flow rate to determine the lateral inflow along the subject reach. The lateral inflows at major side drain locations were then prorated from the change in discharge based on the tributary area to the side drain. Inflow at the Yale Avenue street crossing also included street flow from drainage areas north of Irvine Boulevard.

The results of the hydraulic analysis indicate that assuming no outflow from the Trabuco Retarding Basin, the existing channel downstream of Yale Avenue does not meet current criteria for freeboard requirements during a 100-year storm event. A bank full capacity analysis was also prepared. The results of the bank full analysis indicate that a maximum outflow of approximately 300 cfs from the retarding basin will result in the downstream channel flowing at the top of the channel banks during a 100-year storm event.

5.3.2 MARSHBURN WATERSHED

Runoff from the project site within the Marshburn watershed is tributary to the existing Marshburn Retarding Basin, and the Marshburn Channel at Trabuco Road. The existing condition runoff from the project site within the Marshburn watershed has been recently studied as part of the "Final Design Report, Marshburn Retarding Basin," dated August 21, 1997. A field survey of the watershed boundaries and land use assumptions for the interim condition analysis indicate that the study accurately reflects the current pre-development condition, except at concentration point 4 at Irvine Boulevard. The field review indicated that an additional 26 acres is tributary to the Marshburn Channel at this point. The interim condition hydrology from the Marshburn Retarding Basin report will be used as the baseline condition to represent the existing condition of the watershed, with the additional 26 acres of drainage area added at Irvine Boulevard. The model from the Marshburn Retarding Basin report was then extend downstream to Trabuco Road. The downstream reach of channel intercepts runoff between the ETC and the Marshburn Channel, and from the northwest corner of the MCAS El Toro base. A field review of the base drainage patterns was performed to identify the area tributary to the Marshburn Channel. The field review indicated that the base drainage area is in conformance with the area previously identified in the FCMPSDC.

Table 5.3 includes a summary of existing condition runoff at the downstream limits of the Protocol Planning Area within the Marshburn watershed.

Table No. 5.3 - Existing Condition (Baseline) Hydrology Summary Marshburn Watershed			
Concentration Point	**Location**	**Existing Condition**	
		Q_{100} (cfs)	**Area (acres)**
94	Inflow/Outflow from Marshburn Basin	1,938/97 (232 ac-ft) (1)	3,687.5
4	Discharge to Marshburn Channel at Irvine Blvd.	195	3,773.5
7	Marshburn Channel Discharge at Trabuco Road.	1,048	4,233.5

Notes: 1. Existing Condition Flow Rates at CP 94 taken from Interim Condition Flow Rates from "Final Design Report Marshburn Retarding Basin.
2. Peak storage volume in the basin during the design storm event.

The Marshburn Basin was designed to ultimately handle the runoff from the developed condition watershed. However, the inflow and outflow facilities for the existing basin were constructed for the interim condition only. The interim condition was designed to operate under the existing land use condition, and result in a maximum discharge to the Marshburn Channel at Irvine Boulevard of less than 300 cfs. Modifications to the basin will be required as a part of the project development to retrofit the inflow and outflow facilities to handle the ultimate condition discharges.

5.3.3 AGUA CHINON WATERSHED

Runoff from the project site within the Agua Chinon watershed is tributary to the existing Agua Chinon Retarding Basin, and downstream at an existing storm drain culvert at the former Marine Corps Base boundary. A hydrologic analysis for the Agua Chinon watershed has been prepared as part of the FCMPSDC. The analysis was only prepared for the developed condition, and assumed single family residential development (5-7 dwelling units/acre) for much of the watershed. Per the FCMPSDC, the Agua Chinon Retarding Basin was designed to mitigate developed condition flow rates to the capacity of the existing downstream drainage facilities within the former Marine Corps Base. As indicated in the "Application/Certification Forms to obtain a Letter of Map Revision for Agua Chinon Retarding Basin, Agua Chinon Wash in Orange County, California," dated November 2000, the existing facilities downstream of the basin have the capacity to convey the design flow rates. The proposed development of the Protocol Planning Area will result in less intensive land uses than what was assumed in the FCMPSDC, therefore, no impact to the regional channel is anticipated from the project development.

Table 5.4 includes a summary of design runoff to the Agua Chinon Retarding Basin, and at the downstream limits of the Protocol Planning Area within the Agua Chinon watershed.

Table No. 5.4 - Design Discharge Hydrology Summary
Agua Chinon Watershed

Concentration Point	Location	Design Condition (1)	
		Q_{100} (cfs)	Area (acres)
8	Inflow/Outflow from Agua Chinon Basin	2,686/278 (224 ac-ft) (2)	1,410
403	Discharge to Agua Chinon Channel at Marine Corps Boundary	634	1,760

Notes:
1. Flow Rates from "Application/Certification Forms to obtain a Letter of Map Revision for Agua Chinon Retarding Basin, Agua Chinon Wash in Orange County, California."
2. Peak storage volume in the basin during the design storm event.

5.4 ULTIMATE WATERSHED ANALYSIS

The ultimate condition hydrology was established for the project watershed, based on the most current land use planning to identify impacts to existing drainage facilities, and determine required drainage facility sizes for the development of the Protocol Planning Area.

Ultimate hydrology calculations were performed using the guidelines established in the Orange County Hydrology Manual, 1986 Edition. The Rational Method was used to calculate discharges for areas with less than 1 square mile of tributary area, the Unit Hydrograph method was used for tributary areas greater than 1 square mile. The Rational method was used to estimate watershed lag times for the Unit Hydrograph procedure and to tabulate the maximum watershed loss rate. Rational Method and Unit Hydrograph calculations were performed for the 25-, and 100-year return frequencies per OCPFRD requirements. Ultimate Condition Hydrology Maps are included as Exhibits C and D in this report.

5.4.1 TRABUCO BASIN WATERSHED

The results of the existing condition hydrology analysis indicated that the existing drainage facilities servicing the Protocol Planning Area within the Trabuco watershed are severely deficient in conveying the existing tributary runoff. To develop potential mitigation measures to eliminate impacts to these existing systems, two alternative drainage patterns were prepared for the ultimate condition analysis. Alternative A maintains the drainage boundaries, and generally follows the ultimate drainage patterns developed in the FCMPSDC. Alternative B was developed to limit the runoff from PA 5B to the existing storm drain facility F25P03 in Irvine Boulevard to the design capacity of the system. The remainder of the runoff from PA 5B will be diverted to the Trabuco Retarding Basin. The remaining ultimate condition drainage patterns are the same as Alternative A.

A summary of the results of the ultimate condition hydrology are shown in Table 5.5.

Table No. 5.5 - Ultimate Condition Hydrology Summary
Trabuco Watershed

CP	Location	MPD Analysis *Alternative A*		*Alternative B*		Peters Canyon Wash Update[1]	
		Q_{100} (cfs)	Area (acres)	Q_{100} (cfs)	Area (acres)	Q_{100} (cfs)	Area (acres)
447	PA 5B discharge to Fac. F25P03	832 (630)[3]	316.5	227 (174)[3]	72.9	706.4	312.4
409	Inflow/Outflow from Trabuco Basin	3,827/948 (164 ac-ft) [4]	1785.7	4,257/1008 (195 ac-ft) [4]	2,029.3	--- / 952	1,779
60	PA 8A discharge to Trabuco Channel	176	70.9	176	70.9	— [2]	---

Notes:

1. Ultimate Condition Flow Rate from “San Diego Creek Flood Control Master Plan, Peters Canyon Wash Updated.”
2. “—“ indicates that flow rates were not identified in the Peters Canyon Wash Update.
3. ( ) 25-year ultimate condition discharges.
4. Peak storage volume in the basin during the design storm event.

5.4.2 MARSHBURN WATERSHED

An ultimate condition hdyrology analysis for the Marshburn watershed was prepared to reflect the drainage patterns and conceptual land uses planned within the Protocol Planning Area. The majority of the Protocol Area within the Marshburn watershed is tributary to the Marshburn Retarding Basin. The Final Design Report prepared for the Marshburn Retarding Basin developed drainage patterns tributary to the three inflow systems to the basin. The ultimate condition analysis was developed to approximate the drainage patterns and peak flow rates to the existing basin intake systems. A summary of the results of the ultimate condition hydrology analysis are shown in Table 5.6.

Table No. 5.6 - Ultimate Condition Hydrology Summary
Marshburn Watershed

CP	Location	MPD Analysis		Marshburn Basin Design Report [1]	
		Q_{100} (cfs)	Area (acres)	Q_{100} (cfs)	Area (acres)
93	Basin Inflow #1	1,562	537	1,260	556
76	Basin Inflow #2	2,014	2,793	2,163	2,774
88	Basin Inflow #3	784	327	963	327
Basin	Total Inflow/Outflow	4,000/909 (218 ac-ft) [3]	3,687.5	4,086/901 (210 ac-ft) [3]	3,687.5
4	Discharge to Marshburn Channel at Irvine Blvd.	1,019	3,773.5	921	3,746.5
7	Marsburn Channel flow at Trabuco Road	1,838	4,233.5	1860 [2]	

Notes:
1. Ultimate Condition Flow Rate from "Final Design Report Marshburn Retarding Basin."
2. Ultimate Condition Design Flow Rate from "Final Design, Marshburn Channel Improvements."
3. Peak storage volume in basin during design storm event.

5.4.3 AGUA CHINON WASH

No new ultimate conditon hydrology analysis was prepared for the watershed tributary to the Agua Chinon Wash. The design discharges for the drainage facilities within the watershed have been previously developed as part of the FCMPSDC, and no significant changes to the drainage patterns or land uses are proposed as part of the Protocol Planning Area.

SECTION 6 - HYDROLOGIC IMPACTS AND MITIGATION REQUIREMENTS

Development of the Protocol Planning Area will result in a change in the character of the runoff from the project site. A comprehensive storm water mitigation program must be developed to address the potential impacts of increased runoff associated with the Protocol Area development. Peak storm water discharges shall be mitigated to levels equal to or below pre-project levels, or improvements to downstream drainage facilities shall be made to convey the increased discharges. The project impacts and mitigation requirements within each of the three watershed boundaries are summarized in the following sections.

6.1 TRABUCO BASIN WATERSHED

6.1.1 HYDROLOGIC IMPACTS

The results on the hydrology analyses indicate that the project development will increase runoff from the project site compared to the existing condition. A comparison of the computed pre-development and post-development (unattenuated) flows indicates that discharges increase moderately in the after-project condition. Table No. 6.1 shows the 100-year discharges at the major concentration points.

Table No. 6.1 - Comparison of Existing and Ultimate Condition Discharges Trabuco Watershed

CP	Location	MPD Analysis - Ultimate Condition *Alternative A*		*Alternative B*		Existing Condition	
		Q_{100} (cfs)	Area (acres)	Q_{100} (cfs)	Area (acres)	Q_{100} (cfs)	Area (acres)
447	PA 5B discharge to Fac. F25P03	832 (630)[(1)]	316.5	227 (174) [(1)]	72.9	642.4	316.5
409	Inflow/Outflow from Trabuco Basin	3,827/ 948	1785.7	4,257/ 1,008	2,029.3	2,502/ 839	1,696
60	PA 8A discharge to Central-Irvine Channel	176	70.9	176	70.9	103.1	70.9

Notes:
1. ( ) 25-Year ultimate condition discharges

Alternative A is in substantial conformance with the FCMPSDC and the Peters Canyon Wash Update, and will not impact the Trabuco Retarding Basin or downstream facilities which have been constructed to the ultimate configuration. However, the immediate downstream facilities have not been constructed to the ultimate size, and the increased runoff from the project site will result in additional flooding and adverse impacts to the downstream Central-Irvine channel and storm drain facility F25P03. Alternative B results in a watershed diversion from the drainage patterns in the FCMPSDC and the Peters Canyon Wash Update. The alternative was developed to eliminate impacts to storm drain facility F25P03, however, the watershed diversion results in an increase in the flow rates and runoff volume to the Trabuco Retarding Basin.

6.1.2 MITIGATION REQUIREMENTS

Central-Irvine Channel

The development of the Protocol Planning Area will increase discharge to the existing Central-Irvine Channel downstream of the Trabuco Retarding Basin. A hydraulic analysis of the Central-Irvine Channel indicated that the system is undersized to convey the runoff from a 100-year storm event under the current existing land use conditions. Assuming no outflow from the Trabuco Retarding Basin, the existing channel does not have the capacity to convey the tributary runoff from the downstream drainage area between Culver Drive and Jeffrey Road. Therefore, increasing the storage capacity of the Trabuco Retarding Basin is not a feasible option to eliminate the existing downstream channel deficiencies. The existing channel deficiencies are not a result of the proposed development.

Flood control measures to eliminate the adverse impacts to the existing Central-Irvine Channel from the development of the Protocol Planning Area include;

1. Increasing the storage volume in the Trabuco Retarding Basin to reduce the ultimate condition runoff to less than or equal to the existing condition values. This alternative will mitigate adverse impacts from the project site, but will not improve the existing downstream channel deficiencies.

2. Improve the existing Central-Irvine Channel from Culver Drive to Jeffrey Road to the ultimate channel section. The existing downstream deficiencies are not a result of the proposed project, and improvements to upsize the downstream channel to the ultimate configuration should not be the sole responsibility of the project proponent.

PA 5B Runoff to Facility F25P03

Alternative A for drainage of the project site will require on-site detention within PA 5B to mitigate the increased runoff from the development of the project site. Runoff from the area should be mitigated to the design capacity of the existing storm drain system (Facility F25P03) within Irvine Boulevard.

Alternative B will eliminate the need for on-site detention in PA 5B, however, a detailed analysis of the existing Trabuco Retarding basin will be required to ensure that the diverted runoff will not adversely impact the operation of the basin or the downstream channel facilities.

6.2 MARSHBURN WATERSHED

6.2.1 HYDROLOGIC IMPACTS

The results of the hydrology analyses indicate that development of the Protocol Planning Area will increase runoff from the project site. Table No. 6.2 shows a comparison of the 100-year discharges at the major concentration points.

Table No. 6.2 - Comparison of Existing and Ultimate Condition Discharges Marshburn Watershed

CP	Location	MPD Analysis Ultimate Condition		Existing Condition (1)	
		Q_{100} (cfs)	Area (acres)	Q_{100} (cfs)	Area (acres)
94	Total Inflow/Outflow to Marshburn Basin	4,000/909	3,687.5	1,938/97	3,687.5
4	Discharge to Marshburn Channel at Irvine Blvd.	1,019	3,773.5	195	3,773.5
7	Marshburn Channel discharge at Trabuco Road	1,838	4,233.5	1,048	4,233.5

Notes:
1. Existing Condition Flow Rate at CP 94 taken from Interim Condition Flow Rates from “Final Design Report Marshburn Retarding Basin.

The ultimate condition analysis assumes that the Marshburn basin inflow and outlet systems are reconstructed to the ultimate configuration. This results in a significant increase in runoff to the Marshburn Channel compared to the existing condition. The existing Marshburn Channel at Irvine Boulevard was estimated in previous studies to have a capacity of approximately 300 cfs. Downstream of the Irvine Boulevard the channel is a concrete-lined trapezoidal section to Trabuco Road, and has not been constructed to the ultimate configuration. From Trabuco Road to Irvine Center Drive the channel has been constructed to the ultimate configuration in accordance with the peak discharges determined in the SCDFCMP. Improvements from Irvine Center Drive to the outlet at the San Diego Creek have been designed, and are anticipated to completed construction in mid-summer 2001.

The development of the Protocol Planning Area will not impact the ultimate condition design discharges to the Marshburn Retarding Basin or the downstream channel. The SDCFCMP developed a 100-year ultimate condition flow rate of 1,000 cfs for the Marshburn Channel at Irvine Boulevard, and the recent improvements downstream of Trabuco Road were sized for an ultimate condition discharge of 1,860 cfs (per the *Final Design, Marshburn Channel Improvement Report).*

6.2.2 MITIGATION REQUIREMENTS

The development of the project site within the Marshburn watershed will require that the ultimate inflow and outlet systems to the Marshburn Retarding Basin are constructed. These improvements will increase the discharge to the downstream channel to the ultimate condition level, and will require that the existing channel section from Irvine Boulevard to Trabuco Road be constructed to the ultimate configuration.

No improvements are required downstream of the project limits, since the downstream improvements have been constructed (or are under construction), and the ultimate condition discharges from the project site are in conformance with the FCMPSDC.

6.3 AGUA CHINON WATERSHED

The change in peak runoff that will occur as a result of development within the watershed which is directly tributary to Agua Chinon Wash is insignificant since the planned development will be in substantial conformance with original FCMPSDC. Consequently, no mitigation is necessary.

SECTION 7- HYDRAULICS

Hydraulic calculations for this study included the development of preliminary regional channel configurations and sizes, and preliminary storm drain sizing for the master planned facilities. Master plan level storm drain systems are generally those facilities with a storm drain diameter of 36 inches or larger. The hydraulic requirements for the systems are determined by the County and City, which include regulations set forth by FEMA. A summary of the design requirements for the regional and master planned drainage facilities is included in Section 3.

The regional and master planned facilities are illustrated on Figures 7.1 and 7.2, Master Plan of Drainage Facilities Maps for Alternatives A and B.

7.1 REGIONAL DRAINAGE FACILITIES

The hydraulic analysis used to sized the regional drainage facilities was based on normal depth calculations. The 100-year design discharges used in the calculations were taken from the results of the unit hydrograph analysis. The following Manning's "n" values were used for the channel sizing:

- Concrete lined rectangular channel 0.014
- Concrete lined trapezoidal channel 0.015
- Soft bottom channel, concrete side slopes 0.025
- Soft bottom channel, rock side slopes 0.033

The channel slope used to size the soft bottom facilities is based on a stable slope of 0.0010 feet per foot used for the existing Trabuco Channel upstream of the retarding basin. Slopes for concrete lined facilities are based on the existing gradient. The existing gradients are modified as required, to obtain stable flow conditions in accordance with County design requirements.

Freeboard was added to the calculated water surface depths for each facility to obtain the required channel height. A freeboard of 1.5 feet was used for channels with a subcritical flow regime, and 3.0 feet was used for channels with a supercritical flow regime.

7.2 MASTER PLANNED STORM DRAIN FACILITIES

The preliminary hydraulic sizing of the master planned storm drain facilities was taken from the assumed pipe sizes from the 25-year rational method calculations or based on normal depth calculations. The rational method estimates required pipe sizes using normal depth calculations. The Manning's "n" values for RCP used in the analysis was 0.013. The storm drain system will be designed to convey the 25-year discharge within the system. The 100-year storm will be contained using a combination of the storm drain capacity and street capacity.

Pipe sizes ranged from 36" to 120" Reinforced Concrete Pipe (RCP). Figure 7.1 shows the approximate locations and sizes of the proposed back bone storm drains system. The sizes listed on the exhibit are for master planning purposes only. Final hydraulic calculations must be performed before final design of the storm drain system.

Figure 7.1 Master Plan of Drainage Facilities Map

Alternative A

Figure 7.2 Master Plan of Drainage Facilities Map

Alternative B

SECTION 8 - STORMWATER DETENTION/WATER QUALITY

Changes to the existing agricultural and natural terrain resulting from development of the Protocol Planning Area tends to increase impervious surfaces, accelerate storm runoff and increase the volume of runoff resulting in higher peak flow rates. One effective means of mitigating peak flow rates is to attenuate the flows with the use of detention basins. The stormwater detention basins can also be a joint-use facility to potentially accommodate both peak flow rate reduction, and provide stormwater quality benefits.

8.1 STORM WATER PEAK FLOW RATE REDUCTION

Five existing regional storm water detention basins are located with the project site. These basins were designed and constructed to reduce the ultimate condition peak flow rates from their tributary area in accordance with the recommendations of the FCMPSDC. The basins include: 1.) Trabuco Basin, 2.) Marshburn Basin, 3.) Bee Canyon Basin, 4.) Round Canyon Basin, and 5.) Agua Chinon Basin. The development of the drainage plan for the Protocol Planning Area was designed to conform to the parameters used for the original design of the basins. No modifications to the basins are required for the development of the Protocol Planning Area, except for the Marshburn Basin, which will require the construction of the ultimate intake and outlet systems. The existing basin only included the construction of the inlet and outlet systems for the interim condition, which will need to be retrofitted when the watershed is developed to the ultimate condition.

Additional storm water detention will be required to mitigate runoff from PA 5B. Runoff from this area currently drains to an existing 42 inch storm drain system within Irvine Boulevard. The system has an original design capacity of 174 cfs. The 25-year storm event ultimate condition runoff from PA 5B is 630 cfs. Two alternatives have been identified to mitigate runoff from PA 5B. The alternatives include: A) construct a storm water detention basin within PA 5B to mitigate ultimate condition runoff to the capacity of the existing storm drain system, or B) divert runoff from PA 5B to the Trabuco Basin so that the ultimate condition runoff to the existing storm drain is at or below the system capacity. Alternative B will require modifications to the Trabuco Basin to accommodate the additional runoff.

8.2 STORM WATER QUALITY

Current requirements of the Regional Water Quality Control Board and the local Orange County Drainage Area Management Plan (DAMP) require implementation of control measures to assist in mitigating runoff water quality. Recommendations regarding the selection of structural and non-structural control measures will be developed specific to the watershed to comply with these requirements. A detailed water quality assessment and implementation plan shall be developed in a separate report as parts 2 and 3 of the ROMP.

Storm water quality features within the Protocol Planning Area are proposed to be implemented in accordance with the requirements of the Standard Urban Stormwater Mitigation Plan (SUSMP) developed by the Los Angeles County Department of Public Works.

At a minimum, the SUSMP requires that new developments:

A. Mitigate (infiltrate or treat) the volume of storm water runoff produced from a 0.75 inch storm event prior to its discharge to a storm drain system, and

B. Control peak flow discharge to provide stream channel and over bank flood protection, based on the flow design criteria selected by the local agency.

The Master Plan of Drainage is intended to serve as the first part of a comprehensive Runoff Management Plan (ROMP) to be developed for the Protocol Planning Area. The development of BMP's to improve water quality will be identified as part of a separate Water Quality Control Plan, and Water Quality Monitoring Plan. The primary focus of this MPD is to identify drainage patterns and flow rates, and develop a backbone drainage system which will provide the necessary level of flood protection while ensuring that the "baseline" watershed hydrologics are maintained to the extent possible.

Storm water retention or extended detention basins are an effective method to infiltrate or treat the first flush runoff in accordance with the criteria outlined in the SUSMP requirement "A." The drainage patterns, areas, and master planned storm drain system outlined in this MPD can be used to locate and size the required water quality basins or other structural measures to treat the first flush runoff. The storm drain systems and mitigation measures outlined in this MPD will be used to comply with the criteria in the SUSMP requirement "B."

SECTION 9 - DESIGN CONSIDERATIONS

9.1 AGENCY AGREEMENTS, PERMITS, AND APPROVALS

This MPD is subject to review and approval by the City of Irvine for the implementation of the local drainage facilities. This MPD is intended to update the FCMPSDC and will require the review and approval of the County of Orange.

9.2 GEOTECHNICAL

No geological constraints have been identified at this stage of the project.

9.3 ENVIRONMENTAL CONSTRAINTS

The City of Irvine is currently in the process of preparing an Environmental Impact Report (EIR). This MPD must be consistent with the EIR that is being prepared.

9.4 ULTIMATE DEVELOPMENT REQUIREMENTS

The drainage facilities employed in the MPD are as follows:

- Detention Basins: A total of five existing detention basins will be used for peak discharge attenuation. The drainage patterns within the Protocol Planning Area were developed to work with the existing basins.

- Regional Drainage Facilities: The City of Irvine recommends the use of soft-bottom channels where possible within the City limits. A combination of open channels and closed conduits is proposed for the project drainage. Where feasible, natural or soft-bottom channels were incorporated into the project design. Engineered stream courses and stable soft-bottom channels will be incorporated to eliminate channel erosion and accompanying downstream sediment deposition. The existing Bee Canyon and Round Canyon channels, downstream of the SR-241 and upstream of the Marshburn Retarding Basin is proposed to remain natural to preserve natural habitat and aid with cleansing of runoff. Installation of grade control structures is required to eliminate the potential for erosion and establish stable channel gradients. The open space spine along Jeffrey Road is also proposed to include a soft-bottom channel.

  The Marshburn Channel downstream of the retarding basin is an existing concrete-lined facility. The ultimate improvements to this system are proposed to include an underground reinforced concrete box culvert, and a concrete lined trapezoidal channel.

- Master Plan Storm Drain Systems: The master plan level storm drain systems are proposed to be constructed of reinforced concrete pipe to provide a 100-year service life. Alternative materials may be substituted upon approval of the governing agencies.

9.5 LOCAL DRAINAGE CONSIDERATIONS

Backbone drainage system alternatives for the development are shown on Figures 7.1 and 7.2. The backbone systems represent the major collector system required to drain the planning area. In addition, a local drainage system will need to be constructed based on the local street patterns and tract layouts. The design of the local drainage system will need to be consistent with the backbone system and drainage patterns proposed in this MPD. The local storm drain facilities shall be designed in accordance with the City of Irvine policy and requirements. It is proposed that the local drainage system be designed to convey the 10- or 25-year storm event based on City criteria. The difference in discharges between the 10- or 25-, and 100-year storm events will be conveyed in the streets or drainage channels. The local drainage system must also be in substantial conformance with the proposed Water Quality Control Plan proposed for the site. This would mean that low flows developed within the development must be conveyed through the Water Quality Controls prior to entering regional drainage facilities.

9.6 RIGHT-OF-WAY

Regional drainage facilities shall be located in an easement or fee dedicated right-of-way provided to the Orange County Flood Control District. Required easements or right-of-way widths shall be determined during final design in accordance with OCFCD criteria.

Master planned storm drain systems constructed outside of the public street right-of-way will be contained in an easement with a minimum width of 10-feet. Determination of easement widths will be in accordance with the City of Irvine or County of Orange policy and requirements.

SECTION 10 - RECOMMENDED DRAINAGE FACILITIES

10.1 MASTER PLANNED DRAINAGE FACILITIES

The phased implementation of the development will require construction of some minimum amount of the drainage facilities to ensure the drainage objectives are achieved. The priorities for specific facilities can be evaluated based upon construction timing of the development and may require specific interim facilities to be constructed.

All storm drain facilities for the residential and commercial areas shall be designed in accordance with the City of Irvine and County of Orange policy and requirements. Conceptual alignment and locations have been identified, however, final drainage facility design and locations will be reviewed as part of the final engineering plans and grading plans. All on-site storm drain facilities shall be designed to convey flows from the minimum City and County criteria design storm with additional design factors of safety and freeboard to provide a 100-year level of flood protection to all proposed residences and commercial structures. During storms of intensity greater than the minimum design storm, additional flood protection is provided by utilizing the local storm drain systems capacity and conveying excess runoff above the storm drain capacity within the streets. Regional drainage facilities shall be designed to convey the entire tributary runoff from a 100-year storm event.

The primary regional drainage features associated with the project include the improvement to the Trabuco Channel from Culver Drive to Jeffrey Road, and the Marshburn Channel from Irvine Boulevard to Trabuco Road. Master plan level storm drain systems are reinforced concrete pipe ranging in size from 36" to 120".

10.2 FACILITY ALIGNMENT

The alignment of the proposed master planned drainage systems are based on a preliminary assessment of existing drainage patterns within the site, and the conceptual land plan layout and street alignments. The inlet design of the existing Trabuco and Marshburn Retarding Basins provided constraints which dictated the ultimate drainage patterns within the tributary areas.

The drainage facility alignments are shown on Figures 7.1 and 7.2.

10.3 FACILITY DESIGN ISSUES

The drainage facilities within the site will be designed to provide 100-year flood protection. In general, the master plan level storm drain system will be designed for 25-year discharges with 100-year discharges conveyed in the streets and/or stream areas. Regional drainage facilities are designed to convey runoff from the 100-year storm event.

10.4 FLOOD PROTECTION ASSESSMENT

The implementation of the regional and master plan level storm drain facilities outlined in this MPD will provide the required level of flood protection, and eliminate effective 100-year flood plain limits located within the project site.

10.5 DETENTION FACILITIES

A significant element of the FCMPSDC is the implementation of regional storm water detention basins. Five existing regional detention basin are located within the project site. The proposed drainage plan has been developed to conform to the criteria used in the original design of the basins. The ultimate condition flow rates and drainage patterns in this MPD comply with the design conditions for the basins.

10.6 WATER QUALITY FEATURES

Best Management Practices to improvement storm runoff water quality will be developed as part of the overall ROMP for the Protocol Planning Area.

SECTION 11 - ESTIMATED CONSTRUCTION COSTS

This MPD and recommended drainage facilities plan are based on a conceptual land use plan for the Protocol Planning Area to develop storm water runoff discharges and assess impacts from the site development. Construction cost estimates for the drainage facilities associated with the development of the Protocol Planning Area will be determined as more detailed site plans are developed.

SECTION 12 - DEVELOPMENT OF DRAINAGE DESIGN GUIDELINES

12.1 MINIMUM SUBMITTAL REQUIREMENTS

The final design of the regional drainage improvements identified in this MPD shall be completed in accordance with the concepts and design discharges developed in this report, and in compliance with the design criteria of the County of Orange. Development of final plans shall be coordinated between the project proponents, the OCFCD, and the City of Irvine.

Master plan facilities are intended to be owned and maintained by the City of Irvine, or the County of Orange. For such facilities, ownership and maintenance responsibilities will be based on the size of the facility and the watershed which they serve. Final design of the improvements should be processed through the agency responsible for final ownership and maintenance.

The preparation of improvement plans and local drainage systems for individual developments within the Protocol Planning Area should be required to verify conformance with this MPD. The drainage improvements identified in this MPD are interrelated, and should not be adjusted without an analysis of the effects on the entire system, and review and approval by the City and County.

12.2 LOCAL DRAINAGE FACILITIES

In order to provide the required level of flood protection and reduce potential public safety hazards, an underground drainage systems shall be provided to intercept and convey the stormwater flow generated by the on-site project development.

Storm Drains: The following is an outline of the storm drain criteria and the local flood protection requirements:

- Drainage facilities shall be designed in accordance with the *County of Orange Flood Control Design Manual* and *Local Drainage Manual* for the drainage systems on the project, including maintenance features.

- Runoff generated from the project shall be directed to and intercepted by an underground storm drain facility. The on-site project storm drain system will be connected to the appropriate existing or master planned storm drain system for which the drain area was originally tabled.

- Street interception inlets and those inlets in a sump condition with a secondary outlet will be designed for the appropriate frequency storm event based on local drainage criteria.

- Local area drains and the landscaping or common area drainage system will connect to the storm drain at street inlet locations or manholes in order to provide locations of adequate maintenance.

- Local surface inlets for the common area or the landscaped area will be sized with the appropriate clogging factors, minimum of 50%, to account for debris.

- Dedicated emergency overflow paths will be provided along the drainage system at sump locations based upon an “extreme event analysis” (i.e., 100-year). The overflow paths will assist in assuring that during large rainfall events there is a dedicated flow path that overland flow can escape without causing flood damage to any of the facilities. The emergency overflow paths may consist of pedestrian walk paths which can confine and direct the flow without causing erosion.

- The finished floor elevations of the commercial and habitable structures will be elevated one foot above the 100-year water surface in the street or one foot above the top of the curb, which ever is greater.

- The drainage system will be designed to provide 100-year level of flood protection to all structures through a combined hydraulic conveyance of the underground storm drain section and the street section.

- The proposed underground drainage systems which connect to existing downstream drainage facilities will be designed so the proposed design discharge does not exceed the original hydraulic design capacity or the original tabled drainage area to that system.

- Provisions for maintenance shall be incorporated in the proposed drainage system which include providing manholes at the appropriate spacing and locations.

12.3 DESIGN STANDARDS

The final design of regional drainage improvements shall be completed in accordance with the requirements of the County of Orange. Master plan storm drain systems shall be designed in accordance with the City of Irvine and County of Orange criteria.

12.4 COMPLIANCE WITH MASTER PLAN

The development of this MPD was prepared to comply with the design discharges and drainage patterns in the FCMPSDC and subsequent Peters Canyon Wash Update. In addition, this MPD is in conformance with the modifications to the FCMPSDC developed for the design of the Marshburn Retarding Basin.

The implementation of local drainage systems within the MPD area shall be designed and constructed in conformance with this master plan. The project proponent for construction of local drainage facilities shall verify that the proposed systems comply with the drainage patterns in this MPD.

12.5 PHASED CONSTRUCTION

Development of the Protocol Planning Area will occur in phases over many years. Generally, drainage improvements should be completed from downstream to upstream so that development of the upper watershed will not exceed the capacity of the downstream drainage facilities. The phased development of the project site is based on numerous factors, and may occur at various locations within the planning area. The development may not follow an orderly progression from downstream to upstream. Therefore, consideration must be given in the development of the phased construction to ensure that the mitigation goals of the project are complied with as development proceeds.

Interim mitigation measures may be required to ensure consistency with the MPD recommendations during all stages of the development. The MPD is intended principally to serve as a master plan document to provide ultimate mitigation goals.

12.6 CONTROL OF SEDIMENTATION DURING CONSTRUCTION

In order to minimize the impacts of construction operation with respect to sedimentation, erosion control measures during and immediately following grading operation will be necessary. Soil loss will occur due to sheet erosion and channel erosion, therefore, these two processes must be properly controlled. Most serious erosion occurs along slopes; therefore, soil on steep slopes must be preserved by planting to reduce this potential. During the interim period before groundcover becomes established, bonded fiber matrix, rolled erosion control material, straw, wood chips, and plastic (visqueen) can be used as stabilizing agents. Overland flow must be prevented from running uncontrolled over slopes. The top of slopes should bermed to prevent overflow. Due to the steep terrain in the watershed, the overland flows will probably have high erosive velocities and will need to be slowed to tolerant limits. Possible solutions include gravel bag dams placed perpendicular to the flow or to direct the overland flow into temporary gravel bottom channels. In addition, energy dissipation devices should be provided to prevent erosion of the natural channel bed directly downstream of the high-velocity storm drain outlets. In general, the basic principles involved in effectively controlling erosion and sedimentation include the following:

1. Leaving the soil exposed for the shortest time possible.
2. Providing protective cover for the soil utilizing mulch or vegetation.
3. Reducing the velocity and controlling the flow of runoff.
4. Detaining runoff onsite to trap sediment.
5. Releasing runoff safely to downstream areas.

Sediment control structures should be provided where construction has created an artificial erosion potential. Sedimentation rates should be maintained in major natural streams to sustain streambed equilibrium.

SECTION 13 - FACILITIES MAINTENANCE

Maintenance of the regional, master planned and local storm drain facilities described in this report is proposed to be provided through a combined effort of the Orange County Flood Control District, City of Irvine, and Protocol Area Homeowners Association. Generally, facilities characterized as “regional” will be maintained by the Orange County Flood Control District. Maintenance of all publically owned master planned (MPD) or local storm drain systems will be assumed by City of Irvine, and privately owned local drainage systems will be maintained by the Protocol Area Homeowners Associations.

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_Northern Sphere Area
Water Quality Assessment
Technical Appendix

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1 INTRODUCTION

1.1 Purpose

This report addresses the potential impacts of the proposed Northern Sphere Area Development Project (Project) on the water quality of local surface waters and groundwater. The evaluation for surface water impacts is based on water quality modeling that takes into account local precipitation and the effects of land use changes on runoff volume and quality. Source of data used in the modeling include local water quality data collected in the San Diego Creek watershed and regional and national sources.

1.2 Organization

Section 2 of the report summarizes the analysis methods and significance criteria. Section 3 describes local water quality and the water quality constituents of concern. Section 4 summarizes the results of the water quality model and assesses the potential impacts of the project. Section 5 lists the references.

Attachment A describes the construction and post-construction BMPs under consideration and the proposed process for selecting the BMPs.

Attachment B describes the water quality model, the input data, assumptions used in the modeling, and modeling results.

1.3 Project Description

The Northern Sphere Area, which includes Planning Areas 3, 5B, 6, 8A and 9A, is in the unincorporated portion of Orange County and is proposed for annexation to the City of Irvine. The Northern Sphere Area lies to the north and west of the former El Toro Marine Corps Air Station and is generally bounded by State Route 241 to the north, the El Toro Marine Station to the east, Trabuco Road to the south and Jeffrey Road and existing residential development to the west. The total project area is approximately 7,743 acres.

Table 1 shows the approximate existing and proposed land uses for each Planning Area. Existing land uses are primarily open space and agriculture. Agricultural uses include row crops (e.g., strawberries and tomatoes), avocado orchards and nurseries. The nurseries are of two types: container nurseries, and shrub/ground cover nurseries. Some land also is used for grazing.

These land uses were modeled using water quality monitoring data from similar land use catchments in Ventura County and Los Angeles County, as discussed in the Modeling Attachment B, "Water Quality Model Description." Planning Area 3 was not modeled because there are no anticipated changes in land use.

Storm water runoff from the Northern Sphere Area development site discharges into several drainage channels: the Central Irvine Channel, Trabuco Channel, Marshburn Channel, Bee Canyon Channel, Round Canyon Channel, and the Agua Chinon Wash. Runoff from Planning Area 9 is discharged to the Jeffrey/Trabuco Retarding Basin, which in turn flows to the Central Irvine Channel. Planning Area 6 spans three drainage areas, and discharges runoff to the Agua Chinon and Marshburn Retarding Basins and the Agua Chinon Wash, Bee and Round Canyon Channels, and Marshburn Channel. Planning Areas 5B and 8A are currently routed to the Central Irvine Channel. Flows from the Central Irvine Channel enter Peters Canyon Wash, and flows from the Marshburn and Agua Chinon channels enter San Diego Creek (Reach 2). Thus, portions of the development drain to Peters Canyon Wash and other portions drain to the upper reaches of San Diego Creek.

The project proponent proposes to include as part of the project design a feature (the Project Design Feature or PDF) to improve the quality of storm water runoff from the development area. The PDF consists of two components. First, the existing Trabuco Retarding Basin will be modified to treat over a 24-hour period the volume of runoff produced by a 24-hour, 85th percentile storm event (runoff from a 0.75 inch, 24-hour storm) over the 1226 acre Planning Area 9, which constitutes approximately 40 percent of the development area. Second, for the remaining 60 percent of the development area (those areas within Planning Areas 5B, 6 and 8A which are not tributary to the Trabuco Retarding Basin and which will be developed), BMPs (for example, BMPs that achieve similar performance per National BMP Database ratings as catch basin inserts) will be designed to infiltrate, filter or treat the volume of runoff produced by either (a) a 24-hour, 85th percentile storm event (runoff from 0.75 inch, 24-hour storm), or (b) the maximum flow rate of runoff produced by a rainfall intensity of 0.2 inch of rainfall per hour. For the purposes of modeling, a network of catch basin inserts has been assumed. It has further been assumed that the density of inserts (e.g., the number per unit acre) would be sufficient to meet the standard described above.

Table 1: Land Use (acres) and Modeling Assumptions (Acres)

Land Uses & % Imperviousness			Project Planning Areas					Totals	Modeled as
			2/3[1]	**5B**	**6**	**8A**	**9A**		
Existing Conditions	Open Space	0	3,745	32	1,304		132	5,213	Open
	Ag – Nursery	10		224	231		344	799	Row crop
	Ag – Strawberries	50		63	110		573	746	Row crop
	Ag - Other Row Crops	0			81[3]	73	228	382	Row crop
	Ag – Orchards	0			378			378	Orchards
	Ag – Grazing	0			200			200	Open
	Water Bodies	100			25			25	Water
	Totals		**3,745**	**319**	**2,329**	**73**	**1,277**	**7,743**	
Developed Conditions	Preservation[2]	0	3,745		852			4,597	Open
	Recreation	0			258		72	330	Open
	Commercial Recreation	0					51	51	Open
	Water Bodies	100			25			25	Water
	Medium Density Res.	60		319	866	73	678	1,936	SF Res.
	Medium-high Density Res.	70					89	89	MF Res.
	Multi-use	90			20		60	80	Commercial
	Community Commercial	90			20			20	Commercial
	Medical and Science	90			285		317	602	Commercial
	Institutional	70			3		10	13	Education
	Totals		**3,745**	**319**	**2,329**	**73**	**1,227**	**7,743**	

Notes:
1 – Planning Area 3, Implementation District "P" in Planning Area 2 and the Trabuco Retarding Basin were not included in the water quality model because there are no land use changes proposed for these areas as part of the Project. As a result, water quality in these areas would not be affected by the proposed development.
2 - Preservation: open space areas that will be preserved in their existing condition
3 – Agricultural uses including some equipment and material storage
Sources: Northern Sphere Area Pre-Annexation Development Agreement, Screencheck Draft (Table 2-2), and table of leased agricultural acreage provided by P. Changala, TIC.

2 METHODS FOR EVALUATION OF IMPACT SIGNIFICANCE

The impact analysis addressed stormwater flows, dry-weather flows, and groundwater.

2.1 Stormwater Flows

Two criteria were used to evaluate the anticipated changes in stormwater flows: (1) post versus pre-development flows, water quality and loads, and (2) applicable state water quality criteria.

2.1.1 Post vs. Pre-Development Water Quality and Loads

One method for evaluating the potential effects of the project is to assess the change in pollutant loadings and concentrations that would occur with the project. Federal, state and local laws, including the Clean Water Act do not require that projects demonstrate no changes or increases in pollutant loadings and concentrations unless (1) there has been a TMDL established for a water body with this specific requirement for selected pollutants, and/or (2) the water quality in the waterbody is such that any increase in pollutant load would be prohibited by the Clean Water Act anti-degradation policy. Nonetheless, if no increases in pollutant loads or concentrations were predicted, then it is unlikely that the project would cause an increase in the exceedances in a receiving water of water quality standards, an increase in sediment pollutant concentrations, or would be considered an additional source of pollutants in general. If a small increase in pollutant loads and/or concentrations would be expected to occur, then other factors would need to be evaluated. For example, if loads are projected to increase, but concentrations are lower than pre-project, the assessment would depend on the behavior of the constituent (e.g., bioaccumulation characteristics) and regulatory status (e.g., on 303(d) list).

2.1.2 Water Quality Criteria

The water quality criteria are those that apply to designated beneficial uses of receiving waters as described in the Santa Ana Basin Plan. The specific criteria are included in the Basin Plan and in the California Toxics Rule (CTR). Water quality criteria cited in the Santa Ana Basin Plan and in the CTR provide concentrations that are not to be exceeded in receiving waters more often than once every 3 years. The criteria include both acute and chronic values. Due to the intermittent nature of stormwater runoff (especially in Southern California), the acute criteria are considered to be more applicable to stormwater conditions and therefore used in assessing project impacts. Water quality criteria do not apply directly to discharges of storm water runoff. Nonetheless, water quality criteria provide a useful benchmark to assess the potential for project discharges to affect the water quality of receiving waters. If the project discharges were expected to be below water quality criteria values, than the project would be unlikely to have an adverse effect on downstream water quality.

2.2 Dry Weather Flows and Water Quality

Dry weather flow and water quality changes were evaluated by applying a multiple regression using existing in-stream dry weather flow and water quality data as the independent variables and land uses (agriculture, residential, commercial, open space) as the dependant variables. This and other information were used to qualitatively assess the potential impacts associated with dry weather flows and loads for selected pollutants (nitrate and bacteria).

2.3 Groundwater Impacts

Impacts to groundwater were evaluated qualitatively based on current data on groundwater levels and quality, and the potential changes to infiltration associated with land use conversion and water quality basins.

3 CONSTITUENTS OF CONCERN AND RECEIVING WATER QUALITY

3.1 303(d) Listed Constituents

There are three classes of constituents that have been identified by the Santa Ana Regional Water Quality Control Board as not meeting water quality criteria in San Diego Creek and Upper Newport Bay, and for which TMDLs have been developed:

- nutrients
- pathogens
- siltation (sediment)

The Regional Board also is in the process of developing a TMDL for toxic constituents.

Nutrients - Nutrients (especially nitrogen compounds) are believed to be contributing to algal blooms in Upper Newport Bay, which in turn contributes to low dissolved oxygen concentrations. During two intensive weeklong studies the average nitrate nitrogen concentration in the Bay was 9.04 mg/l in September 1999 and 2.84 mg/l in June 2000 (OC PFRD NPDES Annual Progress Report, 2000). According to the 1998-303(d) list, the major sources of nutrient runoff are plant nurseries, urban runoff, high nutrient groundwater, agricultural lands, and soil erosion from open lands (including construction sites).

Pathogens - There are frequent elevated concentrations of fecal and total coliforms in San Diego Creek and Upper Newport Bay waters. For example, bacteriological monitoring conducted over a 10-month period in Costa Mesa Channel (located in a nearby watershed) indicated a median fecal coliform concentration of about 4000 MPN/100ml (OC PFRD NPDES Annual Report, 2000). Total and fecal coliform are used as indicators of pathogens in the bay and tributary waters. The indicators have been relatively successful in assessing human pathogens in sanitary system discharges. The indicators are relatively poor when used for storm water. Sources of indicator bacteria as cited in the State Board's 1998 303(d) list include: urban runoff (pet waste), domestic wastewater spills and leaks, some agricultural practices (e.g. grazing), and wildlife.

Sediment – According to the State Board's 1998 303(d) list, the sediment load in the Upper Newport Bay and San Diego Creek comes from a variety of developed and undeveloped land uses. Sources may generally include agricultural land uses, construction sites, hill slope landslides, and in-stream sediment sources (channel erosion).

Toxic Constituents - Water in San Diego Creek has been found to be occasionally toxic to sensitive freshwater organisms (e.g., *Ceriodaphnia Dubia*) in laboratory bioassay tests. Approximately half of the toxicity is believed to be attributable to the organophosphate pesticides diazinon and chlorpyrifos, which are used in urban areas and nurseries for structural, lawn and garden pest control. EPA is currently phasing out these pesticides for most urban uses. There is also concern that metals (e.g., copper) and metalloids (e.g., mercury, selenium) may be causing or contributing to the observed toxicity. Sources of these and other trace metals include natural and anthropogenic sources. For example, natural sources of selenium in soils can be leached out with groundwater flows and discharged to surface waters. Anthropogenic sources of copper include pesticides, leaks of radiator fluid and lubricants from vehicles, vehicle wear from metal parts (e.g., brake pad wear), and copper used in building construction.

Table 2: 303(d) Listing of Constituents

Water Body	**TMDL Priority**	**Pollutant or Stressor (start date)**	**Probable Sources**
Upper Newport Bay Biological Preserve	High	Metals[1]	Urban Runoff & Storm Drains
		Nutrients (1/96)	Agriculture
		Pathogens	Urban Runoff & Storm Drains
		Pesticides	Unknown Non-point source Agriculture
		Siltation (1/96)	Urban Runoff & Storm Drains Construction
San Diego Creek, Reach 1	High	Metals[1]	Unknown Non-point source
		Nutrients (7/96)	Agriculture Unknown Non-point source Nurseries
		Pesticides	Unknown Non-point source
		Siltation (1/96)	Unknown Non-point source
San Diego Creek, Reach 2	High	Metals[1]	Urban Runoff & Storm Drains
		Nutrients	Nurseries Agriculture Unknown non-point source
		Siltation (1/96)	Construction
		Unknown Toxicity	Unknown non-point source

Reproduced from the State of California 303d lists - http://www.swrcb.ca.gov/tmdl/docs/303dtmdl_98reg8.pdf

1 – According to the SARWQCB TMDL for Toxic Substances (Dec. 2000), dissolved copper in Newport Bay and dissolved selenium in San Diego Creek are the metals most likely contributing to toxicity.

3.2 Constituents of Concern

Storm water runoff from the development site will be discharged to Peters Canyon Wash and San Diego Creek, and ultimately into Upper Newport Bay. Thus TMDL constituents for these water bodies are constituents of concern. In addition to the 303(d)-listed constituents, trace metals including lead and zinc, and hydrocarbons are commonly associated with urban runoff at significant concentrations and are also included in the following list of constituents of concern.

- Sediment
- Nutrients (Phosphorus and Nitrogen)
- Trace Metals (Copper, Lead, and Zinc)
- Metalloids (Selenium)
- Pathogens (Bacteria, Viruses, and Protozoa)
- Hydrocarbons (Oil and Grease, Polycyclic Aromatic Hydrocarbons)
- Pesticides (especially Diazinon and Chlorpyrifos)

3.3 Modeled Constituents

Constituents of concern were analyzed quantitatively when sufficient input data for modeling were available; otherwise the constituent was evaluated qualitatively. The following constituents of concern were not modeled due to limited storm water monitoring data.

1. Various forms of hydrocarbons are common constituents associated with urban runoff; however, these constituents are difficult to measure because of laboratory interference effects, sample collection challenges (hydrocarbons tend to coat sample bottles), and they are typically measured with single grab samples, making it difficult to develop reliable Event Mean Concentrations (EMCs) based on collecting and analyzing flow composite samples.

2. Pesticides in urban runoff are often at concentrations that are below detection limits for most commercial laboratories; and therefore there are limited statistically reliable data on pesticides in urban runoff.

3. Actual human pathogens are usually not directly measured in storm water monitoring programs because of the difficulty and expense involved; rather indicator bacteria such as fecal coliform are measured. Most indicators are not very reliable for storm water conditions; in part because storm water tends to mobilize pollutants from many sources, some of which contain non-pathogenic bacteria. For this reason, and because holding times for bacterial samples are necessarily short, most storm water programs do not collect flow composite samples that potentially could produce more reliable estimates of averages vs. the traditional single grab samples.

The following constituents were chosen for modeling because statistically significant monitoring data are available. Data for these constituents have been collected over a range of storm events using flow composite sampling methods, and the data are consistently measured at levels well above laboratories' method detection levels.

- Total Suspended Solids (sediment)
- Total Phosphorus
- Total Kjeldahl Nitrogen
- Nitrate-Nitrogen
- Total Copper
- Total Lead
- Total Zinc

3.4 Surface Water Quality

The County of Orange conducts a comprehensive monitoring program in compliance with the County of Orange area-wide NPDES permit. Automatic water quality samplers have been installed at various locations throughout the watershed in order to collect flow composite samples during wet weather runoff events. Table 3 shows data collected on Peters Canyon Wash and San Diego Creek (at Harvard) from 1994 through 2000. These data represent the mean concentrations of the flow composite samples collected from 15 to 18 storm events depending on the site. These locations were selected, as they are the closest monitoring stations to the Project site having reasonably robust data sets. The data indicate that San Diego Creek tends to carry more sediment than Peters Canyon Wash, probably because of the larger upland portion of the watershed located in the open steep terrain, and extensive down cutting in some tributary streams (e.g., Serrano Creek). On the other hand, Peters Canyon Wash has higher nitrogen levels, which is thought to result from the infiltration of groundwater high in nitrogen into Peters Canyon Wash and tributary channels. The concentrations of metals are quite similar in both streams. As discussed in more detail in Attachment B, these data are consistent with the results of the water quality modeling.

Table 3: Wet-Weather Water Quality in Peters Canyon Wash and San Diego Creek (Reach 2)

Development Condition	Units	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
San Diego Creek at Harvard[1]	(mg/l)	1517	n.a.	n.a.	3.79	0.047	0.022	0.204
Peters Canyon Wash [2]	(mg/l)	800	n.a.	n.a.	6.05	0.048	0.023	0.137

n.a. – not available
1 – stormwater monitoring (03/94 to 03/00) average of 15 storm event EMCs
2 –stormwater monitoring (01/94 to 02/00) average of 18 storm event EMCs

3.5 Hydrogeology and Groundwater Quality

Groundwater in the Northern Sphere Area follows two regimes (NMG, 2001). Groundwater in the mountainous and foothill regions, comprising the northern and eastern portions of Project area, is typically represented by perched groundwater tables within alluvial filled canyons and by groundwater seepage from fractured bedrock into streams. Depths to perched water tables vary from canyon to canyon, generally ranging between 10-25 ft, up to 50-70 ft. Groundwater seeps are present in the foothill areas and are most prevalent near agriculture areas (NMG, 2001). The regional groundwater table underlying the mountainous regions is thought to be hundreds of feet deep (NMG, 2001).

Groundwater in the Tustin alluvial plain, comprising the western and southern portions of the Project area, generally flows in a westerly direction corresponding to regional topography. The alluvial plain within the Project area ranges in thickness from a few feet in the foothill areas up to 300 feet in the Southwest corner. Recharge areas are in the foothill plain regions where sandy soils are predominant. Clayey and less permeable surface materials occur in the southwest portions of the Project Area, providing less opportunity for recharge. Depth to groundwater within the Tustin plains range from 45 ft in the southwest corner up to 125 ft in the northeast corner. A shallow perched groundwater table (depths 15-25 ft) to the west of the Project area is not present on the site (NMG, 2001).

There are no potable water supply wells within the Northern Sphere Area (NMG, 2001 and Samuel, 2001). Consequently, groundwater quality information within the Project area is sparse. Limited historical data from deep agricultural production wells are available from the Irvine Ranch Water District (Samuel, 2001). Nitrate concentrations in water samples collected in two off-site wells at depths ranging between 200-1500 ft, were between 1.4 to 15 mg/L (federal drinking water standard is 10 mg/L as nitrogen). These data were collected between 1953-1965 and in 1983.

Limited historical and recent groundwater quality information is available from several monitoring wells (about seven total) located in residential areas immediately west and southwest of Northern Sphere Area (Defense Facilities Assessment Section, 1993). These wells withdraw water from the shallow aquifer west of Northern Sphere Area, at depths generally between 10-25 ft. Historical data (1981-89) indicate nitrate concentrations generally below or slightly above 10 mg/L in most samples, with a few wells showing high concentrations above 20 mg/L. Concentrations of total dissolved solids ranged from 230-2150 mg/L. Data collected in June 1999 show increased nitrate levels in comparison with historical data; nitrate concentrations in nearly all samples were above 10 mg/L, typically ranging between 15-35 mg/L. The location of these shallow groundwater wells is down-gradient of groundwater flow emanating from Northern Sphere Area, thus suggesting that the source of elevated nitrate is either within the residential area, or more likely from agricultural practices in the up-gradient Northern Sphere Area.

Elevated concentrations of nitrate and TDS in the shallow wells west of the Northern Sphere Area are indicative of general basin characteristics, although TDS levels in the development area may be naturally elevated as a result of groundwater movement through soil. IDM1 is a multilevel monitoring well about two miles west of the Project area, constructed and maintained by the Orange County Water District. Groundwater samples from December 1997 show high nitrate and TDS concentrations (above recommended levels) in the shallow zone (85-95 ft) and low concentrations (<1000 mg/L TDS and under 10 mg/L nitrogen) in the lower zones (270-1060 ft) (Defense Facilities Assessment Section, 1993). The sources of nitrate and TDS are generally attributed to agricultural practices and leaching of natural mineral deposits.

The limited data did not indicate the presence of organic compounds (solvent, fuels) in groundwater within the Project area. A large plume of groundwater contamination by number of organic compounds including trichloroethylene (TCE) is present beneath the former El Toro Marine base directly south of the Project area. This plume should have no impact on groundwater quality within the Project area because it is down gradient of groundwater flow emanating from the site.

Elevated selenium concentration is also of concern within the groundwater basin. Available information, however, indicates that sources of selenium contamination are primarily in shallow sediments within historical marshland areas down gradient of the Northern Sphere Area (Hibbs and Lee, 2000).

4.0 WATER QUALITY ASSESSMENT

The following sections present the results of the water quality modeling for wet weather; and the evaluation of dry weather impacts, groundwater impacts, impacts on stream channel stability, and construction-related impacts.

4.1 Wet Weather Assessment

The wet weather assessment was based on two measures: predicted changes in loads and concentrations, and exceedances of water quality criteria

4.1.1 Post Versus Pre-Development Concentrations and Loads

Table 4 presents the predicted pre and post-development pollutant loads and Table 5 presents the pre and post-development concentrations calculated in the water quality model. These load and concentration estimates represent average annual runoff conditions. During high or low rainfall years, pollutant loads and concentrations could increase or decrease depending on hydrologic and watershed conditions. The percent changes in the tables are calculated by dividing the difference between post-development and existing conditions by the existing conditions value (i.e. [post – existing]/existing $\times$ 100%). As described below, post-development results are presented with and without the PDF proposed by the project proponent.

Table 4: Pollutant Loads and % Changes

Development Condition	Units	Annual Q (ft^3)	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
Pre-Dev	Load (lbs/yr)	32,824,101	2,222,400	4,153	12,297	16,821	245.1	79.9	527
Post-Dev (w/o PDF)	Load (lbs/yr)	78,350,588	445,283	1,757	13,710	3,708	107	55.2	614
% Change (pre vs. post w/o PDF)		139%	-80%	-58%	11%	-78%	-56%	-31%	17%
Post-Dev (w/ PDF)	Load (lbs/yr)	78,350,588	333,685	1,393	10,907	3351	81.5	43.7	467
% Change (pre vs. post with PDF)		139%	-85%	-66%	-11%	-80%	-67%	-45%	-11%

Table 5: Pollutant Concentrations and % Changes

Development Condition	Units	Annual Q (ft^3)	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
Pre-Dev	Conc (mg/l)	32,824,101	1085	2.03	6.00	8.21	0.120	0.039	0.257
Post-Dev (w/o PDF)	Conc (mg/l)	78,350,588	91.0	0.359	2.80	0.758	0.022	0.011	0.126
% Change (pre vs. post w/o PDF)		139%	-92%	-82%	-53%	-91%	-82%	-71%	-51%
Post-Dev (w/ PDF)	Conc (mg/l)	78,350,588	68.2	0.285	2.23	0.685	0.017	0.0089	0.095
% Change (pre vs. post with PDF)		139%	-94%	-86%	-63%	-92%	-86%	-77%	-63%

The following summarizes key modeling results for the three cases modeled.

Existing Conditions - The model results indicate elevated concentrations and loads for suspended sediments and nutrients (nitrogen and phosphorous) under existing conditions, reflecting the contribution from exposed soils and more intense fertilizer applications associated with agriculture and nursery uses.

Post Development without PDF – Model results under post-development without the PDF reflect the predicted changes in water quantity and quality associated with land conversion only. Runoff volumes are estimated to increase by about 140% because of the increase in impervious areas. Total suspended solids (TSS) loads are predicted to decrease by about 80% and TSS concentrations are predicted to drop from about 1100 mg/l to about 90 mg/l. Nutrient loads are also predicted to decrease by about 80% for nitrate-nitrogen and about 60% for total phosphorous. (The load of organic nitrogen in the form of Kjeldhal nitrogen is predicted to increase by about 10%; however this form of nitrogen is generally not bio-available and, therefore, of less concern than the other nutrients.) Loads and concentrations for the metals copper and lead are also predicted to decrease compared to the existing conditions, whereas the load for zinc is predicted to increase by about 17%.

Post Development with PDF – Model results under post-development conditions with the PDF show a further reduction in loads and concentrations. The PDF is predicted to reduce zinc and TKN loads to below the levels of existing conditions.

4.1.2 Other Constituents

This section describes predicted changes in constituents of concern that were not modeled. These constituents are: pathogen indicators (e.g., fecal coliform), hydrocarbons, and pesticides. These constituents are addressed qualitatively for evaluation of the possible changes in runoff concentrations for these pollutants, based on anticipated pre vs. post land use conditions and current knowledge regarding the effects of land use on agricultural and urban runoff quality.

Pesticides

Pesticides are currently being used for agricultural purposes (including nurseries). Pesticide use will decrease substantially as some agricultural activities are phased out. In the post-developed condition, pesticides would be applied to common landscaped areas and in residential areas. However, some reduction in diazinon and chlorpyrifos (commonly used urban pesticides) is anticipated because of EPA's ban. Source control measures such as landscape contractor education would be employed to help manage fertilizer applications to common landscape areas.

Hydrocarbons

Concentrations of hydrocarbons are likely to increase under post-development conditions because of the increased levels of traffic and parking. Because of the nature of the development (mostly housing), the major source of oil and grease will be from roads and driveways. Data from parking lot studies conducted by CalTrans in California indicate that concentrations of oil and grease are typically low (below 10 mg/l). Hydrocarbons are hydrophobic (low solubility in water), have the potential to volatilize, and most forms are biodegradable. Hydrocarbons in urban runoff also can attach to particulates and would be treated in BMPs being proposed as part of the Project Design Feature. Hydrocarbons have not been identified as contributing to toxicity in the San Diego Creek watershed according to the Final Problem Statement for the TMDL for Toxic Substances prepared by the Santa Ana RWQCB (December, 2000).

Pathogens

The change in concentrations of pathogens associated with development of the site compared to the existing open space and agricultural land use is difficult to evaluate for a number of reasons. Measurements of indicator organisms are not necessarily reliable indicators of viable human pathogenic viruses, bacteria, or protozoa. Moreover, there are numerous sources of pathogens including existing grazing, birds and other wildlife, as well as domesticated animals and pets.

The presence of pathogens in the post-development condition is not expected to substantially change as a result of the project. The conversion of the existing grazing areas to residential and commercial development will eliminate grazing animals as a source of pathogens. Development of the site into residential, commercial, and research and development office uses will reduce some of the natural sources of pathogens by eliminating the row crops and orchards which tend to attract birds and other wildlife searching for foraging and habitat areas. Additionally, the development will be a new development with new infrastructure, thus no leakage from the sanitary sewer system would be expected. This would help minimize the human pathogen loading to the receiving waters. While existing pathogen sources are expected to be reduced, the proposed development will introduce new sources. Urban runoff characteristically contain indicator organisms from known and unknown sources, including, for example, pets. On balance, however, no substantial change is anticipated.

Although it is not possible to quantify, the proposed PDF is expected to reduce pathogens in storm water runoff. Some fraction of pathogens in storm water runoff will adhere to larger particles. Particles in runoff tributary to the Trabuco Retarding Basin will then settle out in that basin; particles in runoff tributary to other water bodies will be filtered out by other means of treatment, as specified in the PDF.

Selenium

Selenium is a bioaccumulative trace element, which, under certain conditions, can become bioavailable, enter the food chain and cause toxicity to fish and wildlife. In the Santa Ana RWQCB Final Problem Statement for the Total Maximum Daily Load for Toxic Substances in Newport Bay and San Diego Creek (Santa Ana RWQCB, 2000) 100 % of the measured dissolved selenium concentrations (20 samples) in San Diego Creek at Campus Drive exceeded the chronic CTR objective of 5 ug/l. The maximum concentration observed was 65 ug/l.

The causes of the elevated selenium observed in channels downstream of the project site is attributed to a combination of high selenium concentrations in shallow groundwater down-gradient of the project site, and groundwater flow from this area into the streams (Hibbs and Lee, 2000). Concentrations in shallow groundwater are believed to be as high as 478 ug/l, with the highest concentrations located near the confluence of El Modena Channel, Santa Fe Channel, and Peters Canyon Wash. This area, unlike the development area, is within the historical location of the Swamp of the Frogs, which, according to Hibbs and Lee, is where selenium became sequestered in the peat soils of the anoxic marsh environment. Hibbs and Lee hypothesize that today selenium is being released as oxygenated groundwater flows through the soils where the marshes once existed.

In the Project area, Hibbs and Lee conducted sampling at 6 stations below Hines Nursery and one station below Bordiers Nursery and found most samples were below detection (less than 4 ug/l). No groundwater samples were obtained in the Project area. The closest groundwater sampling location was near Marshburn Channel and I5 where the concentration was 7 ug/l. Moreover, current groundwater levels below the Project area are quite deep; varying from approximately 50 feet in the southwestern portion of the development to over 100 feet to the northeast (NMG, 2001). Thus groundwater infiltration into stream channels in this area is unlikely.

Significant changes in the groundwater levels are not anticipated with development of the Project. Moreover elevated concentrations of selenium in the groundwater do not occur in the Project area. Thus it is unlikely that the Northern Sphere Area Project will result in an increase in selenium discharges to local channels.

4.1.3 Post Development Water Quality Compared to Water Quality Criteria

The project drains into Peters Canyon Wash and San Diego Creek (Reach 2), which are waters of the United States and subject to the California Toxics Rules. Although the CTR criteria apply to receiving water quality and not to stormwater discharges, CTR provide criteria that, along with other criteria, can be used as a benchmark to evaluate the significance of potential impacts of stormwater runoff to receiving waters.

The model results for metals are given as total metal loads and concentrations because the majority of EMC and effluent data are in this form, while the CTR acute criteria are in terms of dissolved metal concentrations. In order to evaluate the potential for dissolved metal concentrations to exceed CTR criteria, estimates of the dissolved metal concentrations were made based upon results from Sansalone at a highway site (1997) and LA County monitoring data.

Table 6: Predicted Dissolved Metals Concentrations (ug/l)

Metal	**Pre-Development**	**Post Development Without PDF**	**Post-Development with PDF**	**California Toxics Rule Acute Criteria Dissolved Metal Concentration (ug/L)** ***(Hardness as CaCO3 300 mg/L)***
Copper	68	13	9.7	38
Lead	11	3	2.4	208
Zinc	140	71	53	297

Table 6 shows that the predicted dissolved metal concentrations in the storm water runoff are well below the acute CTR criteria for post development conditions without and with the PDF. These runoff concentrations are average conditions and will fluctuate from storm to storm and within storms. Despite fluctuations in discharge concentrations, this analysis would indicate that it is unlikely that these metals will exceed the CTR acute criteria for the receiving waters.

4.2 Dry Weather Assessment

Dry weather flow data have been obtained by Orange County Public Facilities & Resources Department (OCPFRD, 2000) at several locations whose catchments represent a mix of open, commercial, residential, and agricultural land uses. A multiple regression of these data indicates that dry weather flows (per unit acre) from agricultural and residential areas are comparable and much larger (by about a factor of about 5) to open and commercial land uses. Although preliminary results from a limited database, these results suggest that irrigation practices (and other urban inputs: car washing, pavement washing, etc) for these two types of land uses result in comparable dry weather flows. Therefore the conversion of land from agricultural to urban land uses is not likely to significantly change current dry weather flows.

Dry weather flows are typically low in sediment because the flows are relatively low and the more coarse suspended sediment tends to settle out or are filtered by algae and other plants at the bottom of drainage systems. As a consequence, pollutants that tend to be associated with suspended solids (e.g., phosphorous, some trace metals, and some pesticides) are typically found in very low concentrations in dry weather flows. Therefore, the focus is on constituents that tend to be dissolved, e.g., nitrate; or constituents that are so small as to be effectively transported, e.g., pathogen indicators, whose presence has been noted in dry weather.

A regression analysis, similar to that conducted for dry weather flow, was conducted for total nitrogen concentrations using data obtained by Orange County PFRD. The preliminary results indicate that the total nitrogen in dry weather flows attributed to agricultural areas far exceeded the total nitrogen attributed to residential and other land uses. This analysis, although preliminary and based on limited data, indicates that the conversion of land from agriculture to residential land uses will result in a reduction in nitrogen concentrations and loads during dry weather conditions.

The principal sources of pathogens during dry weather flows is leaking septic systems, cross-connections between sanitary sewers and storm drains, or leakage from the sanitary sewer system into groundwater, which feeds the dry and non-storm flows. Pet wastes can also be a source of pathogens. However, the Northern Sphere Area project will be a new development with a new storm drain and sanitary sewer system, which is expected to have minimal if any leakage, the development should not result in increased dry weather pathogen levels.

4.3 Groundwater Impacts

The concern for groundwater impacts from the Northern Sphere Area Development focuses on the potential for infiltration of water containing pollutants associated with urban runoff. Particular concern would be associated with infiltration of stormwater collected and treated in water quality basins, and in other types of water quality controls (e.g., landscaped areas used for bioretention). Research conducted on the effects on groundwater from stormwater infiltration by Pitt et al, (1994) indicate that the potential for contamination is strongly dependent on a number of factors including the local hydrogeology and the chemical characteristics of the pollutants of concern.

Local hydrogeologic data indicate that the depth to groundwater varies from about 50 feet in the southwestern portion of the site (near the Jeffrey Trabuco Retarding Basin) to over 100 feet in the northwestern portion of the site (NMG, 2001). The site is primarily underlain with alluvium, which varies from a few feet near the foothills to over 300 feet in the southwest corner of the site, where there are interlayered clays and silts. The surficial soils in the southwestern portion of the site are also indicated to have poor to moderate permeability whereas soils near the foothills have moderately rapid permeability. Thus the site can be generally characterized as having relatively deep alluvium, shallower ground water, and less infiltrative soils in the southern part of the site associated with the Tustin Plain; tending towards the northwestern portion of the site (nearer the foothills) where the alluvium is relatively shallow, groundwater levels are deeper, and surficial soils are more infiltrative.

Chemical characteristics that influence the potential for groundwater impacts include high mobility (low sorption potential), high soluble fractions, and abundance in stormwater. For example, as a class of constituents, trace metals tend to adsorb onto soil particles and are filtered out by the soils. This has been confirmed by extensive data collected beneath stormwater detention/retention ponds in the City of Fresno (Fresno Nationwide Urban Runoff Program Project, 1984) that showed that trace metals tended to be adsorbed in the upper few feet of the pond bottom sediments. More mobile constituents such as nitrate would have a greater potential for infiltration.

Pollutants associated with urbanization often include hydrocarbons, trace metals, pathogen indicators, nutrients and pesticides. According to the analysis conducted by Pitt et al, most of these pollutants are less mobile and would pose a low to moderate threat to groundwater quality. Certain pathogens and salts would have the greatest potential for impacting groundwater. With respect to nitrogen, the conversion from agriculture to urban land uses would likely result in a reduction in nitrate because of the reduced application of fertilizers in urban versus agricultural areas.

4.4 Erosion and Siltation Impacts

Runoff volume, flow rate, and duration tend to increase with urbanization because of the increase in impervious surfaces and the installation of drainage facilities that more efficiently convey runoff from the site to the local water bodies. This combination of factors tends to increase the energy available to mobilize sediments in stream channels and cause down cutting and/or slope instabilities.
In the case of the Northern Sphere Area development, many of the streams have lined slopes and alluvial bottoms and therefore slope instability is not an issue for these channels as long as the toe of the slope is adequately protected. Moreover, additional channel protections will be provided as part of the Northern Sphere Area Development project.

Channel grade control is more the issue and depends on the extent to which the proposed development adds to current flows, and the effectiveness of existing grade control structures designed as part of the County's Flood Control Master Plan. The Master Plan does incorporate a number of grade control structures (drop structures throughout the San Diego Creek watershed) that will limit the effects of increased flows on channel down cutting.

As most channels in the area that would be affected by discharges from the Northern Sphere Area Development currently have or plan to have channel protection in the form of stabilized slopes and/or grade controls, the potential for stream destabilization is limited.

4.5 Construction Related Impacts

The potential impacts of construction on water quality focus primarily on sediments and turbidity and pollutants that might be associated with sediments (e.g., phosphorous). These constituents currently are listed in the State Water Resources Control Board (SWRCB) 1998 303(d) list as impairing beneficial uses in San Diego Creek, and are currently regulated under a sediment TMDL and a nutrient TMDL. The TMDL for sediment identifies construction sites as an important source of sediments.

Construction-related activities that are primarily responsible for sediment releases are related to exposing soils to potential mobilization by rainfall/runoff and wind. Such activities include removal of vegetation from the site, grading of the site, and trenching for infrastructure improvements. Environmental factors that affect erosion include topographic, soil, and rainfall characteristics. The Northern Sphere Area Development is located in a relatively flat area that is subject to a mean annual rainfall of about 12 inches per year, although storm events can have high intensities.

Impacts will be minimized through the development and implementation of erosion and sediment control BMPs, which are required by existing regulations. Erosion control BMPs are designed to prevent erosion, whereas sediment controls are designed to trap sediment once it has been mobilized. (Erosion control is considered the more effective strategy.) A Storm Water Pollution Prevention Plan (SWPPP) will be developed as required by, and in compliance with, the SWRCB's State General Construction Permit. This Permit requires BMP selection and implementation for various phases of construction, and BMP maintenance. In the recently revised General Permit, water quality monitoring is required in addition to visual monitoring. Specific BMPs that will be considered in the development of the SWPPP are described in Attachment A.

Drainage from a major portion of the development is directed to the Trabuco Retarding Basin, which will be effective in settling out coarser sediments that could be discharged during the construction phase. The combination of on-site controls implemented as part of the SWPPP, and the Trabuco Retarding Basin should result in substantial control of sediment (and pollutants associated with sediment) in runoff that ultimately enters Upper Newport Bay.

4.6 Conclusions

Wet Weather - A comparison between predicted post and pre-development concentrations and loads during wet weather runoff conditions indicate a reduction in all constituents modeled except for zinc and TKN loads. Zinc loads are predicted to increase by 17% under post-development conditions without the PDF; but would be reduced with the PDF to levels comparable to pre-development conditions. TKN concentrations are predicted to increase by about 11% under post development without the PDF and are predicted to be somewhat less that existing conditions with the PDF. Hydrocarbon concentrations and loads may increase because of vehicle emissions and leaks; although this would be offset somewhat as most vehicles would be well maintained and relatively new. Pathogen indicator levels may increase because of urban sources; although this is expected to be substantially offset by a reduction in wildlife sources and the elimination of grazing. Some reduction in hydrocarbon and pathogen concentrations is anticipated to occur in the PDFs as some fraction of both of these constituents will adhere to particles and be subject to treatment by settling and filtration.

Dry Weather - A preliminary analysis of dry weather flow and water quality data collect by the County of Orange indicates that conversion of agricultural lands to urban would not likely change dry weather flow rates. On the other hand, the analysis indicates that dry weather nitrogen concentrations would likely be reduced under post-development conditions.

Groundwater - Groundwater impacts (if any) would most likely be associated with infiltration beneath water quality basins, and would tend to be associated with those constituents that tend to remain in dissolved form in groundwater (e.g., nitrate, salts). Basins located in the southwestern portion of the site (e.g., Trabuco Basin) are likely to have limited infiltration because soils in that area have low infiltrative characteristics.

Erosion and Siltation - Channel instabilities caused by the increase in runoff volumes will be minimal as most channel side slopes in the Northern Sphere Area Development are stabilized and the channel bottoms are protected by downstream grade controls.

Construction Effects – The proposed project will incorporate erosion and sediment control BMPs suitable to local conditions and in compliance with the Construction General Permit. Also most of the development is on flat land, which is less prone to erosion.

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ATTACHMENT A PROJECT SPECIFIC BMPS

Consistent with the applicable laws and regulations, the proposed development will include as part of its design and implementation BMPs meeting standards defined in applicable permits and federal, state, and local agencies, and complementing the regional, programmatic water quality measures. In addition, the project proponent proposes to include as part of the project design a PDF that contains BMPs that will further protect (and may benefit) receiving water quality. Use of BMPs is a recognized approach to protecting receiving water quality.

What follows is a discussion of the process for identifying BMPs for inclusion in the final WQMP and SWPPP. The decision tree to be used to select project BMPs is shown in Figure A-1 and is described in the following.

Step 1: Select BMPs to be considered. The first step is to develop a list of BMPs to be considered. This list will include a variety of BMPs that address source control and site planning, and treatment-type controls. It will be based on information provided in the DAMP, the California BMP Manuals, the ASCE/EPA Nationwide Storm Water BMP Database, other sources, and local experience gained by the project proponent in previous projects. (See discussion below regarding range and types of BMPs.)

Step 2 : Select BMPs that address constituents of concern. The second step is to select, in accordance with the MSW Permit and the DAMP, those BMPs that have been shown to be effective in controlling one or more of the pollutants of concern. These pollutants have been identified in Table 4 and are based on regulatory TMDLs in place or planned, other regulatory requirements, and local concerns. In this step, the form of the pollutant is also considered as BMP effectiveness varies depending on whether the pollutant is in the dissolved or particulate form.

Step 3: Select BMPs consistent with source areas. Select those BMPs that address the types of pollutant sources in the proposed development. For example, in the proposed project, potential sources of pollutants will be building roofs, roads, parking lots, and landscaped areas. For each of these types of source areas certain BMPs may be more effective than others.

Step 4: Select BMPs compatible with site environmental conditions. Evaluate the site environmental conditions and constraints that might limit BMP feasibility. In this step, environmental conditions that would either enhance the performance of a type of BMP or significantly reduce the performance of a BMP would be identified.

Step 5: Select BMPs that are compatible with each other. In the last step BMPs would be selected that assembled in a treatment train that would enhance the effectiveness of the overall system of BMPs. This concept of treatment train is based on the desire to first remove gross pollutants (litter, debris, trash, and coarse sediment) from the runoff stream, followed by removal of finer sediment sizes, and if necessary dissolved constituents. The final selection will be made consistent with the feasibility criterion that capital costs and maintenance requirements are proportional in comparison with anticipated environmental benefits and the overall size of the project.

All BMPs selected for the project will be selected to complement one another forming a treatment train of pollutant removal practices and devices. Such treatment trains work by relying on several BMPs, each designed to remove different types of pollutants or forms of pollutants. For example, street sweeping and litter control programs before a storm may remove trash, debris, and coarser sediments and particulate metals. Then finer sediments, nutrients, pathogens, pesticides, and metals can be addressed through additional BMPs during storm events. Using the treatment train system better ensures pollutant removal, because multiple systems are utilized and each device or practice is designed to complement the other. Table A-1 is an example of the range and types of controls that will be considered for both the SWPPP and WQMP. The BMPs shown are for consideration only. The assessment of each BMP for the proposed project will follow the decision tree described above, including an assessment of environmental conditions and constraints that might limit BMP feasibility and an proportional analysis of capital costs and maintenance requirements with potential cumulative environmental benefits. Inclusion of a BMP in the following table does not imply that it will ultimately be included in the SWPPP or WQMP. The BMPs that make up the PDF, however, will ultimately be included in project design.

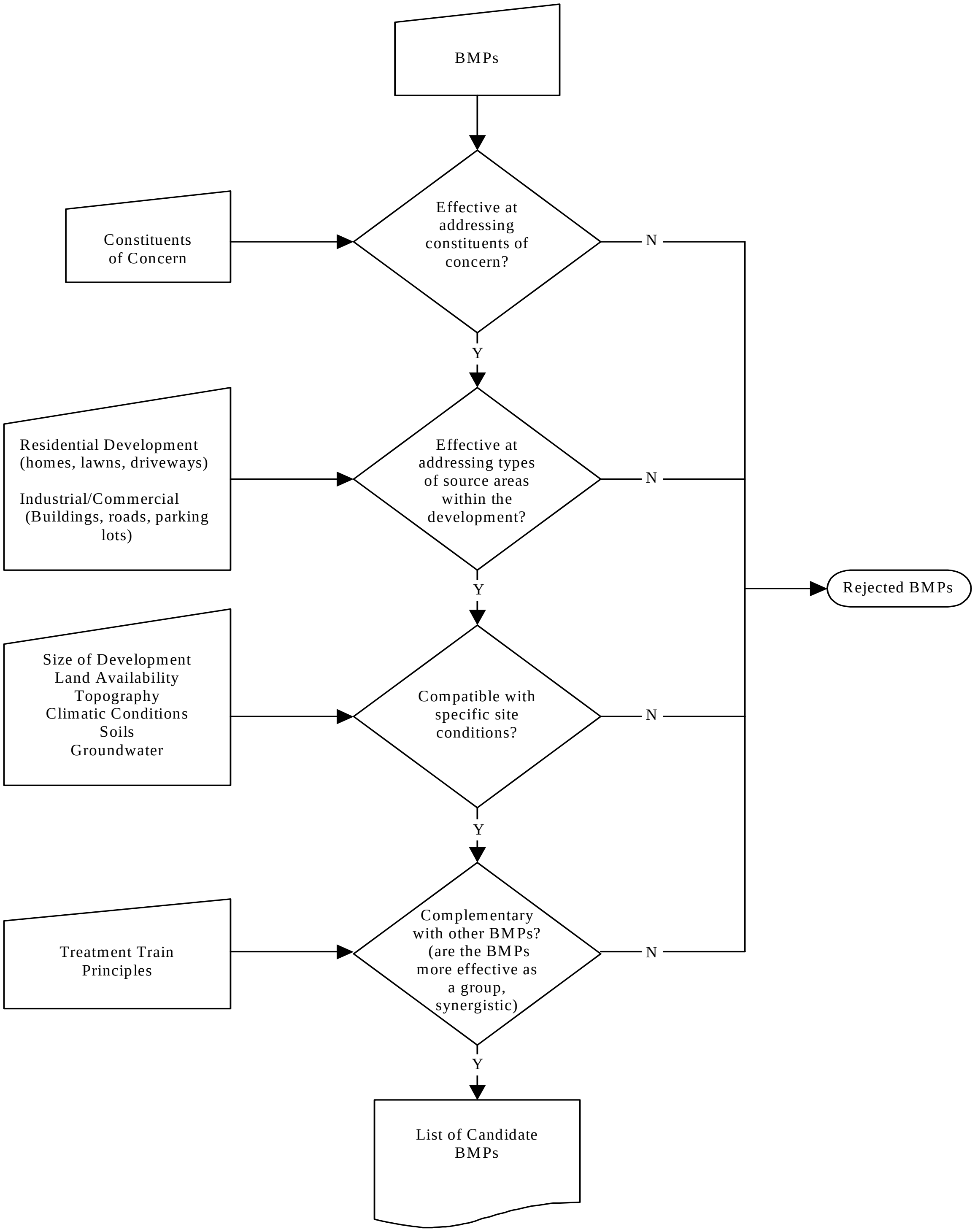

Figure A-1 BMP Selection Process

Table A-1 Example of Range and Types of BMPs to be Considered							
Phase of Project	**Typical BMPs to be considered in selection process**	**Constituents addressed by BMPs**					
		Sediment	**Nutrients**	**Pathogens**	**Pesticides**	**Metals**	**Other**
Construction	Soil and slope stabilization utilizing the appropriate combination of natural and synthetic matting, geotextiles, mulches, and temporary and permanent seeding	X	X			X	
	Temporary desilting basins constructed where necessary and consisting of ponds with outflow pipes designed to retain or detain runoff sufficiently to allow sediment to settle	X	X			X	
	Storm drain inlet protection utilizing an appropriate combination of barrier devices such as sand bags, straw rolls, hay bales, fiber rolls, gravel, silt fencing, screens, and temporary drain signs (raising awareness and limiting construction wastes from entering the storm drain system)	X	X			X	
	Energy dissipation devices installed where necessary and consisting of physical devices such as rock, riprap, concrete rubble intended to prevent scour of downstream areas	X	X			X	

Table A-1
Example of Range and Types of BMPs to be Considered

Phase of Project	Typical BMPs to be considered in selection process	Constituents addressed by BMPs					
		Sediment	**Nutrients**	**Pathogens**	**Pesticides**	**Metals**	**Other**
	On-site dust control and street sweeping employed when and where necessary paying close attention to paved areas and areas susceptible to wind erosion (such as soil stockpiles)	X	X			X	
	Stabilized construction entrance consisting of pads of aggregate and located where traffic enters public right-of-ways; when and where necessary, wash racks or tire rising may be employed (tire rinse waters being directed through on-site sediment control devices)	X				X	
	Diversion structures utilized where necessary to divert storm water flows from disturbed areas, and consisting of devices such as silt fencing, temporary or permanent channels, V ditches, earthen dikes, down drains, straw bales, and sand bag check dams	X				X	
	Adherence to De Minimis Permit conducting required testing, monitoring, and discharge provisions for activities including dewatering, hydrostatic line testing, fire hydrant testing, and water line disinfection	X				X	Chlorine

Table A-1
Example of Range and Types of BMPs to be Considered

Phase of Project	**Typical BMPs to be considered in selection process**	**Constituents addressed by BMPs**					
		Sediment	**Nutrients**	**Pathogens**	**Pesticides**	**Metals**	**Other**
	<u>Construction housekeeping practices</u> consisting of practices such as barricading catch basins and manholes during paving activities; utilizing plastic sheeting, secondary containment, or bermed areas for construction materials when necessary; removing construction debris in a timely fashion; designating and lining concrete wash out areas; and berming or locating sanitary facilities away from paved areas	X		X		X	Trash
	<u>Fertilizer, pesticide, and soil amendment management</u> not over-applying such materials and adhering to the County's Management Guidelines for such materials (located in the DAMP)		X		X		
Post Construction (Source Controls)	<u>Street sweeping</u> occurring as necessary or otherwise on a routine basins and including, at a minimum, sweeping of the streets and parking lots prior to the beginning of the rainy season (October 15th each year)	X		X		X	
	<u>Catch basin inspection and cleaning</u> including the inspection and cleaning of privately-owned catch basins prior to the rainy season	X				X	Hydrocarbons
	<u>Drain and catch basin stenciling</u> with A "no dumping drains to ocean" or equivalent						Hydrocarbons Trash

Table A-1
Example of Range and Types of BMPs to be Considered

Phase of Project	Typical BMPs to be considered in selection process	Constituents addressed by BMPs					
		Sediment	Nutrients	Pathogens	Pesticides	Metals	Other
	Landscape efficient irrigation system preventing excess irrigation and reducing dry weather runoff by implementing irrigation controls consistent with County Water Conservation Resolution or City equivalent and including, if necessary, water sensors or programmable irrigation short cycles times		X		X		
	Landscape fertilization and pesticide controls minimizing potential discharges by storing and applying such materials in accordance with County Management Guidelines for fertilizers and pesticides (located in the DAMP)		X		X		
	Dumpster areas diverting drainage from adjoining roof and pavement area around such areas						Trash
	Common area runoff minimizing landscape design grouping plants with similar water requirements in order to reduce excess irrigation and promote surface filtration		X		X		

Table A-1
Example of Range and Types of BMPs to be Considered

Phase of Project	Typical BMPs to be considered in selection process	Constituents addressed by BMPs					
		Sediment	Nutrients	Pathogens	Pesticides	Metals	Other
	Common area litter control designing and implementing a litter control program which may include litter patrols, emptying of trash bins, maintaining trash bins, and educating tenants regarding litter reduction						Trash Hydrocarbons
	Public education distributing brochures at the time of initial sale or lease describing to homeowners, tenants, occupants, and employees of resident businesses topics such as the management of fertilizers, pesticides, chemicals; introduction into storm drains of oil, paints, and other pollutants; effective cleaning practices; proper landscaping practices; and impacts of over-irrigation	X	X	X	X	X	Trash Hydrocarbons
Post Construction (Treatment Controls)	Inlet trash racks where appropriate to reduce floatable debris, installing such racks where drainage from open areas enters the storm drain system						Trash
	Filtration where practicable, directing runoff to landscaped or vegetated areas, or to inlets with drain inlet filters	X	X	X	X	X	
	Energy dissipation devices installing such devices where new storm drains enter unlined channels	X	X			X	
	Detention basins designed to store stormwater runoff for a sufficient period of time to allow for the removal of pollutants through sedimentation						
	Mechanical Screening/Sedimentation devices designed to separate trash, debris and sediment from runoff	X					Trash

ATTACHMENT B WATER QUALITY MODEL DESCRIPTION

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1.0 INTRODUCTION

Urbanization changes the hydrology of a watershed by reducing infiltration and evapotranspiration and increasing runoff. The replacement of vegetated open space with roads, rooftops and other impervious surfaces increases runoff rates, velocities, and volumes. Urban structures and activities also introduce pollutants that are mobilized during rainfall events. These hydrologic and water quality changes are analyzed to determine the effect of the project on pollutant loads and concentrations discharged to receiving waters.

A water quality model was used to estimate pollutant loads for existing and post-development conditions. The model is based on observed relationships between rainfall and runoff, and water quality and land use. The model is adapted from an empirical method referred to as the Simple Method (Schueler 1987). The model was developed to provide a simple yet reasonably reliable method for predicting runoff volumes, pollutant loads, and resulting pollutant concentrations that occur as a result of development; and to provide estimates of the improvement in water quality from the implementation of Best Management Practices. The model steps for calculating runoff volumes are based upon observed relationships between runoff volumes and impervious areas in urban development. Pollutant load estimates are based upon observed pollutant concentrations in stormwater runoff from specific types of urban land uses. The model was originally based upon data collected in the Washington D.C. area and by the National Urban Runoff Program (NURP, EPA 1983) for development of the model parameters.

Empirical models of this type are commonly used to estimate pollutant loads and/or concentrations from small development sites to large watersheds (Wong et al., 1997). This method allows for selection of model inputs to reflect regional conditions, while the procedure of estimating runoff volumes and loads can be applied anywhere. Adaptations to the model used for this water quality analysis include a more detailed rainfall analysis; the use of specific water quality characteristics derived from local monitoring when possible; and use of the National Stormwater Best Management Practices Database for estimating the performance of planned Best Management Practices (BMPs).

The following constituents were modeled:

- Total Suspended Solids
- Total Phosphorus
- Nitrogen (TKN and nitrate)
- Total Copper
- Total Lead
- Total Zinc

These pollutants were chosen because they are commonly found in runoff from residential and commercial land use and reliable land use water quality data in the form of event mean concentrations (EMCs are the flow-weighted composite concentrations) are available.

As with all environmental modeling, the accuracy of model results is dependent on how well the hydrologic, water quality, and structural BMP effectiveness data describe the actual site characteristics. Consequently, local and regional data (as opposed to national data) are used to the fullest extent possible, and model results are evaluated carefully based on experience.

1.1 Project Design Features

Storm water runoff from the Northern Sphere Area development site discharges to several drainage channels: the Central Irvine Channel, Trabuco Channel, Marshburn

Channel, Bee Canyon Channel, Round Canyon Channel, and the Agua Chinon Wash. Runoff from Planning Area 9 is discharged to the Jeffrey/Trabuco Retarding Basin, which in turn flows to the Central Irvine Channel. Planning Area 6 spans three drainage areas and runoff discharges to the Agua Chinon and Marshburn Retarding Basins and the Agua Chinon Wash, Bee and Round Canyon Channels, and Marshburn Channel. Planning Areas 5B and 8A are currently routed to the Central Irvine Channel. Flows from Central Irvine Channel enter Peters Canyon Wash, and flows in Marshburn and Agua Chinon channels enter San Diego Creek (Reach 2). Thus, portions of the development drain to Peters Canyon Wash and other portions drain to the upper reaches of San Diego Creek.

The project proponent proposes to include as part of the project design a feature (the Project Design Feature or PDF) to improve the quality of storm water runoff from the development area. The PDF consists of two components. First, the existing Trabuco Retarding Basin will be modified to treat over a 24-hour period the volume of runoff produced by a 24-hour, 85th percentile storm event (runoff from a 0.75 inch, 24-hour storm) over the 1226 acre Planning Area 9, which constitutes approximately 40 percent of the development area. The release rate of this basin will be 24 hours, during which time pollutant removal will occur, primarily through settling of suspended solids and associated pollutants.

Second, for the remaining 60 percent of the development area (those area within Planning Areas 5B, 6 and 8A which are not tributary to the Trabuco Retarding Basin and which will be developed), BMPs (for example, BMPs that achieve similar performance per the National BMP Database ratings as catch basin inserts) will be designed to infiltrate, filter or treat the volume of runoff produced by either (a) a 24-hour, 85th percentile storm event (runoff from 0.75 inch, 24-hour storm), or (b) the maximum flow rate of runoff produced by a rainfall intensity of 0.2 inch of rainfall per hour. For the purposes of modeling, a network of catch basin inserts has been assumed. Catch basin inserts are screens or filters that can be installed in existing or new storm drains. For this project, the performance standard has been assumed to require a BMP or set of BMPs that would capture and treat the volume or flow rate of runoff described above. This assumes that a sufficiently large network of catch basin inserts will be installed throughout Planning Areas 5B, 6 and 8A to provide the required level of treatment.

1.2 Modeling Steps

The modeling method consists of the following steps:

1. Estimate the mean annual volume of rainfall a watershed receives that exceeds its infiltrative and evaporative capacity over a given period (one year).
2. Evaluate pre- and post-development land uses, land areas, and percent impervious values.
3. Estimate runoff using observed relationships between percent imperviousness and runoff volumes.

4. Estimate runoff water quality based on observed statistical data from similar land-use types.
5. Compute pollutant loads by multiplying the concentration in stormwater runoff by the predicted runoff volume.
6. Estimate the treatment performance of BMPs in terms of effluent quality achieved or percent reduction in loads or concentration.
7. Sum flows and loads from individual sub-areas just upstream of the BMPs. Estimate the reduction in concentration and load (and possibly flow) based on anticipated BMP performance.
8. Sum flows and loads from the project area to estimate predicted average annual pollutant loads and average concentrations.
9. Compare predicted post-development concentrations (from step 8) to pre-development conditions (from step 5), appropriate water quality criteria, and/or water quality design standards.
10. Compare post to pre-development loads.

The data analysis and evaluation of steps 1, 2, and 4 are discussed in the section on model parameters (Sections 2.1, 2.2, 2.3 respectively). The model calculations described by steps 3, 5, and 8 are discussed in Section 1.3. The evaluation of the model results described by the modeling steps 9 and 10 are contained in the Water Quality Assessment – the main part of this report.

<u>1.3 Model Calculations</u>

Runoff Volumes (Step 3)
An analysis of local rainfall data is performed to estimate the annual depth of rainfall that is likely to result in surface runoff (step 1, Section B.2.1). The annual volume of stormwater runoff, resulting from the annual rainfall, can be predicted with the following formula (based upon the rational formula, only using depth rather than intensity to result in volumes rather than flow rate).

$$Q = Rv \times I \times A$$

Where: Q: runoff (volume/year)
Rv: mean annual runoff coefficient
I : rainfall (depth/year)
A: drainage area

The runoff coefficient (Rv) is a unit-less value that is a function of the imperviousness of the watershed and is approximated in the model by the equation:

$$Rv = 0.007 \times (\%\ \text{impervious}) + 0.1 \qquad \text{(FHWA 1990).}$$

Mean annual runoff volumes are calculated for each type of land use utilizing the above method based on land use runoff characteristics, mean annual rainfall, and drainage basin area.

Pollutant Loads & Concentrations (Step 5)
Flow and EMC values are used to calculate the yearly load of a pollutant as shown in the equation below.

$$\underbrace{\frac{lbs}{year}}_{\text{Load}} = \underbrace{\frac{ft^3}{year}}_{\text{Runoff}} \times \underbrace{\frac{mg}{L}}_{\text{EMC}} \times \underbrace{\frac{6.2428\times10^{-5}\ {}^{lbs}\!/\!_{ft^3}}{{}^{mg}\!/\!_{L}}}_{\text{Conversion Factor}}$$

This process gives yearly load calculations for each land use type for each area (or sub-basin) modeled.

Average Annual Pollutant Loads and Concentrations (Step 8)
Once the average annual runoff volume and pollutant load have been determined for each land use within each planning (or drainage) area these result are combined into average annual results by planning area (or drainage area or other delineation).

The average annual concentration is calculated for each pollutant for each planning area by summing the pollutant load results for the individual land uses within the area and dividing this by the summation of the total stormwater runoff volumes of the areas.

$$\underbrace{\frac{mg}{L}}_{\text{Concentration}} = \left[\underbrace{\Sigma\frac{lbs}{year}}_{\text{Total Load}} \div \underbrace{\Sigma\frac{ft^3}{year}}_{\text{Total Runoff}}\right] \times \underbrace{\frac{6.2428\times10^{-5}\ {}^{lbs}\!/\!_{ft^3}}{{}^{mg}\!/\!_{L}}}_{\text{Conversion Factor}}$$

2 MODEL PARAMETERS

2.1 Annual Rainfall Depth

National Climatic Data Service (NCDC) hourly rainfall data from the Fullerton Dam and Santiago Dam weather stations were analyzed to develop descriptive rainfall characteristics for the site. Fullerton Dam is close in elevation to the project site, but it is about 14 miles to the northwest, while the Santiago Dam gauge is much closer physically, but at a higher elevation. Analysis was conducted at both station to evaluate effects of distance and elevation between the stations on rainfall characteristics. The differences in location and elevation do not result in significantly different average annual rainfall or storm characteristics.

Hourly rainfall data is analyzed with the synoptic rainfall analysis program SYNOP developed by USEPA (USEPA, 1989), which converts the data into individual storm events and computes event and annual rainfall statistics. This analysis used an inter-event time of 6 hours (USEPA, 1989) and a minimum storm event size of 0.10 inches. This results in rainfall periods separated by less than 6 hours being aggregated into a single storm event. Storm events equal to and less than 0.10 inches on average are not expected to contribute significantly to runoff.

Additional investigations into available rainfall data revealed average annual rainfall information for the El Toro Marine Corps Air Station. Hourly rainfall data were not available at this site, which prevents rainfall analysis to estimate the rainfall depths from storms that are expected to result in stormwater runoff. Due to the close proximity of the station to the development site, despite the lack of hourly data, this station was felt to be most representative of the project site. The average annual rainfall used in the water quality model is based on the El Toro rainfall data.

Table 1: Parameters Used for Selection of NCDC Rainfall Station

Location	Latitude	Longitude	Elevation (feet)
Project Site	33^{o} 41’ N	117^{o} 44’ W	≈ 300 - 400
Fullerton Dam Station	33^{o} 53’ N	117^{o} 53’ W	340
Santiago Dam Station	33^{o} 47’ N	117^{o} 43’ W	855
El Toro Station	33^{o} 40’ N	117^{o} 44’ W	383

Table 2: Rainfall Analysis Statistics (analysis for storms > 0.1 inches depth)

Station	Average annual rainfall (inches)	Average number of events	Average duration (hours)	Average intensity (inches/hr)	Average Storm Depth (inches)
Fullerton Dam[1]	13.0	17	12.1	0.065	0.75
Santiago Dam[1]	12.7	16	11.6	0.069	0.80
El Toro[2]	12.4[3]	Unknown	Unknown	Unknown	Unknown

1 – Source: SYNOP analysis of NCDC Hourly Precipitation data from Hydrosphere Data Products, Boulder, CO. 1999.
2 – Source: NOAA website http://www.wrh.noaa.gov/sandiego/eltoro.html
3 – includes all storm events

2.2 Land Use Areas and Percent Imperviousness

Pre-Development Condition

The existing land uses for the project area are approximately 2,505 acres of agricultural and nursery land uses, and 5,213 acres of open space of which the majority (3,745) is in Planning Area 3. Percent imperviousness values were estimated as 0% for open space, 0% for crops not covered by plastic, and 50% for crops which are covered by plastic (strawberries), and 100% for the water body in PA 6 (i.e. all rainfall on the water surface is considered to contribute to stormwater runoff volumes). Where plastic mulch is used, the plastic covers most of the planted area. Runoff from the plastic covering the soil flows into the unlined ditches between the rows of berries, where some of the water may infiltrate into the soils. Based on these considerations we have assumed an effective imperviousness of 50% for the areas having plastic mulch. The nursery land use has been estimated as 10% impervious, resulting in a runoff coefficient of 0.17, to account for compacted soils, buildings, roads, and greenhouses. This value is comparable to the estimate for cultivated flat sandy loam soils of 0.2 provided by Novotny and Olem (1994). Runoff coefficients listed at a Purdue University website for crop land use range from 0.2 for crops with conservation water rates (i.e. low water use) and well drained soils to 0.3 for poorly drained soils. The runoff coefficients used in the water quality model (Table 3) for row crops and nurseries ranged from 0.1 to about 0.2, except for strawberries, where the runoff coefficient was estimated at 0.45 because of the presumed effects of the plastic mulch.

Post-Development Condition

The project area development plans include 2,740 acres of urban development. Approximately 4,597 acres will be preserved including 3,745 acres in Planning Area 3. The acreages for both pre- and post-development conditions and the assumed percent imperviousness assigned to each type of land use are listed in Table 3.

Table 3: Land Use (acres) and Modeling Assumptions (Acres)

Land Uses & % Imperviousness			Project Planning Areas					Totals	Modeled as
			2/3[1]	**5B**	**6**	**8A**	**9A**		
Existing Conditions	Open Space	0	3,745	32	1,304		132	5,213	Open
	Ag – Nursery	10		224	231		344	799	Row crop
	Ag – Strawberries	50		63	110		573	746	Row crop
	Ag - Other Row Crops	0			81[3]	73	228	382	Row crop
	Ag – Orchards	0			378			378	Orchards
	Ag – Grazing	0			200			200	Open
	Water Bodies	100			25			25	Water
	Totals		**3,745**	**319**	**2,329**	**73**	**1,277**	**7,743**	
Developed Conditions	Preservation[2]	0	3,745		852			4,597	Open
	Recreation	0			258		72	330	Open
	Commercial Recreation	0					51	51	Open
	Water Bodies	100			25			25	Water
	Medium Density Res.	60		319	866	73	678	1,936	SF Res.
	Medium-high Density Res.	70					89	89	MF Res.
	Multi-use	90			20		60	80	Commercial
	Community Commercial	90			20			20	Commercial
	Medical and Science	90			285		317	602	Commercial
	Institutional	70			3		10	13	Education
	Totals		**3,745**	**319**	**2,329**	**73**	**1,227**	**7,743**	

Notes:

1 – Planning Area 3, Implementation District "P" in Planning Area 2 and the Trabuco Retarding Basin were not included in the water quality model because there are no land use changes proposed for these areas as part of the Project. As a result, water quality in these areas would not be affected by the proposed development.

2 - Preservation: open space areas that will be preserved in their existing condition

3 – Agricultural uses including some equipment and material storage

Sources: Northern Sphere Area Pre-Annexation Development Agreement, Screencheck Draft (Table 2-2), and table of leased agricultural acreage provided by P. Changala, TIC.

Roads within the project are incorporated into the residential and commercial acreages for the purposes of estimating contaminant concentrations used in the water quality model. The street areas have been included in the residential and commercial use areas because the stormwater monitoring data used in the model is obtained from basins that include the runoff from residential and commercial streets. Planning area 3 will not be affected by the proposed project. Therefore, to allow for a more meaningful comparison between pre- and post-development pollutant loads and concentrations, the 3,798 acres of open space (preservation and recreation) areas in planning area 3 were not included in the water quality model (including this large land area in the model analysis would mask changes in the areas proposed for development).

2.3 Event Mean Concentrations (EMCs)

The type of land use within a watershed has been shown to affect the types and concentrations of pollutants found in runoff. Numerous studies have been conducted to characterize runoff quality as function of land use. A review of available water quality monitoring data in southern California was conducted to obtain more recent local and regional EMC data in order to estimate the levels of contaminants expected to be associated with the pre- and post-development land uses on the project site. The counties of Los Angeles, San Diego, and Ventura have conducted stormwater monitoring studies that differentiate the monitored basins by type of land use (e.g. residential, commercial, open space). Tables 4 displays the mean stormwater concentrations of pollutants from the LA and Ventura County monitoring data. These values have been used in the model to represent the stormwater EMC values.

Table 4: Event Mean Concentration Data: Values for Selected Land Uses

Parameter	Units	LA County Monitoring Data[1]					Ventura County[2]	
		Open Space / Parks	Schools	Single Family Res.	Multi Family Res.	Commercial	Agriculture	
							Row Crops	Orchards
TSS	mg/l	186	95	95	46	66	1176	4267
Total Phos	mg/l	0.16	0.31	0.39	0.19	0.39	2.70	2.02
TKN[3]	mg/l	0.79	1.65	2.89	1.96	3.4	7.65	9.23
NO_3	mg/l	1.05	0.51	0.86	1.10	0.48	11.13	3.79
Total Copper	ug/l	15	24	15	12	39	132	465
Total Lead	ug/l	2.5[4]	4.9	10	5.8	18	47	108
Total Zinc	ug/l	46	140	79	150	241	324	397

1) LA County data, mean values, from Los Angeles County 1994-2000 Stormwater Monitoring Report
2) Ventura County data, mean values, from Ventura County Flood Control Department Stormwater Monitoring Reports November, 1997 through July, 2001 (ten events for crops, nine for orchards).
3) Total Kjeldahl Nitrogen (organic nitrogen and ammonia)
4) Insufficient data above detection limit to determine EMC, EMC set to 0.5 ×detection limits

The mean values from monitoring of row cropland uses are also used to represent nurseries, while the grazing land use is represented with open space monitoring data. The basis for representing these agricultural practices with data available from other types of land uses is discussed in Section 3.1.

3.0 MODEL RELIABILITY

The reliability of a water quality model is traditionally evaluated by comparing model predictions with actual field data. This approach is not appropriate here as projections are being made for conditions that currently do not exist. However, there are a number of indicators that can be applied to help address model validity.

3.1 Representativeness of Land Use Water Quality Data

The characteristics of the drainage areas from which the model data was obtained are similar to those of the proposed project site, primarily flat lands used for row crops and more hilly areas used for orchards. The mix of row crops grown in the Ventura County drainage area is similar to the mix grown in the Northern Sphere Area, although at any given time, the specific crops planted at both sites are likely to vary. The orchards in the Ventura County drainage area are largely avocado orchards located on slopes, as are the orchards located in the Northern Sphere Area. Topography, soils, and precipitation appear to be similar. Irrigation and mulching techniques also appear to be similar.

Existing water quality conditions for the nursery uses were estimated using row crop data from Ventura County. This data is considered to be representative of the nursery uses because both areas have similar topography (relatively flat) and are expected to have similar practices with respect to irrigation and chemical use (fertilizers, pesticides, and herbicides). Existing water quality conditions for the grazing uses were estimated using open space data from upland Los Angeles County. This data is considered to be representative of the grazing uses because both areas have similar topography and are expected to have similar practices with respect to irrigation and chemical use (neither uses irrigation or chemicals). In addition, the grazing is highly managed to avoid over-grazing with its associated erosion.

For these reasons, the estimates in the analysis below are considered to be reasonable approximations of existing storm water quality conditions for development areas within the project site.

The following provides more detail on the sites from which data were obtained and the extent to which these sites appear to be representative of conditions in the Northern Sphere Area.

Description of Ventura County Agricultural Sites

As part of its Municipal Separate Storm Sewer System Permit (MS4 Permit), the Ventura County Flood Control District conducts storm water monitoring to determine water quality of stormwater runoff from areas with specific land uses. These sites include two stations monitoring catchments with predominantly agricultural uses that have been used to represent specific land use types in the water quality model: Wood

Road at Revolon Slough (station A-1) and La Vista Avenue (station W-3) in the Upper Revolon Slough.

The Wood Road at Revolon Slough Station is located on Revolon Channel just downstream of Laguna Road in Oxnard, Ventura County. The station receives runoff from a watershed that is approximately 350 acres, and is used primarily for row crops. The watershed contains a small number of farm residences and ancillary farm facilities for equipment maintenance and storage. With regard to irrigation practices, sprinklers are used for plant establishment; once the plants are established, farmers switch to drip irrigation. Plastic mulch is required during certain life stages of some crops, namely strawberries.

Stormwater samples are collected as either grab samples or flow-based composite samples. The water quality data from water years 96/97, 97/98, 98/99, and 2000/01, are available for the Wood Road site. During this period 9 grab samples and 10 flow composite samples were obtained during runoff events. The data from the flow composite samples were used in the modeling as these are more appropriate for estimating pollutant loads.

The mix of row crops grown in the Wood Road watershed are similar to those grown in the Project area; although at any given time, the specific crops planted at both sites are likely to vary. Based on field visits to the site and review of precipitation data, topography, and soils, conditions at the Ventura County site appears to be quite similar to those at the Project site. Irrigation and mulching techniques also appear to be similar. The data set (10 sampling events) includes flow composite samples that have been taken over a range of storm events and is therefore reasonably robust.

The La Vista Avenue Station is located south of Center Road in the Upper Revolon Slough Watershed in foothills to the north of the city of Camarillo and south of the Santa Clara River in Ventura County. The watershed draining to this monitoring location consists of 752-acres and is used for avocado orchards, which are estimated to cover approximately 85% of the land area. The watershed is less than 2% developed with the developed areas consisting of facilities used to support the farming practices. The remaining areas are undeveloped open spaces. The orchards located in the Northern Sphere Area are largely avocado orchards located on slopes and are similar in both crop type and topography to the watershed monitored by the La Vista Avenue Station. The stormwater monitoring data collected by Ventura County at this site is considered to be a reasonable approximation of existing orchard land uses at the development site for these reasons.

Stormwater samples are collected as either grab samples or flow-based composite samples. The water quality data from water years 96/97, 97/98, 98/99, and 2000/01, are available for the La Vista Avenue site. During this period 10 grab samples and 6 flow composite samples were obtained during runoff events. Data included in the EMC estimates for three storms during the 97/98 water year were collected by grab sample during peak flow condition due to equipment malfunctions or vandalism preventing collection of composite samples. All other data consisted of composite samples, which is generally more representative of EMC values. The data set (10 sampling events) includes flow composite samples that have been taken over a range of storm events and is therefore reasonably robust.

Description of Los Angeles Urban Sites

Los Angeles County has been monitoring stormwater quality since the mid 1990s. The monitoring includes flow composite sampling at various “land use stations” that contain primarily one type of land use including single family, multi family, and mixed residential land uses. Table 5 shows some the land use stations monitored by LA County that were used in the modeling for the Northern Sphere Area Development Project. The LA County data also is comprehensive in that it contains 30-60 samples per site and most samples are above detection (Table 6). This number of samples provides a robust statistical characterization of the storm water quality data.

Table 5: LA County Stations used for Land Use Water Quality Modeling

Station Name	Station	Land Use	Site Description	Years Monitoring Conducted
Project 620	S18	Single Family Residential	Located in the Los Angeles River watershed in City of Glendale. The monitoring station is at the intersection of Glenwood Road and Cleveland Ave. Land use is predominantly high-density single family residential. Catchment area is approximately 120 acres.	1996-2000
Santa Monica Pier	S08	Commercial	The monitoring site is located near intersection of Appian Way and Moss Ave. in Santa Monica. The storm drain discharges below the Santa Monica Pier. Catchment area is approximately 81 acres.	1997-2000
Project 404	S26	Multi-Family Residential	Located in Los Angeles River watershed in City of Arcadia. The monitoring station is located along Duarte Road, between Holly Ave and La Cadena Ave. Catchment area is approximately 214 acres.	1996-2000
Dominguez Channel	S23	Freeway	Located within the Dominguez Channel Los Angeles Harbor watershed in Lennox, near LAX. The monitoring station is near the intersection of 116th Street and Isis Ave. Land use is predominantly transportation and includes areas of LAX and Interstate 105.	1996-2000
Sawpit Creek	S11	Open Space/ Parks	Located in Los Angeles River watershed in City of Monrovia. The monitoring station is Sawpit Creek, downstream of Monrovia Creek. Sawpit Creek is a natural watercourse at this location.	1996-2000

Station Name	Station	Land Use	Site Description	Years Monitoring Conducted
			Catchment area is approximately 3300 acres.	
Project 474	S25	Education	Located in Los Angeles River watershed in the Northridge section of the City of Los Angeles. The monitoring station is located along Lindley Ave , one block south of Nordoff Street. The station monitors runoff from the California State University of Northridge. Catchment area is approximately 262 acres.	1997-2000

Source: Los Angeles County 1999-2000 Draft Stormwater Monitoring Report (Los Angeles County, 2000)

Table 6: Event Mean Concentration Data: Number of Samples & Percent Detects

Parameter	LA County Monitoring Data									
	Open Space		Education		S.F. Residential		M.F. Residential		Transportation	
	#	%	#	%	#	%	#	%	#	%
TSS	39	97	39	100	30	100	36	97	61	100
Total Phos	39	59	37	100	32	100	30	97	59	98
Dissolved Phos	37	43	37	97	32	100	30	97	59	95
TKN (Kjeldhal)	40	100	39	100	35	100	41	100	61	100
NO_3	40	98	39	69	32	66	37	68	61	75
NO_2	43	30	39	67	33	64	37	73	64	84
Total Copper	34	56	42	100	32	94	45	91	54	100
Total Lead	34	9	42	29	32	56	45	31	54	46
Total Zinc	45	27	42	88	38	66	45	89	65	100

Note - # = number of samples collected, % = percentage of samples with detectable levels of parameter;

Use of Available Monitoring Data for Existing Grazing and Nursery Land Uses

Monitoring data is available to estimate EMCs for the row crop and orchard land uses in the proposed development area, but comparable data for nurseries and grazing are not currently available. Therefore it is necessary to represent these existing land uses with data collected from monitoring areas that are believed to have similar stormwater pollutant concentrations.

Nurseries are believed to impact stormwater quality due to the use of fertilizers, associated farming machinery, and other chemicals such as pesticides and herbicides. Nurseries are represented in the water quality model with the EMC values from monitoring of row crops because of the similarity in topography, irrigation practices, and fertilization and other chemical application practices.

Grazing land uses have been represented in the water quality model with monitoring data collected for open space land uses, which does not reflect any increased pollutant loads due to this land use. This decision was based on limited scientific literature indicating well managed grazing has only minor impacts on sediment and nutrient loads. Owens et al. (1983) monitored a 26 hectare unimproved pasture in Ohio for two years prior to the introduction of a 17 cow herd for summer grazing. Monitoring conducted for three years with grazing found small increases in concentrations of nitrogen compounds and no appreciable change in total phosphorous concentrations. For example average annual concentrations of nitrate-as-nitrogen increased from 0.5 to 0.7 mg/L. Edwards et al. (2000) simulated the effects of grazing through application of cattle wastes and mowing of vegetation to 30 plots of a silt loam soil constructed at the University of Kentucky. Experimental results did not demonstrate considerable increases in sediment or nutrient loads due to the simulation of grazing effects. This is likely to be particularly true for the existing grazing because that grazing is highly managed, which minimizes erosion and sediment generation.

3.2 Comparison of Land Use Data Used in Model with Local In-stream Water Quality Data

A second indicator of model reliability is based on how well the water quality concentration data used in the model compare with local data. Ideally this comparison would be with local land-use-specific runoff data; however, the data collected by the County of Orange is mixed land use data collected within streams tributary to the coast. The in-stream data thus reflects runoff and pollutant contributions from the entire watershed including open space upland areas, transportation corridors, and in-stream sources. Table 7 compares water quality data taken from San Diego Creek and Peters Canyon Wash with agriculture and single-family residential land use data used in the model. In most cases the in-stream data are bracketed by the land use data. This is appropriate given that the in-stream data generally represents mixed land uses and agricultural and residential land use data generally bound the land use data. The only exception is the high levels of TSS in San Diego Creek. These numbers are relatively high because there is extensive down cutting in Serrano Creek, a tributary to San Diego Creek. This comparison, although by no means comprehensive, does provide some level of confidence that the land use data sets used in the model, although taken from sites outside of Orange County, appear to be reasonable surrogates for local conditions.

Table 7: Wet-weather Water Quality in Peters Canyon Wash and San Diego Creek (Reach 2) Compared to Land Use Data Used in Water Quality Model

Location	Units	TSS	NO_3-N	Total Cu	Total Pb	Total Zn
San Diego Creek at Harvard[1]	(mg/l)	1517	3.79	0.047	0.022	0.204
Peters Canyon Wash [2]	(mg/l)	800	6.05	0.048	0.023	0.137
Ventura County Row Crops	(mg/l)	1176	11.13	0.132	0.047	0.324

Location	Units	TSS	NO_3-N	Total Cu	Total Pb	Total Zn
LA County SFR	(mg/l)	95	0.39	0.015	0.010	0.079

n.a. – not available
1 – stormwater monitoring (03/94 to 03/00) average of 15-storm event EMCs
2 –stormwater monitoring (01/94 to 02/00) average of 18-storm event EMC

4.0 MODEL RESULTS

4.1 Project Design Feature

The project proponent proposes to include a PDF to improve the quality of storm water runoff from the development area. The PDF consists of two components. First, the existing Trabuco Retarding Basin will be modified to treat over a 24-hour period the volume of runoff produced by a 24-hour, 85th percentile storm event (runoff from a 0.75 inch, 24-hour storm) over the 1226 acre Planning Area 9, which constitutes approximately 40 percent of the development area. The release rate of this basin will be 24 hours, during which time pollutant removal will occur, primarily through settling of suspended solids and associated pollutants.

Second, for the remaining 60 percent of the development area (those area within Planning Areas 5B, 6 and 8A which are not tributary to the Trabuco Retarding Basin and which will be developed), BMPs (for example, BMPs that achieve similar performance per the National BMP Database ratings as catch basin inserts) will be designed to infiltrate, filter or treat the volume of runoff produced by either (a) a 24-hour, 85th percentile storm event (runoff from 0.75 inch, 24-hour storm), or (b) the maximum flow rate of runoff produced by a rainfall intensity of 0.2 inch of rainfall per hour. For the purposes of modeling, a network of catch basin inserts has been assumed.

The structural BMPs have been modeled as if the detention volume is sized to capture and treat the runoff from the 0.75-inch, 24-hour storm event. The water quality pool has been sized to account for discharge of treated stormwater from the detention basin during the storm event.

The overall treatment performance of a PDF is dependent on two factors: the volume of runoff that can be diverted into the PDF for treatment (or when expressed as a percent - capture efficiency), and the improvement in water quality (or treatment effectiveness). Table 8 summarizes the capture efficiencies for the detention basin and catch basin inserts based on a multi-year analysis of a long-term raingage (see Appendix B).

Table 8: Modeled Scenario, BMPs, and Capture Efficiencies

Basin WQ pool volume (AF)	Basis for sizing WQ pool	Draw down time (hrs)	% Capture efficiency	
			Detention Basin	Catch Basin Inserts
22.1	Volume to process runoff from area 9A for 0.75" event	24	59	60

4.2 Percent Capture of Structural BMPs

Percent capture is the ratio of water (expressed as a percent) that passes through the BMP to the total runoff volume. The water that is not treated in the BMP bypasses the BMP. The percent capture for the Trabuco Retarding Basin was estimated using a continuous modeling of the volume of water in the basin as it fills from storm runoff and empties based on the assumed drain time. The model was run with an input rainfall sequence taken from the Fullerton raingage (785 storm events), which took into account the size and actual sequencing of storms. The continuous analysis also took into account the capacity of the water quality pool (22.1 acres), and the drain time of 24 hours. The analysis was conducted two ways, initially using an Excel spreadsheet type model and results were then checked using EPA's Storm Water Management Model (SWMM). The resulting estimate of the "capture efficiency" for the Trabuco Retarding Basin was 59%.

Catch basin inserts are flow-based BMPs and the capture efficiency is normally based on the number of inserts per acre of catchment, which is not currently available. Capture efficiencies of catch basin inserts are typically around 60 to 70%. A percent capture of 60% was used for the catch basin inserts to provide a conservative estimate of pollutant removal. These estimates are consistent with the proposed PDF.

4.3 BMP Pollutant Removal Performance

The overall performance of a stormwater BMP is a function of the volume of water processed by the BMP (the percent capture as described above) and the treatment effectiveness. Anticipated treatment effectiveness for the Trabuco Basin was based effluent quality data obtained from a number of monitoring studies compiled in EPA's Nationwide BMP database (Table 5). Catch basin treatment effectiveness was characterized in the form of percent removal based on an evaluation of effectiveness data collected by Stenstrom et al (1998).

Table 9: Median Outflow Concentrations for Wet Ponds and % Removal for Catch Basin Inserts

Parameter	Water Quality Basin Outflow Conc.[1] (mg/L)	Catch Basin Insert % Removal[2]
TSS	16.0	21
Total Phos	0.13	14
TKN	1.13	14[3]
NO3-N	0.42	0[4]
Total Cu	0.0058	11
Total Pb	0.0050	15
Total Zn	0.029	5

1 – Estimated from National Stormwater Best Management Practices Database wet pond outflow concentration data. Median value of outflow data from all available studies.
2 - Performance estimate based on Mangarella et al. 2000
3 – TKN consists of organic nitrogen and ammonia. As organic nitrogen is predominantly associated with particulates, the removal of this constituent was estimated to be equivalent to the removal of phosphorous, which is also largely in particulate form.
4 – Because nitrate is water soluble, catch basin inserts (which rely primarily on filtering) were not considered to remove this pollutant.

Based on the information on treatment effectiveness and percent capture, estimates of the overall performance of the BMPs were made. These estimates were then applied to pre-development loads and concentrations to estimate reductions projected to be achieved with the BMPs. These estimates of the reduction in pollutant loads and concentrations are provided in Table 8 and Table 9 respectively.

Tables 10 and 11 present modeling results for pollutant loads and concentrations. Each table contains results for the existing and developed conditions (both with and without the PDF) and the percent changes in load or concentration compared to the pre-development conditions. The percent change results are calculated by dividing the difference between post-development and existing conditions by the existing conditions value (i.e. [post – existing]/existing × 100%).

The load and concentration estimates in the tables are based on runoff estimates and available water quality data that were determined to be the most representative of pre and post-development conditions. These load estimates were modeled for average annual rainfall and represent average annual conditions. During high or low rainfall years, pollutant loading to the receiving waters could vary depending upon the mobilization and dilution of pollutants by the rainfall.

Table 10: Pollutant Loads and % Changes

Development Condition	Units	Annual Q (ft^3)	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
Pre-Dev	Load (lbs/yr)	32,824,101	2,222,400	4,153	12,297	16,821	245.1	79.9	527
Post-Dev (w/o BMPs)	Load (lbs/yr)	78,350,588	445,283	1,757	13,710	3,708	107	55.2	614
% Change (pre vs. post w/o BMPs)		139%	-80%	-58%	11%	-78%	-56%	-31%	17%
Post-Dev (treatment)	Load (lbs/yr)	78,350,588	333,685	1,393	10,907	3,351	81.5	43.7	467
% Change (pre vs. treatment)		139%	-85%	-66%	-11%	-80%	-67%	-45%	-11%

Table 11: Pollutant Concentrations and % Changes

Development Condition	Units	Annual Q (ft^3)	TSS	Total Phos	TKN	NO_3-N	Total Cu	Total Pb	Total Zn
Pre-Dev	Conc (mg/l)	32,824,101	1085	2.03	6.00	8.21	0.120	0.039	0.257
Post-Dev (w/o BMPs)	Conc (mg/l)	78,350,588	91.0	0.359	2.80	0.758	0.022	0.011	0.126
% Change (pre vs. post w/o BMPs)		139%	-92%	-82%	-53%	-91%	-82%	-71%	-51%
Post-Dev (treatment)	Conc (mg/l)	78,350,588	68.2	0.285	2.23	0.685	0.017	0.0089	0.095
% Change (pre vs. treatment)		139%	-94%	-86%	-63%	-92%	-86%	-77%	-63%

4.4 Comparison with California Toxic Rule Criteria

The project drains into receiving waters that are subject to the California Toxics Rules. Although the CTR criteria apply to receiving water quality and not to stormwater discharges, CTR provide criteria that can be used as a benchmark to evaluate the significance of potential impacts of stormwater runoff to receiving waters. Based on monitoring data collected by the County of Orange in the San Diego Creek watershed, typical hardness values tend to range between about 300- 400 mg/l (OC PFRD NPDES Annual Progress Report, 2000).

In order to evaluate the potential for dissolved metal concentrations to exceed CTR criteria, estimates of the dissolved metal concentrations were made based upon results from Sansalone at a highway site (1997) and LA County monitoring data (LACDPW 2000).

Table 12: Fraction of Metals in Dissolved Form

Metal	Estimated Fraction Dissolved[1]
Copper	57
Lead	27
Zinc	56

1 –Sources Sansalone (1997) and LA County (2000)

Table 13: Comparison of Predicted Dissolved Metals Concentrations (ug/l) to CTR Criteria

Metal	Pre-Development	Post Development without PDF	Post Development with PDF	California Toxics Rule Acute Criteria Dissolved Metal Concentration (ug/L) ***(Hardness as CaCO3 300 mg/L)***
Copper	68	13	9.7	38
Lead	11	3.0	2.4	208
Zinc	140	71	53	297

Table 13 shows the predicted dissolved concentrations for copper, lead and zinc compared to the CTR values based on a hardness of 300 mg/l. The hardness value is based on a review of hardness data collected in San Diego Creek by Orange County. Concentrations under post-development conditions are predicted to result in dissolved metal concentrations that are below the CTR acute criteria.

5.0 REFERENCES

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Noise Assessment For:

PROTOCOL AREA

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1.0 EXISTING SETTING

1.1 Project Description

The Protocol Area is generally bounded by Trabuco Road and MCAS El Toro to the south, Jeffrey Road and existing residential development to the west and the Santiago Hills to the North. SR-241 traverses the northern portion of the site and SR-133 traverses the eastern portion of the site. The area covers the City of Irvine Planning Areas 3, 6, 9 and portions of Planning Areas 5 and 8. The project proposes the development of 12,350 residential units and 7,316,000 square feet of retail and industrial uses on 4,390 acres. A vicinity map showing the location of the project and the proposed uses is presented in Exhibit 1.

This report will analyze the potential noise impacts associated with this project. Traffic volume information used in this report to project traffic noise levels was provided by Austin-Foust Associates (August 10, 2001). Noise generated during construction that could potentially impact existing residential areas is discussed. Noise impacts due to increased traffic noise generated by the project are analyzed for three future scenarios as well as cumulatively with several other potential projects. Noise impacts from project site activity on nearby residential areas are discussed. Impacts from traffic noise, off-site activities, and on-site activities on the proposed uses for the project are also analyzed.

1.2 Background Information on Noise

1.2.1 Noise Criteria Background

Sound is technically described in terms of the loudness (amplitude) of the sound and frequency (pitch) of the sound. The standard unit of measurement of the loudness of sound is the decibel (dB). Decibels are based on the logarithmic scale. The logarithmic scale compresses the wide range in sound pressure levels to a more usable range of numbers in a manner similar to the Richter scale used to measure earthquakes. In terms of human response to noise, a sound 10 dB higher than another is judged to be twice as loud; and 20 dB higher four times as loud; and so forth. Everyday sounds normally range from 30 dB (very quiet) to 100 dB (very loud).

Since the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. Community noise levels are measured in terms of the "A-weighted decibel," abbreviated dBA. Exhibit 2 provides examples of various noises and their typical A-weighted noise level.

Sound levels decrease as a function of distance from the source as a result of wave divergence, atmospheric absorption and ground attenuation. As the sound wave form travels away from the source, the sound energy is dispersed over a greater area, thereby dispersing the sound power of the wave. Atmospheric absorption also influences the levels that are received by the observer. The greater the distance traveled, the greater the influence and the resultant fluctuations. The degree of absorption is a function of the frequency of the sound as well as the humidity and temperature of the air. Turbulence and gradients of wind, temperature and humidity also play a significant role in determining the degree of attenuation. Intervening topography can also have a substantial effect on the effective perceived noise levels.

Noise has been defined as unwanted sound and it is known to have several adverse effects on people. From these known effects of noise, criteria have been established to help protect the public health and safety and prevent disruption of certain human activities. This criteria is based on such known impacts of noise on people as hearing loss, speech interference, sleep interference, physiological responses and annoyance. Each of these potential noise impacts on people are briefly discussed in the following narratives:

> **HEARING LOSS** is not a concern in community noise situations of this type. The potential for noise induced hearing loss is more commonly associated with occupational noise exposures in heavy industry or very noisy work environments. Noise levels in neighborhoods, even in very noisy urban environs, are not sufficiently loud to cause hearing loss.
>
> **SPEECH INTERFERENCE** is one of the primary concerns in environmental noise problems. Normal conversational speech is in the range of 60 to 65 dBA and any noise in this range or louder may interfere with speech. There are specific methods of describing speech interference as a function of distance between speaker and listener and voice level.
>
> **SLEEP INTERFERENCE** is a major noise concern for traffic noise. Sleep disturbance studies have identified interior noise levels that have the potential to cause sleep disturbance. Note that sleep disturbance does not necessarily mean awakening from sleep, but can refer to altering the pattern and stages of sleep.
>
> **PHYSIOLOGICAL RESPONSES** are those measurable effects of noise on people that are realized as changes in pulse rate, blood pressure, etc. While such effects can be induced and observed, the extent is not known to which these physiological responses cause harm or are sign of harm.
>
> **ANNOYANCE** is the most difficult of all noise responses to describe. Annoyance is a very individual characteristic and can vary widely from person to person. What one person considers tolerable can be quite unbearable to another of equal hearing capability.

1.2.2 Noise Assessment Metrics

The description, analysis and reporting of community noise levels around communities is made difficult by the complexity of human response to noise and the myriad of noise metrics that have been developed for describing noise impacts. Each of these metrics attempts to quantify noise levels with respect to community response. Most of the metrics use the A-Weighted noise level to quantify noise impacts on humans. A-Weighting is a frequency weighting that accounts for human sensitivity to different frequencies.

Noise metrics can be divided into two categories: single event and cumulative. Single-event metrics describe the noise levels from an individual event such as an aircraft fly over or perhaps a heavy equipment pass-by. Cumulative metrics average the total noise over a specific time period, which is typically 1 or 24-hours for community noise problems. For this type of analysis, cumulative noise metrics will be used.

Several rating scales have been developed for measurement of community noise. These account for: (1) the parameters of noise that have been shown to contribute to the effects of noise on man, (2) the variety of noises found in the environment, (3) the variations in noise levels that occur as a person moves through the environment, and (4) the variations associated with the time of day. They are designed to account for the known health effects of noise on people described previously. Based on these effects, the observation has been made that the potential for a noise to impact people is dependent on the total acoustical energy content of the noise. A number of noise scales have been developed to account for this observation. Two of the predominate noise scales are the: Equivalent Noise Level (LEQ) and the Community Noise Equivalent Level (CNEL). These scales are described in the following paragraphs.

> **LEQ** is the sound level corresponding to a steady-state sound level containing the same total energy as a time-varying signal over a given sample period. LEQ is the "energy" average noise level during the time period of the sample. LEQ can be measured for any time period, but is typically measured for 1 hour. This 1 hour noise level can also be referred to as the Hourly Noise Level (HNL). It is the energy sum of all the events and background noise levels that occur during that time period.
>
> **CNEL**, Community Noise Equivalent Level, is the predominant rating scale now in use in California for land use compatibility assessment. The CNEL scale represents a time weighted 24-hour average noise level based on the A-weighted decibel. Time weighted refers to the fact that noise that occurs during certain sensitive time periods is penalized for occurring at these times. The evening time period (7 p.m. to 10 p.m.) penalizes noises by 5 dBA, while nighttime (10 p.m. to 7 a.m.) noises are penalized by 10 dBA. These time periods and penalties were selected to reflect people's increased sensitivity to noise during these time periods. A CNEL noise level may be reported as a "CNEL of 60 dBA," "60 dBA CNEL," or simply "60 CNEL." Typical noise levels in terms of the CNEL scale for different types of communities are presented in Exhibit 3.
>
> **Ldn**, the day-night scale is similar to the CNEL scale except that evening noises are not penalized. It is a measure of the overall noise experienced during an entire day. The time-weighted refers to the fact that noise that occurs during certain sensitive time periods is

penalized for occurring at these times. In the Ldn scale, those noise levels that occur during the night (10 pm to 7 am) are penalized by 10 dB. This penalty was selected to attempt to account for increased human sensitivity to noise during the quieter period of a day, where home and sleep is the most probable activity.

L(%) is a statistical method of describing noise which accounts for variance in noise levels throughout a given measurement period. L(%) is a way of expressing the noise level exceeded for a percentage of time in a given measurement period. For example since 5 minutes is 25% of 20 minutes, L(25) is the noise level that is equal to or exceeded for five minutes in a twenty minute measurement period. It is L(%) that is used for most Noise Ordinance standards. For example most daytime City, state and county Noise Ordinances use an ordinance standard of 55 dBA for 30 minutes per hour or an L(50) level of 55 dBA. In other words the Noise Ordinance states that no noise level should exceed 55 dBA for more that fifty percent of a given period.

1.2.3 Noise Criteria

City of Irvine Noise Element

Table F-1 of the City of Irvine Noise Element of the General Plan defines indoor and outdoor noise standards for various land use categories. This table is recreated in Exhibit 4. The 65 CNEL outdoor noise standard is applicable to all residential uses, schools and parks. Note that the outdoor standard is only applicable to picnic areas of the parks. The indoor noise standards applicable to the project are the 45 CNEL standard for residential and school uses, the 50 CNEL standard for office uses, the 55 CNEL standard for retail uses and the 65 CNEL standard for manufacturing, warehousing and wholesale uses.

City of Irvine Noise Ordinance

Title 6, Division 8, Chapter 2 of the City of Irvine Municipal Code contains the City of Irvine Noise Ordinance. The Noise Ordinance is designed to control unnecessary, excessive and annoying sounds from sources on private property by setting limits that cannot be exceeded at adjacent properties. The noise ordinance requirements can not be applied to mobile noise sources such as heavy trucks when traveling on public roadways. Control of the mobile noise sources on public roads is preempted by federal and State laws. However, the noise ordinance does apply to vehicles while they are on private property.

The Noise Ordinance specifies noise levels that cannot be exceeded at adjacent properties for a specified period of time. Both interior and exterior noise level limits are specified for four noise zones. The applicable Noise Zone is based on the land use being exposed to the noise. Noise Zone 1 includes all hospitals, libraries, churches, schools and residential properties. Noise Zone 2 includes all professional office and public institutional properties. Noise Zone 3 includes all commercial properties excluding professional office properties. Noise Zone 4 includes all industrial properties. The noise levels limits contained in the noise ordinance are presented in Table 1 for each of these zones. Exterior noise level limits for each of the zones are presented first and then the interior noise level limits are presented. The interior noise level limits for Noise Zones 2, 3 and 4 are the same.

The first column of Table 1 presents maximum amount of time in a one hour period that the noise level shown in Columns 3 and 4 can be exceeded. Column 2 lists the equivalent noise metric in terms of "percent noise level" or L% (The L% metric is described in Section 2.2). Columns 3 and 4 list the daytime and nighttime noise levels that cannot be exceeded for the time specified in the first column.

For example, for Noise Zone 1, a noise level of 55 dBA cannot be exceeded for more than 30 minutes in an hour during the daytime. A noise level of 60 dBA cannot be exceeded for more than 15 minutes in an hour, 65 dBA cannot be exceeded for more than 5 minutes in an hour, 70 dBA cannot be exceed for more than 1 minute in an hour and 75 dBA cannot be exceeded at anytime. During the nighttime, these limits are reduced by 5 dB for Noise Zone 1. The daytime and nighttime noise level limits are the same for Noise Zones 2, 3 and 4.

Table 1
City of Irvine Noise Ordinance Standards

Maximum Time of Exposure	Noise Metric	Noise Level Not To Be Exceeded 7 a.m. to 10 p.m. (daytime)	10 p.m. to 7 a.m. (nighttime)
NOISE ZONE 1 EXTERIOR NOISE STANDARDS			
30 Minutes/Hour	L50	55 dBA	50 dBA
15 Minutes/Hour	L25	60 dBA	55 dBA
5 Minutes/Hour	L8.3	65 dBA	60 dBA
1 Minute/Hour	L1.7	70 dBA	65 dBA
Any period of time	Lmax	75 dBA	70 dBA
NOISE ZONE 2 EXTERIOR NOISE STANDARDS			
30 Minutes/Hour	L50	55 dBA	55 dBA
15 Minutes/Hour	L25	60 dBA	60 dBA
5 Minutes/Hour	L8.3	65 dBA	65 dBA
1 Minute/Hour	L1.7	70 dBA	70 dBA
Any period of time	Lmax	75 dBA	75 dBA
NOISE ZONE 3 EXTERIOR NOISE STANDARDS			
30 Minutes/Hour	L50	60 dBA	60 dBA
15 Minutes/Hour	L25	65 dBA	65 dBA
5 Minutes/Hour	L8.3	70 dBA	70 dBA
1 Minute/Hour	L1.7	75 dBA	75 dBA
Any period of time	Lmax	80 dBA	80 dBA
NOISE ZONE 4 EXTERIOR NOISE STANDARDS			
30 Minutes/Hour	L50	70 dBA	70 dBA
15 Minutes/Hour	L25	75 dBA	75 dBA
5 Minutes/Hour	L8.3	80 dBA	80 dBA
1 Minute/Hour	L1.7	85 dBA	85 dBA
Any period of time	Lmax	90 dBA	90 dBA
NOISE ZONE 1 INTERIOR NOISE STANDARDS			
5 Minutes/Hour	L8.3	55 dBA	45 dBA
1 Minute/Hour	L1.7	60 dBA	50 dBA
Any period of time	Lmax	65 dBA	55 dBA
NOISE ZONES 2, 3, & 4 INTERIOR NOISE STANDARDS			
5 Minutes/Hour	L8.3	55 dBA	55 dBA
1 Minute/Hour	L1.7	60 dBA	60 dBA
Any period of time	Lmax	65 dBA	65 dBA

Noise Zone 1: All hospitals, libraries, churches, schools, and residential properties.
Noise Zone 2: All professional office and public institutional properties.
Noise Zone 3: All commercial properties excluding professional office properties.
Noise Zone 4: All industrial properties.

Noise Ordinance violation issues are typically only of concern where commercial uses directly abut residential uses. For this project, this occurs in four potential locations where potential retail sites may be located directly abutting residential areas. These potential retail sites are located at the northwest corner of Sand Canyon and Trabuco, the southwest corner of Sand Canyon and Irvine, south of Portola parkway and in the southwest corner of Portola Parkway and SR-241. Additionally there are Research/Industrial uses proposed immediately south of residential uses on the east side of the project between Portola Parkway and Irvine Boulevard. Section 2.4.3 discusses on-site impacts from on-site activities.

1.3 Existing Noise Levels

1.3.1 Ambient Noise Measurements

Ambient noise measurements were made in the vicinity of the project. Specifically measurements were made along roadways where the project is projected to cause a significant noise increase (see Section 2.3.1). Fifteen-minute measurements were made at each site. Traffic counts were also made during the measurements. This allowed computer modeling of the traffic noise levels under the same conditions as the measurements. The measured and modeled noise levels can then be compared and the accuracy of the model verified.

Noise measurements were made during the afternoon of August 31, 2001. The measurements were made utilizing a Brüel and Kjœr 2236 Sound Level Meter. This meter satisfies ANSI Type 1 specifications for sound measurement equipment which is the highest accuracy specification. The meter is checked and certified annually to ensure it remains within specifications. The meter was calibrated with an acoustical calibrator before and after the measurements. The acoustical calibrator is calibrated annually with calibration traceable to the National Institute of Standards and Technology.

Table 2 presents the results of the measurements. A site number, short description of the location and the start time of the measurements are presented in the first three columns of the table. The next three columns present the measured Leq, maximum (Lmax) and minimum (Lmin) noise levels.

Table 2
Ambient Noise Measurement Results

Site	Location	Start	Leq	Lmax	Lmin
1	Along Irvine Blvd. 81 ft. from CL	2:08 PM	68	79	45
2	Along Jeffrey 78 ft. from CL	3:11 PM	67	82	45
3	Along Trabuco 85 feet from CL	4:10 PM	58	72	48
4	Along Bryan 63 ft. from CL	4:53 PM	63	75	44
5	Along Portola Pkwy. 96 ft. from CL	5:33 PM	59	73	39

CL – Roadway Centerline

Site 1 was located along Irvine Boulevard in the field north of the road and east of Jeffrey. Site 2 was located along the east side of Jeffrey in the field approximately 1000 feet south of Irvine Boulevard. Site 3 was located on the south side of Trabuco Road in the landscaping between the road and the parking lot of The Jesus Church at 5210 Trabuco. Site 4 was located on the south side of Bryan in the field across Trabuco from the intersection of Duane street west of Jeffrey

Road. Site 5 was located on the south side of Portola Parkway near the bicycle trail underpass west of Jeffrey Road.

For the most part, the measurements show noise levels that would typically be expected along each of the roadways. The noise level along Portola is lower than one would expect along a six lane divided roadway. Development not associated with this project is just taking place in this area and noise is projected to increase significantly over existing conditions due to the additional traffic this development will bring. Heavy trucks or single loud cars typically caused maximum noise levels at all sites.

Traffic noise modeling was performed using the traffic counts made during the measurements. The modeled and measured noise levels were compared. Excellent agreement was found for all of the sites except 1 and 5. At Site 1 along Irvine Boulevard it was found that the model predicted too low of a noise level using the posted 50 mph speed limit. Modeling the speed at 55 mph resulted in excellent agreement. A speed of 55 mph was used for all subsequent noise modeling along Irvine Boulevard presented in this report. At Site 5 the noise model predicted a much higher noise level than was measured. The relatively low traffic volume during the measurement is partly responsible for this. This difference resulted primarily due to majority of traffic traveling in the far lanes rather than the near lanes. Over a longer period this would even out. Because the model predicted a higher noise level than the measured level no adjustments were made.

1.3.2 Existing Traffic Noise Levels

Existing roadway traffic noise levels in terms of CNEL were computed using the Highway Noise Model published by the Federal Highway Administration ("FHWA Highway Traffic Noise Prediction Model," FHWA-RD-77-108, December, 1978). The CALVENO noise emission curves developed by Caltrans were used with the FHWA model. These curves better model the California vehicle mix. The FHWA Model uses traffic volume, vehicle mix, vehicle speed, and roadway geometry to compute the "equivalent noise level." A computer code has been written which computes equivalent noise levels for each of the time periods used in the calculation of CNEL. Weighting these noise levels and summing them results in the CNEL for the traffic projections used.

Table 3 presents the existing traffic CNEL noise levels along roadway segments that experience a 0.5 dB or greater noise level increase due to the project. The CNEL level at a distance of 100 feet from the roadway centerline is presented along with the distances, from the centerline, to the 60, 65 and 70 CNEL contours. The values given in Table 3 represent existing noise levels and do not take into account the effect of any existing noise barriers or topography that may affect ambient noise levels. Areas with noise barriers or structures that break line of sight from a receptor to the roadway will experience lower levels.

Table 3
Existing Traffic CNEL Noise Levels

Roadway & Segment	CNEL @ 100 feet[1]	Distance To Contour[1] 70 CNEL	65 CNEL	60 CNEL
Yale Av.				
Irvine to Bryan	61.9	29	62	133
Bryan to Trabuco	62.9	34	73	156
Trabuco to Walnut	62.8	33	72	155
Jeffrey Rd.				
South of Portola	62.8	33	71	153
North of Irvine	62.8	33	71	153
Irvine to Bryan	65.6	51	110	236
Bryan to Trabuco	65.7	52	112	241
South of Trabuco	67.7	70	151	325
North of I-5	67.7	70	151	325
I-5 to Irvine Center Dr.	68.4	78	167	361
Irvine Center Dr. to Barranca	69.4	92	198	426
Sand Canyon Av.				
South of Portola	62.5	32	68	147
North of Irvine	62.5	32	68	147
South of Irvine	64.7	44	96	206
North of Trabuco	64.7	44	96	206
Trabuco to Roosevelt	65.7	51	111	239
Roosevelt to Road "B"	65.1	47	101	218
Road "B" to I-5	65.7	51	111	239
I-5 to Oak Canyon	67.0	63	136	293
Oak Canyon to Irvine Center Dr.	66.2	56	120	260
Irvine Center Dr. to Barranca	66.3	56	121	261
Alton Pkwy.				
South of Portola	61.1	25	55	118
Portola Pkwy.				
Culver to Yale	61.6	27	59	127
Yale to Jeffrey	61.8	28	61	132
Jeffrey to Sand Canyon	61.6	28	60	128
Sand Canyon to SR-133	65.5	50	108	233
SR-133 to Research	65.5	50	108	233
Research to Millennium	65.5	50	108	233
East of Millennium	65.5	50	108	233
South of SR-241	62.5	32	68	147

1. From Roadway Centerline
RW – Contour Falls Within Roadway Right of Way

Table 3 (Continued)
Existing Traffic CNEL Noise Levels

Roadway & Segment	CNEL @ 100 feet[1]	Distance To Contour[1] 70 CNEL	65 CNEL	60 CNEL
Irvine Bl.				
East of SR-261	67.1	64	137	296
West of Culver	67.1	64	137	296
Culver to Yale	66.5	58	126	271
East of Yale	65.5	50	107	231
West of Jeffrey	65.5	50	107	231
East of Jeffrey	65.0	46	100	216
West of Sand Canyon	65.0	46	100	216
Sand Canyon to SR-133	65.9	54	115	249
SR-133 to Research	66.0	54	117	252
Research to Central Park W.	66.0	54	117	252
Central Park W. to Millennium	66.0	54	117	252
Millennium to Connector	65.6	51	110	236
Connector to Central Park E.	65.6	51	110	236
Central Park E. to Trabuco	65.6	51	110	236
Trabuco to Alton	65.6	51	110	236
Bryan Av.				
Yale to Jeffrey	60.4	23	49	106
Trabuco Rd.				
West of Yale	64.2	41	89	191
Yale to Jeffrey	58.1	16	35	74
Jeffrey to Road "A"	56.3	12	26	56
Road "A" to Collector St.	57.4	14	31	67
Collector St. to Road "C"	57.4	14	31	67
Road "C" Sand Canyon	56.3	12	26	56
SR-133				
Trabuco to I-5	73.3	165	356	766

1. From Roadway Centerline
RW – Contour Falls Within Roadway Right of Way

Table 3 shows that most of the existing roadways with noise levels affected by the project generate considerable amounts of noise. Jeffrey Road north of Irvine, Alton Parkway, Portola Parkway between Culver and Sand Canyon, Bryan Avenue, and Trabuco Road from Yale to Sand Canyon generate moderate levels of noise. Yale Avenue, Jeffrey from Irvine to I-5, Sand Canyon, Portola East of Sand Canyon, Irvine Boulevard and Trabuco west of Yale generate substantial levels of noise. Jeffrey south of I-5 generates significant levels of noise and SR-133 generates high levels of noise. Most of the existing residential uses along these roadways have noise barriers that reduce existing traffic noise levels to below the City’s 65 CNEL standard.

2.0 POTENTIAL NOISE IMPACTS

Potential noise impacts are commonly divided into two groups; temporary and long term. Temporary impacts are usually associated with noise generated by construction activities. Long-term impacts are further divided into impacts on surrounding land uses generated by the proposed project and those impacts that occur at the proposed project site.

2.1 Noise Impact Criteria

Off-site impacts from on-site activities, temporary and long-term, are measured against the City of Irvine Noise Ordinance presented previously. Any noise generated on the project site must comply with the Noise Ordinance.

Long-term off-site impacts from traffic noise are measured against two criteria. Both criteria must be met for a significant impact to be identified. First, project traffic must cause a significant noise level increase on a roadway segment adjacent to a noise sensitive land use. Second the resulting future with project noise level must exceed the criteria level for the noise sensitive land use. In this case the criteria level is 65 CNEL for residential land uses.

In community noise assessment, changes in noise levels greater than 3 dB are often identified as significant, while changes less than 1 dB will not be discernible to local residents. In the range of 1 to 3 dB, residents who are very sensitive to noise may perceive a slight change. Note that there is no scientific evidence is available to support the use of 3 dB as the significance threshold. In laboratory testing situations, humans are able to detect noise level changes of slightly less than 1 dB. In a community noise situation, however, noise exposures are over a long time period, and changes in noise levels occur over years, rather than the immediate comparison made in a laboratory situation. Therefore, the level at which changes in community noise levels become discernible is likely to be some value greater than 1 dB, and 3 dB appears to be appropriate for most people. In this case, many residential areas adjacent to roadways in the project vicinity are projected to have future noise levels approaching the 65 CNEL standard. Therefore, for this project, a 1 dB traffic noise level increase due to the project is considered significant.

Cumulative impacts are measured in terms of the total noise increase due to the project and other growth in the area over existing conditions. Because increases over existing conditions will take place over a long period of time, a 3 dB increase over existing conditions will be considered cumulatively significant.

Long-term on-site impacts are measured against the noise level limits applied by the City of Irvine. For residential land uses and schools, the exterior noise standard is 65 CNEL and the interior noise standard is 45 CNEL. For parks the exterior noise standard at picnic areas is 65 CNEL. For commercial areas the applicable interior noise standards are 50 CNEL for offices, 55 CNEL for retail uses, and 65 CNEL for manufacturing, warehousing and wholesale uses.

2.2 Temporary Impacts

2.2.1 Construction Noise

Construction noise represents a short-term impact on ambient noise levels. Noise generated by construction equipment, including trucks, graders, bulldozers, concrete mixers and portable generators can reach high levels. For the proposed project, the highest noise levels will be generated by heavy equipment during grading.

Worst-case examples of construction noise at 50 feet are presented in Exhibit 5. The peak noise level for most of the equipment that will be used during the construction is 70 to 95 dBA at a distance of 50 feet. At 200 feet, the peak construction noise levels range from 58 to 83 dBA. At 400 feet the peak noise levels range from 52 to 77 dBA. Note that these noise levels are based upon worst-case conditions. Typically, noise levels near the site will be less. Noise measurements made by Mestre Greve Associates for other projects show that the noise levels generated by commonly used grading equipment (i.e. loaders, graders and trucks) generate noise levels that typically do not exceed the middle of the range shown in Exhibit 5.

The greatest potential for noise impacts during construction occurs where construction will occur directly adjacent to residential areas. This will occur on the west side of the project between Trabuco and Bryan and between Irvine and Portola. Noise levels could reach very high levels for short periods of time as heavy grading equipment traveled directly adjacent to the residences. The noise levels could exceed 100 dBA for very short periods of time as heavy equipment travels directly adjacent to the homes. As the equipment travels away from these homes the noise level will drop from the extreme maximum relatively quickly. Because these areas are currently being used as agricultural uses and are relatively flat a great deal of grading is not expected and grading adjacent to the residences should occur for a relatively short duration.

The City of Irvine Noise Ordinance exempts construction activities from the noise level limits during specific hours of the day. Noise generating construction activities are permitted during the hours between 7 a.m. and 7 p.m. Monday through Friday 9 a.m. to 6 p.m. on Saturday and at no time on Sundays or national holidays. Any construction occurring within 500 feet of residential areas has the potential to exceed the Noise Ordinance limits and should only occur during the time periods specified by the Noise Ordinance. This is discussed further in the Mitigation Section.

2.3 Long Term Off-Site Impacts

This section examines noise impacts from the proposed project on the surrounding land uses. Specifically traffic noise increases due to the project are examined as well as potential noise impacts from activities on the project site.

2.3.1 Traffic Noise

The project will result in additional traffic on the roadways in the vicinity project. This increase in traffic will result in increased noise levels being generated by these roadways. This section analyzes the potential noise impacts from these increases. Table 4 presents the noise level changes in future years along roadway segments in the vicinity of the project. Only roadway segments with noise level changes greater than 0.5 CNEL due to the project are shown in Table 4. All other roadway segments analyzed had noise level changes of less than 0.5 CNEL.

The first column of Table 4 lists the roadway and segments. The next three columns show the change in existing noise levels for three future year scenarios. That is, how much louder or quieter the future noise levels with the project will be compared to the existing conditions. This increase is due to the project as well as all other growth and development in the region. The first two columns present the changes for the year 2025 under two scenarios. The first scenario is with the buildout of the current City of Irvine General Plan in the year 2025 including all roadways in the General Plan. The second scenario only includes roadway improvements which exist, are committed for construction or would be constructed as part of any new development. The first scenario is referred to as the 2025 Build-Out Toll Network and the second scenario is referred to as the 2025 Constrained Toll Network. Refer to the traffic study prepared for the project for a more complete description of these two scenarios. The final scenario represents the year 2040 and beyond with the City of Irvine General Plan completely built out and the transportation corridors operating toll-free.

The next three columns “Change in Future Noise Levels Due to Project” show the increase in noise levels due to the project for the same three scenarios. The values show how much of the noise increase over existing conditions shown in columns two through four is due to the traffic generated by the project. The final column of Table 4 indicates the existence of residential land uses adjacent to the roadways with either a significant increase over existing levels (3 dB or greater) or significant increase due to the project (1 dB or greater). Significant increases are shown in bold-italic. The traffic volumes used to calculate the noise level changes are presented in the appendix.

Table 4
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change In Existing Noise Levels With Project In Year			Change In Future Noise Levels Due to Project			Existing Res.?
	2025[1]	2025[2]	2040	2025[1]	2025[2]	2040	
Yale Av.							
South of Meadowood	--	--	--	0.4	0.7	0.3	
Irvine to Bryan	2.1	2.0	2.0	0.9	0.8	0.7	
Bryan to Trabuco	1.1	1.0	1.0	0.5	0.5	0.5	
Trabuco to Walnut	2.5	2.5	2.4	0.6	0.5	0.6	
Jeffrey Rd.							
South of Portola	***6.3***	***4.3***	***5.8***	0.9	***1.8***	***1.0***	No
North of Irvine	***7.3***	***5.8***	***6.9***	***1.8***	***3.3***	***2.0***	No
Irvine to Bryan	***5.7***	***4.9***	***5.5***	***1.9***	***2.7***	***1.9***	Yes
Bryan to Trabuco	***5.7***	***5.0***	***5.5***	***1.6***	***2.2***	***1.6***	No
South of Trabuco	***4.3***	***3.8***	***4.2***	***1.6***	***2.0***	***1.6***	No
North of I-5	***5.0***	***4.8***	***5.0***	***1.0***	***1.2***	***1.0***	No
I-5 to Irvine Center Dr.	***3.4***	***3.3***	***3.6***	0.6	0.7	0.6	Yes
Irvine Center Dr. to Barranca	2.3	2.2	2.4	0.5	0.6	0.5	

-- Traffic Data Not Provided or Road Does Not Currently Exist
1. Buildout
2. Constrained

Table 4 (Continued)
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change In Existing Noise Levels With Project In Year 2025[1]	2025[2]	2040	Change In Future Noise Levels Due to Project 2025[1]	2025[2]	2040	Existing Res.?
Sand Canyon Av.							
South of Portola	***5.7***	***4.7***	***4.8***	***1.2***	***2.6***	***1.8***	No
North of Irvine	***7.8***	***7.3***	***7.3***	***3.3***	***5.2***	***4.3***	No
South of Irvine	***6.2***	***5.9***	***5.9***	***4.0***	***5.3***	***4.8***	No
North of Trabuco	***6.2***	***5.9***	***5.9***	***4.0***	***5.3***	***4.8***	No
Trabuco to Roosevelt	***6.7***	***6.8***	***7.0***	***1.9***	***2.3***	***2.0***	No
Roosevelt to Road "B"	***7.0***	***7.1***	***7.3***	***1.2***	***1.5***	***1.4***	No
Road "B" to I-5	***7.0***	***7.1***	***7.3***	0.9	***1.2***	***1.1***	No
I-5 to Oak Canyon	***5.4***	***5.4***	***6.1***	0.5	0.6	0.5	No
Oak Canyon to Irvine Center	***4.7***	***4.7***	***5.2***	0.5	0.6	0.5	No
Irvine Center Dr. to Barranca	***4.5***	***4.5***	***5.1***	0.4	0.5	0.4	No
Research							
South of Portola	--	--	--	***1.3***	***1.2***	***1.2***	No
North of Irvine	--	--	--	***1.3***	***1.2***	***1.2***	No
Irvine to Trabuco	--	--	--	0.5	0.4	0.4	
Central Park W.							
Irvine to W. Culture	--	--	--	***2.7***	***2.7***	***2.7***	No
W. Culture to Trabuco	--	--	--	***2.3***	***2.1***	***2.8***	No
Trabuco to Marine	--	--	--	0.8	0.7	0.7	
Central Park E.							
Irvine to Trabuco	--	--	--	***1.0***	***1.0***	0.7	No
E. Culture							
Millennium to Connector	--	--	--	0.4	0.2	0.9	
Connector to Trabuco	--	--	--	0.3	0.4	0.7	
W. Culture							
Central Park W. to W. Culture	--	--	--	***1.8***	***2.2***	***3.0***	No
W. Culture to Millenium	--	--	--	0.8	0.8	***1.2***	No
Millennium Bl.							
South of Portola	--	--	--	***4.4***	***5.3***	***3.1***	No
North of Irvine	--	--	--	***5.3***	***6.3***	***3.9***	No
Irvine to W. Culture	--	--	--	***2.3***	***2.8***	***1.7***	No
South of W. Culture	--	--	--	***2.2***	***2.4***	***1.6***	No
Trabuco to E. Culture	--	--	--	***1.2***	***1.2***	***1.0***	No
North of Central Park E.	--	--	--	***1.2***	***1.2***	***1.0***	No
Alton Pkwy.							
South of Portola	***4.5***	***6.2***	***4.0***	0.6	0.1	0.2	Yes

-- Traffic Data Not Provided or Road Does Not Currently Exist
1. Buildout
2. Constrained

Table 4 (Continued)
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change In Existing Noise Levels With Project In Year 2025[1]	2025[2]	2040	Change In Future Noise Levels Due to Project 2025[1]	2025[2]	2040	Existing Res.?
Portola Pkwy.							
Culver to Yale	***5.8***	***6.5***	***6.0***	0.8	0.9	0.7	Yes
Yale to Jeffrey	***6.6***	***7.0***	***6.9***	0.9	***1.0***	0.8	Yes
Jeffrey to Sand Canyon	***6.3***	***5.6***	***5.7***	***1.1***	***1.5***	***1.1***	No
Sand Canyon to SR-133	***6.5***	***5.6***	***5.5***	***1.9***	***3.0***	***2.7***	No
SR-133 to Research	***6.6***	***5.7***	***5.7***	***2.0***	***3.1***	***2.8***	No
Research to Millennium	***6.2***	***4.9***	***5.2***	***1.1***	***2.0***	***1.6***	No
East of Millennium	***6.9***	***5.6***	***6.1***	***2.1***	***4.1***	***2.3***	No
South of SR-241	***5.4***	2.7	***5.1***	0.5	***1.3***	***1.3***	No
Irvine Bl.							
East of SR-261	2.4	2.3	2.3	0.4	0.5	0.4	
West of Culver	1.4	1.2	1.2	0.8	0.8	0.7	
Culver to Yale	2.4	2.2	2.2	***1.0***	***1.0***	***1.0***	Yes
East of Yale	***4.2***	***3.9***	***4.0***	***1.2***	***1.3***	***1.2***	Yes
West of Jeffrey	***4.4***	***4.0***	***4.2***	***1.0***	***1.0***	0.9	Yes
East of Jeffrey	***5.3***	***4.9***	***5.1***	***1.7***	***2.0***	***1.7***	No
West of Sand Canyon	***4.4***	***4.1***	***4.4***	0.8	***1.1***	***1.0***	No
Sand Canyon to SR-133	***3.6***	***3.7***	***3.8***	***1.1***	***1.3***	***1.2***	No
SR-133 to Research	***4.3***	***4.3***	***4.3***	***1.0***	0.9	***1.0***	No
Research to Central Park W.	***4.0***	***4.1***	***3.6***	0.8	0.7	0.9	No
Central Park W. to Millennium	***3.8***	***3.9***	***3.4***	0.8	0.6	0.8	No
Millennium to Connector	***3.5***	***4.0***	***3.1***	***1.0***	***1.0***	***1.1***	No
Connector to Central Park E.	***3.9***	***4.4***	***3.5***	0.8	0.8	0.9	No
Central Park E. to Trabuco	***3.8***	***4.3***	***3.4***	0.7	0.7	0.9	No
Trabuco to Alton	***3.5***	***3.8***	***3.2***	0.6	0.6	0.6	No
Bryan Av.							
Yale to Jeffrey	***3.7***	***4.0***	***3.8***	***1.0***	***1.0***	0.9	Yes
Trabuco Rd.							
West of Yale	2.7	2.6	2.3	0.6	0.5	0.5	
Yale to Jeffrey	***8.6***	***8.7***	***8.3***	0.9	0.9	***1.0***	Yes
Jeffrey to Road "A"	***11.6***	***11.6***	***11.2***	0.7	0.5	0.7	No
Road "A" to Collector St.	***10.3***	***10.4***	***10.0***	0.9	0.7	0.9	No
Collector St. to Road "C"	***10.0***	--	***9.7***	0.5	--	0.6	No
Road "C" Sand Canyon	***11.3***	***11.5***	***11.1***	0.5	0.3	0.5	No
Sand Canyon SR-133	--	--	--	0.6	0.4	0.4	
Roosevelt Av.							
West of Sand Canyon	--	--	--	0.7	0.6	0.7	
SR-133							
Trabuco to I-5	***4.3***	***4.4***	***5.4***	0.5	0.4	0.3	No

-- Traffic Data Not Provided or Road Does Not Currently Exist
1. Buildout
2. Constrained

Table 4 shows that seven roadway segments are projected to experience significant increases in noise levels due to the project. The project only results in a significant noise impact if the project causes a significant noise increase and the resulting future noise levels at the residences will be in excess of the City's 65 CNEL standard.

All of the residential areas adjacent to the roadways with significant noise increases due to the project have existing noise barriers. The heights of these barriers and the geometry required to determine the noise reduction provided by the barriers was documented by field surveys. The future worst case noise levels from the roadways was calculated using the FHWA traffic noise model discussed in Section 1.3.2. The existing barriers and future noise levels at the residential areas with significant noise increases due to the project are discussed below.

Jeffrey Road – Irvine to Bryan

The project is projected to cause 1.9 to 2.7 dB of a 4.9 to 5.7 dB increase in the traffic noise CNEL levels over existing conditions. The Grove mobile home park is located on the west side of Jeffrey south of Irvine Boulevard. South of this there is a farm house and orchard. There is a 5'-9" wall between Jeffrey Road and these residences located 75 feet from the roadway centerline. The residences are at the same elevation as the roadway. Modeling including the effect of this barrier shows that the worst-case future noise levels with the project will exceed the City's 65 CNEL. This means that the project results in a significant noise impact at these homes. Mitigation will be required and is discussed in Section 3.2.1.

Based on traffic projections for the year 2007, this section of roadway will not experience a significant noise increase before the year 2007. In the year 2007 the project is projected to result in 0.2 dB of a 2.4 dB increase over existing conditions. This increase is not significant. Therefore, the existing residential uses along this segment of roadway will not be significantly impacted by the project until sometime after 2007.

Portola Parkway – Yale to Jeffrey

Under the 2025 constrained scenario the project results in a 1.0 dB of a 7.0 dB increase in the existing traffic noise CNEL levels. There are residential uses located to the south of Portola Parkway. A noise barrier is located between Portola Parkway and the residences at a distance of 100 feet from the roadway centerline. The height of the wall ranges from 5 to 6 feet with the elevation of the homes ranging from the roadway elevation to 5 feet below the roadway elevation. Noise modeling including the effect of the noise barrier shows that the worst-case future with project noise levels will remain below 65 CNEL. Therefore the project will not result in a significant noise impact at these homes.

Irvine Boulevard – Culver to Yale

The project is projected to result in 1.0 dB of a 2.2 to 2.4 dB increase in the existing traffic noise CNEL levels. There are residential uses located along both sides of the roadway. There are noise barriers located between the roadway and all of the homes. This barrier is typically 80 feet from the roadway centerline but in some cases is as far as 105 feet from the centerline. The barrier ranges in height from 4 to 7 feet and the homes have pads that range from 3 feet below the roadway to 1 foot above. Noise modeling including the effect of the noise barriers shows that the worst-case future with project noise levels will remain below 65 CNEL. Therefore the project will not result in a significant noise impact at these homes.

Irvine Boulevard – East of Yale

The project is projected to result in 1.2 to 1.3 dB of a 3.9 to 4.2 dB increase in the existing traffic noise CNEL levels. There are residential uses located along both sides of the roadway. There are noise barriers located between the roadway and all of the homes. This barrier is typically 80 feet from the roadway centerline but in some cases is as far as 105 feet from the centerline. The barrier ranges in height from 5 to 6.5 feet and the homes have pads that range from 1.5 feet below the roadway to at roadway grade. Noise modeling including the effect of the noise barriers shows that the worst-case future with project noise levels will remain below 65 CNEL. Therefore the project will not result in a significant noise impact at these homes.

Irvine Boulevard – West of Jeffrey

The project is projected to result in 1.0 dB of a 4.0 to 4.4 dB increase in the existing traffic noise CNEL levels under the 2025 scenarios. There are residential uses located along both sides of the roadway. There are noise barriers located between the roadway and all of the homes. This barrier is typically 80 feet from the roadway centerline but in some cases is as far as 105 feet from the centerline. The barrier ranges in height from 5 to 6.5 feet and the homes have pads that range from 1.5 feet below the roadway to at roadway grade. Noise modeling including the effect of the noise barriers shows that the worst-case future with project noise levels will remain below 65 CNEL. Therefore the project will not result in a significant noise impact at these homes.

Bryan Avenue – Yale to Jeffrey

The project is projected to result in 1.0 dB of a 3.7 to 4.0 dB increase in the existing traffic noise CNEL levels under the 2025 scenarios. There are residential uses located along both sides of the roadway. There are noise barriers located between the roadway and all of the homes. This barrier is 48 to 57 feet from the roadway centerline. The barrier ranges in height from 4.5 to 8 feet and the homes have pads that range from 2.5 feet below the roadway to 4 feet above roadway grade. Noise modeling including the effect of the noise barriers shows that the worst-case future with project noise levels will remain below 65 CNEL. Therefore the project will not result in a significant noise impact at these homes.

Trabuco Road – Yale to Jeffrey

The project is projected to result in 1.0 dB of a 8.3 dB increase in the existing traffic noise CNEL levels under the 2040 scenarios. There are residential uses located along both sides of the roadway. There are noise barriers located between the roadway and all of the homes. This barrier is 78 to 90 feet from the roadway centerline. The barrier ranges in height from 5 to 6.5 feet and the homes have pads that range from 2 feet below the roadway to 2 feet above roadway grade. Noise modeling including the effect of the noise barriers shows that the worst-case future with project noise levels will remain below 65 CNEL. Therefore the project will not result in a significant noise impact at these homes.

Significant increases over existing conditions occur for two roadway segments. Jeffrey Road from I-5 to Irvine Center Drive and Alton Parkway south of Portola. The noise increases along these roadway segments are not substantially due to the project. These increases represent cumulative noise impacts and are discussed in Section 2.5.1.

2.3.2 On-Site Activities

Off-site impacts from on site activities typically only occur where commercial uses directly abut residential uses (i.e. there is no intervening roadway). The project proposes residential land uses in the areas of the project that are directly adjacent to existing residential land uses. In any case, all uses within the project will be required to comply with the City of Irvine Noise Ordinance. There are no currently known uses within the project that would preclude compliance with the Noise Ordinance at any adjacent land uses. Therefore, the project will not result in any off-site noise impacts due to on-site activities.

2.4 Long Term On-Site Impacts

2.4.1 Traffic Noise

Future worst-case with project highway noise levels in terms of CNEL were computed using the Highway Noise Model published by the Federal Highway Administration ("FHWA Highway Traffic Noise Prediction Model," FHWA-RD-77-108, December, 1978). The CALVENO noise emission curves developed by Caltrans were used with the FHWA model. These curves better model the California vehicle mix. The FHWA Model uses traffic volume, vehicle mix, vehicle speed, and roadway geometry to compute the "equivalent noise level." A computer code has been written which computes equivalent noise levels for each of the time periods used in the calculation of CNEL. Weighting these noise levels and summing them results in the CNEL for the traffic projections used.

Table 5 presents the future worst-case traffic noise levels for roads impacting the project. The CNEL level at a distance of 100 feet from the roadway centerline is presented along with the distances, from the centerline to the 60, 65 and 70 CNEL contours.

Table 5
Future Traffic Noise Levels for Roads Impacting Project

	CNEL @	Distance To Contour		
Roadway & Segment	**100'**	**70 CNEL**	**65 CNEL**	**60 CNEL**
Jeffrey Rd.				
SR-241 to Portola	67.4	67	145	313
South of Portola	69.8	97	208	448
North of Irvine	70.6	110	237	512
Irvine to Bryan	71.8	131	282	609
Bryan to Trabuco	71.9	133	287	619
Sand Canyon Av.				
South of Portola	70.1	102	220	474
North of Irvine	71.5	126	272	586
South of Irvine	72.0	135	292	629
North of Trabuco	72.0	135	292	629
Research				
South of Portola	68.4	78	169	364
North of Irvine	68.4	78	169	364
Millennium Bl.				
Sout of Portola	67.8	71	153	329
North of Irvine	68.6	81	175	377

Table 5 (Continued)
Future Traffic Noise Levels for Roads Impacting Project

Roadway & Segment	CNEL @ 100'	Distance To Contour 70 CNEL	65 CNEL	60 CNEL
Portola Pkwy.				
Yale to Jeffrey	69.8	98	210	453
Jeffrey to Sand Canyon	69.1	87	187	402
Sand Canyon to SR-133	71.7	129	278	600
SR-133 to Research	71.4	125	269	579
Research to Millennium	69.8	96	207	447
East of Millennium	70.7	111	239	515
South of SR-241	69.3	90	194	417
Irvine Bl.				
West of Jeffrey	70.9	115	247	533
East of Jeffrey	71.4	124	268	578
West of Sand Canyon	70.5	108	233	501
Sand Canyon to SR-133	71.0	116	250	538
SR-133 to Research	71.4	124	266	574
Millennium to Connector	71.5	125	270	582
Bryan Av.				
Yale to Jeffrey	64.4	42	91	195
Trabuco Rd.				
Yale to Jeffrey	66.8	61	131	282
Jeffrey to Road "A"	67.9	73	157	339
Road "A" to Collector St.	67.8	71	154	331
Collector St. to Road "C"	67.4	67	144	311
Road "C" Sand Canyon	67.8	71	153	330
Sand Canyon SR-133	70.1	101	219	471
SR-133 to Research	71.8	131	283	610
SR-241				
Culver to Jeffrey	78.6	376	810	1744
Jeffrey to SR-133	78.8	383	826	1780
SR-1333 to Portola	79.2	412	889	1914
Portola to Alton	78.9	395	851	1833
SR-133				
SR-241 to Irvine	78.6	375	808	1741
Irvine to Trabuco	78.6	372	801	1726

Table 5 shows that with the exception of Bryan, all of the roadways will generate significant level of noise impacting the project. Bryan will generate moderate levels of noise and

Table 6 presents the traffic noise impacts on the project. The land use on each side of each roadway segment is listed along with the distance from the centerline to the nearest use are shown in the first three columns of the table. At this time plans showing the locations of the specific uses was not available. The distance shown in the fourth column of Table 6 is the expected distance from the centerline to the nearest outdoor area. Buildings were assumed to be located 10 feet beyond this. The outdoor CNEL noise level and applicable standard are presented in the fifth and sixth columns. The seventh column of the table indicates if the outdoor noise level results in a significant impact. Indoor noise levels for the buildings adjacent to the roadway are presented in the eighth and ninth columns. The eighth column presents the noise levels with windows open and the ninth column presents the indoor levels with windows closed.

Typical construction achieves at least 20 dB of outdoor-to-indoor noise reduction with windows closed and this reduction falls to 12 dB with windows open. Mechanical ventilation or air conditioning is required to assume that windows can remain closed. The most stringent applicable indoor noise standard is presented in the tenth column. Note that for commercial/industrial uses the most stringent standard is the 50 CNEL standard for offices. Other applicable standards are 55 CNEL for retail uses and 65 CNEL for manufacturing, warehouse and wholesale uses. The final column of the table presents if the roadway significantly impacts the indoor areas of the project for the most stringent standard. There are separate indicators for with windows open and with windows closed. Typically, commercial uses include mechanical ventilation or air conditioning to allow a windows closed assumption while this is not always true for residential uses.

It should be noted that the noise levels presented in Table 6 are the worst-case noise levels for uses located directly along the roadways. Site design could be effectively used to move rear residential yards and buildings away from the roadways reducing the noise levels impacting these uses.

Table 6
Traffic Noise Impacts On Project

Roadway& Segment	Side	Land Use	Dist from Centerline	Outdoor Level	Outdoor Stndrd.	Sig. Impct?	Indoor Level Open	Indoor Level Closed	Indoor Standard	Sig. Impct? Open/Closed
Jeffrey Rd.										
South of SR-241	East	Open Space	66'	70	--	No	--	--	--	--
North of Portola	East	Residential	200'	63	65	No	51	43	45	Yes / No
North of Portola	East	Park	70'	70	65	Yes	--	--	--	--
South of Portola	West	Residential	100'	70	65	Yes	57	49	45	Yes / Yes
South of Portola	East	Residential	200'	65	65	Yes	53	45	45	Yes / Yes
North of Irvine	West	Residential	100'	71	65	Yes	58	50	45	Yes / Yes
North of Irvine	East	Residential	200'	66	65	Yes	54	46	45	Yes / Yes
Irvine to Bryan	East	Residential	200'	67	65	Yes	55	47	45	Yes / Yes
South of Bryan	East	Residential	200'	67	65	Yes	55	47	45	Yes / Yes
South of Bryan	West	Residential	88'	73	65	Yes	60	52	45	Yes / Yes
South of Bryan	East	Golf Retention	66'	75	--	No	--	--	--	--
Sand Canyon Av.										
South of Portola	West	Comm./Ind.	92'	71	--	No	58	50	50	Yes / Yes
South of Portola	West	Potential Retail	92'	71	--	No	58	50	55	Yes / No
South of Portola	East	Comm./Ind.	92'	71	--	No	58	50	50	Yes / Yes
North of Irvine	West	Comm./Ind.	92'	72	--	No	59	51	50	Yes / Yes
North of Irvine	West	Potential Retail	92'	72	--	No	59	51	55	Yes / No
North of Irvine	East	Comm./Ind.	92'	72	--	No	59	51	50	Yes / Yes
South of Irvine	West	Residential	101'	72	65	Yes	59	51	45	Yes / Yes
South of Irvine	West	Potential Retail	101'	72	--	No	59	51	55	Yes / No
South of Irvine	East	Comm./Ind.	101'	72	--	No	59	51	50	Yes / Yes
North of Trabuco	West	Residential	95'	72	65	Yes	60	52	45	Yes / Yes
North of Trabuco	West	Potential Retail	101'	72	--	No	59	51	55	Yes / No
North of Trabuco	East	Comm./Ind.	101'	72	--	No	59	51	50	Yes / Yes

Table 6 (Continued)
Traffic Noise Impacts On Project

Roadway& Segment	Side	Land Use	Dist from Centerline	Outdoor Level	Outdoor Stndrd.	Sig. Impct?	Indoor Level Open	Indoor Level Closed	Indoor Standard	Sig. Impct? Open/Closed
Research										
South of Portola	West	Comm./Ind.	80'	70	--	No	57	49	50	Yes / No
South of Portola	East	Comm./Ind.	80'	70	--	No	57	49	50	Yes / No
North of Irvine	West	Comm./Ind.	80'	70	--	No	57	49	50	Yes / No
Millennium Bl.										
South of Portola	West	Residential	82'	69	65	Yes	56	48	45	Yes / Yes
South of Portola	East	Residential	82'	69	65	Yes	56	48	45	Yes / Yes
North of Irvine	West	Comm./Ind.	80'	70	--	No	57	49	50	Yes / No
North of Irvine	East	Comm./Ind.	80'	70	--	No	57	49	50	Yes / No
Portola Pkwy.										
West of Jeffrey	South	Residential	82'	71	65	Yes	58	50	45	Yes / Yes
East of Jeffrey	North	Residential	82'	70	65	Yes	58	50	45	Yes / Yes
East of Jeffrey	South	Residential	82'	70	65	Yes	58	50	45	Yes / Yes
West of Sand Canyon	North	Open Space	58'	73	--	No	--	--	--	--
West of Sand Canyon	South	Comm./Ind.	80'	71	--	No	58	50	50	Yes / Yes
Sand Canyon to SR-133	North	Open Space	58'	75	--	No	--	--	--	--
Sand Canyon to SR-133	South	Comm./Ind.	80'	73	--	No	60	52	50	Yes / Yes
Sand Canyon to SR-133	South	Potential Retail	80'	73	--	No	60	52	55	Yes / No
SR-133 to Research	North	Comm./Ind.	80'	73	--	No	60	52	50	Yes / Yes
SR-133 to Research	South	Comm./Ind.	80'	73	--	No	60	52	50	Yes / Yes
Research to Millennium	North	Residential	82'	71	65	Yes	58	50	45	Yes / Yes
Research to Millennium	South	Residential	82'	71	65	Yes	58	50	45	Yes / Yes
East of Millennium	North	Residential	82'	72	65	Yes	59	51	45	Yes / Yes
East of Millennium	South	Residential	82'	72	65	Yes	59	51	45	Yes / Yes
East of Millennium	South	Potential Retail	80'	72	--	No	59	51	55	Yes / No
South of SR-241	North	Residential	82'	71	65	Yes	58	50	45	Yes / Yes
South of SR-241	North	Potential Retail	80'	71	--	No	58	50	55	Yes / No
South of SR-241	South	Residential	82'	71	65	Yes	58	50	45	Yes / Yes

Table 6 (Continued)
Traffic Noise Impacts On Project

Roadway& Segment	Side	Land Use	Dist from Centerline	Outdoor Level	Outdoor Stndrd.	Sig. Impct?	Indoor Level Open	Indoor Level Closed	Indoor Standard	Sig. Impct? Open/Closed
Irvine Bl.										
West of Jeffrey	North	Residential	102'	71	65	Yes	58	50	45	Yes / Yes
East of Jeffrey	North	Residential	94'	72	65	Yes	59	51	45	Yes / Yes
East of Jeffrey	South	Residential	94'	72	65	Yes	59	51	45	Yes / Yes
West of Sand Canyon	North	Comm./Ind.	92'	71	--	No	58	50	50	Yes / Yes
West of Sand Canyon	Both	Potential Retail	92'	71	--	No	58	50	55	Yes / No
West of Sand Canyon	South	Residential	94'	71	65	Yes	58	50	45	Yes / Yes
Sand Canyon to SR-133	North	Comm./Ind.	92'	72	--	No	59	51	50	Yes / Yes
Sand Canyon to SR-133	South	Comm./Ind.	92'	72	--	No	59	51	50	Yes / Yes
SR-133 to Research	North	Comm./Ind.	92'	72	--	No	59	51	50	Yes / Yes
Millennium to Connector	North	Comm./Ind.	92'	72	--	No	59	51	50	Yes / Yes
Bryan Av.										
Yale to Jeffrey	South	Residential	82'	66	65	Yes	53	45	45	Yes / Yes
Trabuco Rd.										
Yale to Jeffrey	North	Residential	82'	68	65	Yes	55	47	45	Yes / Yes
Jeffrey to Road "A"	North	Residential	84'	69	65	Yes	56	48	45	Yes / Yes
Road "A" to Collector St.	North	Residential	84'	69	65	Yes	56	48	45	Yes / Yes
Collector St. to Road "C"	North	Residential	84'	69	65	Yes	56	48	45	Yes / Yes
Road "C" Sand Canyon	North	Residential	84'	69	65	Yes	56	48	45	Yes / Yes
Road "C" Sand Canyon	North	Potential Retail	84'	69	--	No	56	48	55	Yes / No
Sand Canyon SR-133	North	Comm./Ind.	84'	71	--	No	58	50	50	Yes / Yes
SR-133 to Research	North	Comm./Ind.	84'	73	--	No	60	52	50	Yes / Yes

Table 6 (Continued)
Traffic Noise Impacts On Project

Roadway& Segment	Side	Land Use	Dist from Centerline	Outdoor Level	Outdoor Stndrd.	Sig. Impct?	Indoor Level Open	Indoor Level Closed	Indoor Standard	Sig. Impct? Open/Closed
SR-241										
Culver to Jeffrey	Both	Open Space	150'	76	--	No	--	--	--	--
Jeffrey to SR-133	Both	Open Space	150'	76	--	No	--	--	--	--
SR-133 to Portola	North	Open Space	150'	77	--	No	--	--	--	--
East of SR-133	South	Comm./Ind.	150'	77	--	No	64	56	50	Yes / Yes
West of Portola	South	Residential	150'	77	65	Yes	64	56	45	Yes / Yes
West of Portola	South	Potential Retail	150'	77	--	No	64	56	55	Yes / Yes
Portola to Alton	North	Open Space	150'	76	--	No	--	--	--	--
SR-133										
South of SR-241	West	Open Space	150'	76	--	No	--	--	--	--
South of SR-241	East	Comm./Ind.	150'	76	--	No	64	56	50	Yes / Yes
North of Irvine	West	Comm./Ind.	150'	76	--	No	64	56	50	Yes / Yes
North of Irvine	East	Comm./Ind.	150'	76	--	No	64	56	50	Yes / Yes
Irvine to Trabuco	West	Comm./Ind.	150'	76	--	No	63	55	50	Yes / Yes

Table 6 shows that all residential uses except along Jeffrey Boulevard North of Portola will experience outdoor noise levels in excess of 65 CNEL and will be significantly impacted by traffic noise. Mitigation will be required to reduce the noise levels at these homes and is discussed in Section 3.3.1. Note that while the area east of Jeffery and north of Portola will be zoned residential under the project. Current plans call for a community park to be located in this area. The 65 CNEL outdoor noise standard for parks only applies to picnic areas. Any picnic areas in the park closer than 150 feet from the centerline of Jeffrey Road or 187 feet from the centerline of Portola Parkway would be exposed to noise levels greater than 65 CNEL. Picnic areas for the park should be located at greater distance from these roadways.

Indoor noise levels along all roadways will exceed the most stringent indoor noise standard for all uses with windows open or closed. If homes were located along the east side of Jeffrey north of Portola the interiors will be significantly impacted by traffic noise unless mechanical ventilation is provided. No additional building upgrades will be required along Collector Street. For the retail areas, the 55 CNEL interior standard for retail areas will be met with windows closed except along SR-241 where additional building upgrades may be required. For some areas along Portola Parkway and Trabuco Road the 50 CNEL interior standard for office uses will be met with windows closed. Buildings along the roadways with indoor areas having significant impacts with windows closed will require further mitigation. This is discussed in Section 3.3.1.

Indoor noise levels are not projected to exceed the 65 CNEL interior standard for manufacturing, warehousing or wholesale uses and no mitigation will be required for these uses.

2.4.2 Aircraft Noise

The current General Plan of the City of Irvine does not include an airport at the former El Toro Military Base. However, the County of Orange is proceeding with the planning of a commercial airport at the former base. Exhibit 6 shows the project site plan with the projected aircraft CNEL noise contours for the El Toro Aviation Plan Alternative B taken from EIR Number 573 for the Civilian Reuse of El Toro MCAS. The exhibit shows that a portion of the proposed residential uses in the northwest corner of the project would be exposed to aircraft noise levels greater than the residential 65 CNEL standard. There would be no way of effectively mitigating outdoor noise levels to below 65 CNEL. There are uses allowed in residential areas that do not have outdoor noise standards including churches and parks (without picnic areas) Exterior noise levels would be below 70 CNEL and interior levels could be mitigated to below the 45 CNEL interior residential or church standards with moderate building upgrades.

Several residential areas of the project would be exposed to aircraft noise levels less than 65 CNEL but greater than 55 CNEL. In these areas the mitigation required to reduce exterior noise levels to below the 65 CNEL standard along roadways would be greater than without the aircraft noise as presented in Section 3.3.1. As the aircraft noise approaches 65 CNEL the increase in required noise barrier heights would be significant. Barriers as high as 10 to 15 feet could be required. Further, measures required to meet the 45 CNEL interior standard would be increased over what would be required without the airport. All homes within the 57 CNEL aircraft contour would require mechanical ventilation.

2.4.3 On-Site Activities

As discussed previously, impacts on residential areas typically occur only where the residential areas directly abut commercial areas. In general, proposed residential areas are located on the opposite sides of roadways from proposed commercial areas. The exceptions to this occur at the potential retail sites that may be located at the northwest corner of Trabuco and Sand Canyon, the southwest corner of Irvine and Sand Canyon, south of Portola Parkway between Millennium and SR-241 and at the southwest corner of SR-241 and Portola Parkway. Additionally there are Research/Industrial uses proposed immediately south of residential uses on the east side of the project between Portola Parkway and Irvine Boulevard.

Three sources of noise from retail sites and research/industrial areas have the potential to impact residential uses. Parking lot activity and mechanical equipment can result in noise levels that exceed the Noise Ordinance limits. Of most concern, are delivery trucks especially those that occur during the nighttime hours. In addition, specific uses in the research/industrial not yet identified area could generate significant noise levels

In any case, all of the commercial uses will need to comply with the City of Irvine Noise Ordinance at the homes proposed by the project. Typically this will only be a concern at the potential retail sites located directly adjacent to residential uses. It is possible that some uses in the Research/Industrial portions of the project will result in exceedences of the Noise Ordinance. Mitigation to ensure compliance with the Noise Ordinance is discussed in Section 3.3.2.

2.4.4 Off-Site Activities

The project proposes only residential uses directly abutting existing residential uses. As discussed previously impacts on residential areas typically only occur where the residential areas directly abut commercial areas. This will not occur with this project. Further there are no known existing noise generating activities on private property that will result in an exceedence of the City of Irvine Noise Ordinance at the proposed residential areas. Therefore, there are no noise impacts on the project site from activities outside of the project.

2.5 Cumulative Impacts

This section analyzes off site traffic noise impacts due to the project in conjunction with other development in the area. Table 4 of Section 2.3.1 presented noise level increases over existing conditions for three future with project scenarios. Increases 3 dB or greater over existing conditions represent a significant cumulative noise level increase. The project's contribution to these impacts is discussed below in Section 2.5.1.

Traffic data was generated for four scenarios in addition to those discussed in Section 2.3.1 above. The three scenarios that are analyzed for the year 2025 are with "Not Approved Probable Future" Projects, with Oak Canyon over crossing and with the El Toro Aviation Plan. For Year 2040 a single scenario with the Irvine Spectrum Trip Reduction Plan is analyzed. The traffic study details the specifics of these scenarios. Sections 2.5.2 through 2.5.5 discuss the off-site traffic noise impacts for each of these projects in conjunction with the proposed project.

2.5.1 General Plan Buildout

Table 4 showed that three roadway segments with adjacent residential uses are projected to experience significant noise level increases over existing conditions where the project does not result in significant increases. These roadway segments are Jeffrey Road from I-5 to Irvine Center Drive, Portola from Culver to Yale and Alton Parkway South of Portola.

Jeffrey Road – I-5 to Irvine Center Drive

The project is projected to result in 0.6 dB to 0.7 dB of a 3.4 to 3.6 dB increase in the existing traffic noise CNEL levels. There are residences located along the west side of the roadway. The southernmost residences are single-family homes. These homes are located 60 feet from the roadway centerline and there is a 5.8-foot high noise barrier. The pads of these homes range from 2 feet below the roadway grade to 2 feet above. Noise modeling including the effect of the existing noise barrier shows that the worst-case future with project noise levels will exceed 65 CNEL.

Just north of the single-family homes are multi-family homes, the Smoketree development. These homes have patios located approximately 100 feet from the centerline with 5.5-foot barriers. The elevations of these homes range from even with the roadway to 3 feet below the roadway elevation. Noise modeling including the effect of the existing noise barrier shows that the worst-case future with project noise levels will slightly exceed 65 CNEL.

The Meadows mobile home park is located north of the railroad tracks and the Smoketree development. There is a 5.5-foot high wall between the roadway and these homes located 70 feet from the centerline. The pads of these homes are located between 2 and 5 feet below the roadway grade. Noise modeling including the effect of the noise barrier shows that the worst-case future with project noise levels will not exceed 65 CNEL.

The City of Irvine is currently in the design stage of a roadway undercrossing for Jeffrey Road between Irvine Center Drive and I-5. This will lower the roadway approximately 20 feet below its current elevation at the rail crossing with the roadway sloping up as it travels away from this low point. As a part of this project a noise analysis per FHWA/Caltrans criteria was performed (Federal Highway Administration funds will be used for the project). To meet the FHWA/Caltrans criteria a 10-foot high wall will be required to be constructed for the single family homes and a portion of the Smoketree development. Where the wall is not required for the Smoketree development the lowering of the roadway will reduce noise levels at the homes. The walls and the lowering of the roadway will result in future worst-case with project noise levels not exceeding 65 CNEL at the homes. Therefore there will not be a cumulative significant noise impact at these homes.

Alton Parkway – South of Portola

The project is projected to result in 0.1 dB to 0.6 dB of a 4.0 to 6.2 dB increase in the existing traffic noise CNEL levels. There are residences located along the west side of the roadway. There is a noise barrier located between the roadway and all of the homes. This barrier is approximately 80 feet from the roadway centerline. The barrier is 6 feet high above the pad elevations and the homes have pads that range from 15 to 20 above roadway grade. Noise modeling including the effect of the noise barriers show that the worst-case future with project noise levels will remain below 65 CNEL. Therefore there will not be a significant cumulative noise impact at these homes.

Portola Parkway – Culver to Yale

The project is projected to result in 0.8 dB to 0.9 dB of a 5.8 to 6.5 dB increase in the existing traffic noise CNEL levels. There are residences located along the south side of the roadway. There is a noise barrier located between the roadway and all of the homes. The barrier is approximately 93 feet from the roadway centerline. The barrier is 6 feet high above the pad elevations and the homes have pads that are the same as roadway grade. Noise modeling including the effect of the noise barriers show that the worst-case future with project noise levels will remain below 65 CNEL. Therefore there will not be a significant cumulative noise impact at these homes.

2.5.2 With "Not Approved Probable Future" Projects

There are several projects currently proposed that have not been approved. Table 7 presents the potential noise increases due to these projects alone and in combination with this project. Table 7 presents the roadway segments that will have increases in future (2025) noise levels due to the combination of the project and "Not Approved Probable Future" projects of more than 0.5 dB. For all roadways not listed in the table, the project combined with "Not Approved Probable Future" projects will result in future noise level increases of less than 0.5 dB. The traffic study presents the details of the "Not Approved Probable Future" projects scenario.

The first column of Table 7 lists the roadway segments. The second column shows change in existing CNEL noise levels in the Year 2025 with the project and the "Not Approved Probable Future" projects. The next three columns show the contributions to this increase due to the project, "Not Approved Probable Future" projects and the combined increase due to the project and the "Not Approved Probable Future" projects. The final column shows if residential uses currently exist adjacent to the roadways with significant noise increases. Significant noise increases are shown in bold italics.

Table 7
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change From Existing Levels	Change In Future Due To			Existing Res.?
		Project	NAPFP	Project + NAPFP[1]	
Santiago Canyon Rd.					
Jamboree to SR-241	--	0.1	-0.6	-0.5	
Chapman Av.					
Jamboree to SR-241	0.5	0.2	-0.8	-0.6	
Canyon View Av.					
Newport to Jamboree	-0.6	0.2	-0.9	-0.8	
Handy Creek					
Jamboree to SR-261	--	0.0	-2.0	-2.0	No
SR-261 to "A" Street	--	0.1	-3.0	-2.9	No
"A" St.					
Handy Creek to Culver Loop	--	0.1	-8.2	-8.0	
Culver Loop					
Santiago Canyon to "A" Street	--	0.3	-4.8	-4.4	
"A" Street to Culver	--	0.2	-6.7	-6.5	

1. Combined change may not be exact sum of individual changes due to project and NAPFP because of rounding.

Table 7 (Continued)
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change From Existing Levels	Change In Future Due To Project	NAPFP	Project + NAPFP[1]	Existing Res.?
Headlands					
Culver to "E" Street	--	0.2	-4.9	-4.7	
"C" St.					
"D" Street to Santiago Canyon	--	0.0	-2.1	-2.1	
Santiago Canyon to Headlands	--	0.2	-4.3	-4.1	
Headlands to Jeffery	--	0.0	***1.4***	***1.4***	No
Jamboree Rd.					
South of Handy Creek	***3.2***	0.1	0.5	0.7	Yes
North of Tustin Ranch Rd.	2.5	0.1	0.4	0.5	
Tusting Ranch Rd. to Portola	1.9	0.1	0.4	0.5	
Culver Dr.					
Santiago Canyon to Headlands	--	0.2	-7.5	-7.3	
Headlands to SR-241	--	0.2	-6.1	-5.9	
SR-241 to Culver Loop	--	0.2	-8.9	-8.7	
North of Portola	--	0.0	-5.2	-5.2	
South of Portola	***3.3***	0.0	-2.4	-2.4	Yes
North of Irvine	0.2	0.1	-0.9	-0.7	
Yale Av.					
Irvine to Bryan	2.2	0.9	0.1	0.9	Yes
Bryan to Trabuco	1.2	0.5	0.1	0.6	
Jeffrey Rd.					
"D" Street to Santiago Canyon	--	0.0	***1.2***	***1.2***	No
Santiago Canyon to "C" Street	--	-0.1	***2.0***	***1.9***	No
"C" Street to SR-241	--	-0.1	***1.2***	***1.1***	No
SR-241 to Portola	--	0.2	0.8	***1.0***	No
South of Portola	***6.8***	0.9	0.4	***1.3***	No
North of Irvine	***7.6***	***1.8***	0.3	***2.2***	No
Irvine to Bryan	***5.9***	***1.9***	0.2	***2.1***	Yes
Bryan to Trabuco	***5.8***	***1.6***	0.1	***1.7***	No
South of Trabuco	***4.3***	***1.6***	-0.1	***1.5***	No
North of I-5	***4.9***	***1.0***	-0.1	0.9	No
I-5 to Irvine Center Dr.	***3.4***	0.6	-0.1	0.5	Yes
Sand Canyon Av.					
South of Portola	***6.2***	***1.2***	0.5	***1.7***	No
North of Irvine	***8.1***	***3.3***	0.3	***3.6***	No
South of Irvine	***6.6***	***4.0***	0.4	***4.4***	No
North of Trabuco	***6.6***	***4.0***	0.4	***4.4***	No
Trabuco to Roosevelt	***6.5***	***1.9***	-0.2	***1.7***	No
Roosevelt to Road "B"	***6.8***	***1.2***	-0.3	***1.0***	No
Road "B" to I-5	***6.9***	0.9	-0.2	0.7	No

1. Combined change may not be exact sum of individual changes due to project and NAPFP because of rounding.

Table 7 (Continued)
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change From Existing Levels	Change In Future Due To Project	NAPFP	Project + NAPFP[1]	Existing Res.?
Research					
Trabuco to Marine	--	0.2	***4.1***	***4.3***	No
Central Park W.					
Marine to Millennium	--	-0.1	-4.5	-4.6	
Millennium Bl.					
Sout of Portola	--	***4.4***	0.6	***5.0***	No
North of Irvine	--	***5.3***	0.6	***5.9***	No
Irvine to W. Culture	--	***2.3***	0.5	***2.8***	No
Trabuco to E. Culture	--	***1.2***	-2.6	-1.4	No
Central Park E. to Barranca	--	0.3	-3.3	-3.0	
North of Alton	--	0.3	-3.6	-3.3	
Alton to Rockfield	--	0.2	-3.2	-3.0	
Alton Pkwy.					
SR-241 to Commercentre	--	0.1	-0.9	-0.8	
Commercentre to Trabuco	--	0.1	-1.3	-1.2	
Trabuco to Irvine	--	0.0	***2.1***	***2.0***	No
Irvine to Fairbanks	***5.3***	0.3	0.4	0.7	No
Fairbanks to Toledo	***7.0***	0.3	0.5	0.7	No
South of Toledo	***3.1***	0.2	0.4	0.6	No
North of Jeronimo	2.7	0.0	0.6	0.7	
Bake Pkwy.					
Millennium to I-5	-0.1	0.1	-1.0	-0.9	
South of I-5	***4.8***	0.1	-0.8	-0.7	No
North of Irvine Center Dr.	-0.8	0.2	-1.0	-0.8	
South of Irvine Center Dr.	--	0.0	-0.5	-0.5	
North of Lake Forest	--	0.0	-0.5	-0.5	
South of Lake Forest	--	-0.1	-0.4	-0.5	
Portola Pkwy.					
Culver to Yale	***5.8***	0.8	0.0	0.8	Yes
Yale to Jeffery	***6.4***	0.9	-0.2	0.7	Yes
Jeffery to Sand Canyon	***6.1***	***1.1***	-0.2	0.9	No
Sand Canyon to SR-133	***6.8***	***1.9***	0.2	***2.1***	No
SR-133 to Research	***6.7***	***2.0***	0.1	***2.1***	No
Research to Millennium	***5.6***	***1.1***	-0.5	0.6	No
East of Millennium	***7.1***	***2.1***	0.1	***2.3***	No
South of SR-241	***5.7***	0.5	0.3	0.9	No
North of SR-241	--	0.3	0.3	0.7	
West of Alton	***6.1***	0.2	0.3	0.5	Yes

1. Combined change may not be exact sum of individual changes due to project and NAPFP because of rounding.

Table 7 (Continued)
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change From Existing Levels	Change In Future Due To Project	NAPFP	Project + NAPFP[1]	Existing Res.?
Rancho					
Alton to Bake	--	0.0	-0.7	-0.6	
Irvine Bl.					
West of Culver	1.3	0.8	-0.1	0.7	
Culver to Yale	2.4	***1.0***	-0.1	0.9	Yes
East of Yale	***4.1***	***1.2***	-0.1	***1.1***	Yes
West of Jeffery	***4.2***	***1.0***	-0.1	0.8	Yes
East of Jeffery	***5.2***	***1.7***	-0.2	***1.5***	No
West of Sand Canyon	***4.1***	0.8	-0.3	0.5	No
Sand Canyon to SR-133	***3.5***	***1.1***	0.0	***1.0***	No
Central Park W. to Millennium	***3.6***	0.8	-0.2	0.6	No
Millennium to Connector	***4.7***	***1.0***	***1.2***	***2.1***	No
Connector to Central Park E.	***4.7***	0.8	0.7	***1.5***	No
Central Park E. to Trabuco	***4.7***	0.7	0.8	***1.6***	No
Trabuco to Alton	***4.6***	0.6	***1.1***	***1.6***	No
Bryan Av.					
Yale to Jeffery	***3.6***	***1.0***	-0.1	0.9	Yes
Trabuco Rd.					
Collector St. to Road "C"	***8.7***	0.5	-1.3	-0.8	No
Road "C" Sand Canyon	***9.8***	0.5	-1.5	-1.0	No
Sand Canyon SR-133	--	0.6	-1.8	-1.3	
SR-133 to Research	--	0.3	-2.4	-2.2	
Research to Central Park W.	--	0.2	-2.6	-2.3	
Roosevelt Av.					
West of Sand Canyon	--	0.7	0.1	0.9	
Marine Wy.					
Sand Canyon to Research	--	-0.1	-0.4	-0.5	
West of Research	--	-0.2	-1.2	-1.5	
Technology Dr.					
North of Laguna Canyon Road	--	0.1	0.4	0.6	
Barranca Pkwy.					
Ada to Millennium	1.7	0.1	-0.6	-0.5	
Rockfield Bl.					
Millennium to Bake	--	0.3	***1.4***	***1.6***	No
Laguna Canyon Rd.					
Sand Canyon to Technology	--	0.3	0.2	0.5	
Technology to Irvine Center Dr.	--	0.2	0.2	0.5	
SR-261					
SR-241 to Portola	2.8	0.1	0.5	0.5	Yes

1. Combined change may not be exact sum of individual changes due to project and NAPFP because of rounding.

Table 7 shows that the project combined with the "Not Approved Probable Future" projects will result in significant noise level increases (1 dB or greater) for two road segments with existing adjacent residential land uses. For both of these road segments, Jeffrey between Irvine and Bryan and Irvine east of Yale, it is the project that causes the significant increase. The "Not Approved Probable Future" projects do not significantly change the noise levels along these roadways. Along Irvine east of Yale, future noise levels will remain below the City's 65 CNEL noise standard at the residences as discussed in Section 2.3.1. Section 2.3.1 shows that the noise levels at the residences along Jeffrey between Irvine and Bryan will exceed the 65 CNEL standard and the project will result in a significant impact. Mitigation is discussed in Section 3.2.1 and will be required to reduce future ultimate noise levels to below 65 CNEL.

Table 7 shows that eight roadway segments with adjacent existing residential uses will experience significant noise increases over existing conditions (3 dB or greater) with the combination of project, "Not Approved Probable Future" projects and all other growth in the area.

Increases along five of these segments are significant even without the project or the "Not Approved Probable Future" projects. These segments are Culver South of Portola, Portola from Culver to Yale, Portola from Yale to Jeffery, Portola west of Alton, and Irvine west of Jeffrey. Along Culver south of Portola the "Not Approved Probable Future" projects results in a 2.4 dB reduction in the future CNEL level along Culver south of Portola. The project does not result in any change in the roadway noise along Culver south of Portola. The increase along this segment of road is completely due to currently planned development. Therefore, the increase along this segment of road is not cumulatively significant.

As discussed in Sections 2.3.1 and 2.5.1, future noise levels at homes along Portola from Culver to Yale, Portola from Yale to Jeffery and Irvine west of Jeffery will not exceed 65 CNEL. Therefore, residences along these roadway segments are not cumulatively impacted by noise.

Along Culver South of Portola there are homes located along the east side of the roadway. All of the existing homes have noise barriers ranging in height between 5 and 7 feet. The barriers are located approximately 90 feet from the roadway center line. Homes are at or slightly above the roadway grade. Noise modeling shows that these barriers will reduce worst case future with project noise levels at these homes to below 65 CNEL. Therefore, there will be no significant noise impact at these homes.

Along Portola from west of Alton there are homes located on both sides of the roadway. All of the homes have existing barriers that reduce traffic noise levels. The homes to the north are elevated approximately 25 feet above the roadway and the barriers are located approximately 110 feet from the centerline. The barriers have an approximate height of 6 feet. Noise modeling shows that these barriers will reduce worst case future with project noise levels at these homes to below 65 CNEL. The homes to the south are located slightly above the roadway grade, at the roadway grade and as much as approximately 25 feet below the roadway grade. The existing walls have heights that range from 6 feet to 8 feet and are located between 50 and 75 feet from the centerline of the roadway. Noise modeling shows that these barriers will reduce worst case future with project noise levels at these homes to below 65 CNEL. Therefore, there will be no significant noise impact at these homes.

Along two roadway segments, Jeffrey from I-5 to Irvine Center Drive and Bryan from Yale to Jeffery the noise level increase over existing conditions would not be significant without the project. The “Not Approved Probable Future” project results in a slight, but insignificant, reduction in the noise levels along these road segments. As discussed in sections 2.3.1 and 2.5.1 future noise levels will not exceed 65 CNEL at the homes along these road segments and there will be no significant noise impacts along these road segments.

Jamboree south of Handy Creek will experience a significant increase over existing conditions due to the “Not Approved Probable Future” projects. The increases along this segment with the “Not Approved Probable Future” projects but without the project would still be significant. Further, the increases with the project but without the “Not Approved Probable Future” projects are not significant. The project contributes 0.1 dB or less to the total increases along these roadway segments.

Existing homes are located along the west side of Jamboree road south of Handy Creek. These homes have existing noise barriers that range in height from 6.5 to 11 feet. The elevations of the homes range from slightly above the roadway to up to 20 feet below the roadway grade. For most of the roadway segment the walls are approximately 75 feet from the centerline. At one section the walls are 130 feet from the centerline. Noise modeling shows that these barriers will reduce worst case future with project noise levels from traffic on Jamboree at these homes to below 65 CNEL. Therefore, there will be no significant noise impact at these homes.

2.5.3 With Oak Canyon Over Crossing

As Laguna Canyon Road crosses Sand Canyon to the west it becomes Oak Canyon Road. Under the currently adopted roadway network Oak Canyon would not cross over the I-5 freeway at this point. This was used to calculate the noise level changes presented in Section 2.3.1. Table 8 presents the noise level changes if Oak Canyon Road crossed over the I-5 freeway connecting to Road “A” north of the freeway. Table 8 presents the roadway segments that will have future (2025) with project noise levels affected by the potential over crossing of the I-5 freeway by Oak Canyon Road.

The first column of Table 8 lists the roadway segments. The second column shows change in existing CNEL noise levels in the Year 2025 with the project and the Oak Canyon over crossing. The next three columns show the contributions to this increase due to the project, Oak Canyon over crossing and the combined increase due to the project and the over crossing. The final column shows if residential uses currently exist adjacent to the roadways with significant noise increases. Significant noise increases are shown in bold italics.

Table 8
Change in Traffic Noise CNEL Levels

Road & Segment	Change From Existing Levels	Change In Future Due To Project	Oak Canyon OC	Project + Oak Canyon OC[1]	Existing Res.?
"A" St.					
Handy Creek to Culver Loop	--	0.1	-0.1	0.1	
Yale Ct.					
South of Portola	2.0	0.1	-0.1	0.1	
Yale Av.					
Walnut to Irvine Center Dr.	0.0	0.1	-0.1	0.0	
Jeffrey Rd.					
SR-241 to Portola	--	0.2	0.1	0.3	
North of I-5	***4.9***	***1.0***	-0.1	0.9	No
I-5 to Irvine Center Dr.	***3.3***	0.6	-0.1	0.5	Yes
Sand Canyon Av.					
Road "B" to I-5	***6.9***	0.9	-0.2	0.8	No
I-5 to Oak Canyon	***5.2***	0.5	-0.2	0.3	No
Oak Canyon to Irvine Center Dr.	***4.6***	0.5	-0.1	0.4	No
Central Park W.					
W. Culture to Trabuco	--	***2.3***	0.1	***2.4***	No
E. Culture					
Connector to Trabuco	--	0.3	0.3	0.7	
W. Culture					
Central Park W. to W. Culture	--	***1.8***	0.3	***2.0***	No
W. Culture to Millennium	--	0.8	0.2	***1.0***	No
Trabuco to Millennium	--	0.0	-0.2	-0.2	
Connector					
Irvine to E. Culture	--	-0.2	0.1	-0.1	
Bake Pkwy.					
North of Irvine Center Dr.	0.1	0.2	-0.1	0.1	
Portola Pkwy.					
Jeffrey to Sand Canyon	***6.2***	***1.1***	-0.1	***1.1***	No
Trabuco Rd.					
East of Culver	0.5	0.4	-0.1	0.3	
Yale to Jeffrey	***8.7***	0.9	0.1	***1.0***	Yes
Jeffrey to Road "A"	***11.7***	0.7	0.1	0.8	No
Collector St. to Road "C"	***9.9***	0.5	-0.1	0.5	No
Road "C" Sand Canyon	***11.2***	0.5	-0.1	0.4	No
Roosevelt Av.					
East of Jeffrey	--	0.0	0.2	0.2	
West of Sand Canyon	--	0.7	-0.7	0.0	

1. Combined change may not be exact sum of individual changes due to project and Oak Canyon Over Crossing because of rounding.

Table 8 (Continued)
Change in Traffic Noise CNEL Levels

Road & Segment	Change From Existing Levels	Change In Future Due To Project	Oak Canyon OC	Project + Oak Canyon OC[1]	Existing Res.?
Rd "B"					
Road "A" to Sand Canyon	--	-0.1	-0.4	-0.5	
Technology Dr.					
North of Laguna Canyon Road	--	0.1	0.2	0.3	
Irvine Center Dr.					
Jeffrey to Sand Canyon	***3.4***	0.1	-0.1	0.0	No
Laguna Canyon Rd.					
Sand Canyon to Technology	--	0.3	0.3	0.6	
Technology to Irvine Center.	--	0.2	0.2	0.4	
Irvine Center Dr. to Barranca	***5.8***	0.2	0.1	0.3	No
Barranca to Alton	***6.2***	0.2	0.1	0.2	No

1. Combined change may not be exact sum of individual changes due to project and Oak Canyon Over Crossing because of rounding.

Table 8 shows that the Oak Canyon over crossing does not significantly alter noise levels along any roadways. There is only one roadway segment where the combination of the project and the Oak Canyon over crossing result in a significant noise increase and there are existing residences, Trabuco from Yale to Jeffrey. This roadway segment is potentially significantly impacted by the project under the Constrained scenario as discussed in Section 2.3.1. Detailed calculations showed that worst-case future noise levels at homes along this segment of roadway will be below 65 CNEL with the existing noise barriers. Therefore, no significant impact will occur.

The only roadway with a significant increase over existing conditions and existing adjacent residential is Jeffrey Road between I-5 and Irvine Center Drive. As discussed in Section 2.5.1 future noise levels at the homes along this road segment will be below 65 CNEL and the project combined with the Oak Canyon over crossing will not result in a significant noise impact.

2.5.4 With El Toro Aviation Plan

The County of Orange has adopted the El Toro Aviation Plan for the closed El Toro Marine Corps Base. The City of Irvine has adopted different land uses for the base that are included in the assumptions to calculate noise level increases presented in Section 2.3.1. Changes in traffic noise levels with the El Toro Aviation Plan are presented in Table 9. Table 9 presents the roadway segments that will have increases in future (2025) noise levels due to the project and the El Toro Aviation Plan (OCX Airport) of more than 0.5 dB. For all roadways not listed in the table, the project combined with the El Toro Aviation Plan will result in future noise level increases of less than 0.5 dB. The traffic study presents the details of the El Toro Aviation Plan scenario.

The first column of Table 7 lists the roadway segments. The second column shows change in existing CNEL noise levels in the Year 2025 with the project and the El Toro Aviation Plan. The next three columns show the contributions to this increase due to the project, the El Toro

Aviation Plan and the combined increase due to the project and the El Toro Aviation Plan. The final column shows if residential uses currently exist adjacent to the roadways with significant noise increases. Significant noise increases are shown in bold italics.

Table 9
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change From Existing Levels	Change In Future Due To Project	OCX	Project + OCX[1]	Existing Res.?
Culver Dr.					
Irvine to Bryan	1.6	0.4	0.2	0.6	
Bryan to Trabuco/I-5	1.5	0.3	0.2	0.5	
Yale Av.					
South of Meadowood	--	0.4	0.2	0.6	
Irvine to Bryan	2.4	0.9	0.3	***1.1***	Yes
Bryan to Trabuco	1.5	0.5	0.4	0.9	
Jeffrey Rd.					
South of Portola	***7.0***	0.9	0.7	***1.5***	No
North of Irvine	***7.9***	***1.8***	0.5	***2.4***	No
Irvine to Bryan	***6.2***	***1.9***	0.5	***2.3***	Yes
Bryan to Trabuco	***6.1***	***1.6***	0.5	***2.1***	No
South of Trabuco	***4.5***	***1.6***	0.1	***1.7***	No
North of I-5	***5.0***	***1.0***	0.0	***1.0***	No
I-5 to Irvine Center Dr.	***3.4***	0.6	0.0	0.6	Yes
Irvine Center Dr. to Barranca	2.3	0.5	0.0	0.5	
Sand Canyon Av.					
South of Portola	***7.6***	***1.2***	***2.0***	***3.1***	No
North of Irvine	***9.0***	***3.3***	***1.2***	***4.5***	No
South of Irvine	***7.3***	***4.0***	***1.1***	***5.1***	No
North of Trabuco	***7.3***	***4.0***	***1.1***	***5.1***	No
Trabuco to Roosevelt	***6.8***	***1.9***	0.1	***2.1***	No
Roosevelt to Road "B"	***7.2***	***1.2***	0.2	***1.4***	No
Road "B" to I-5	***7.2***	0.9	0.2	***1.1***	No
Millennium Bl.					
Alton to Rockfield	--	0.2	-4.8	-4.6	

1. Combined change may not be exact sum of individual changes due to project and OCX because of rounding.

Table 9 (Continued)
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change From Existing Levels	Change In Future Due To Project	OCX	Project + OCX[1]	Existing Res.?
Alton Pkwy.					
South of Portola	***5.1***	0.6	0.5	***1.1***	Yes
Commercentre to Trabuco	--	0.1	-0.8	-0.7	
Trabuco to Irvine	--	0.0	***2.6***	***2.6***	No
Irvine to Fairbanks	***5.8***	0.3	***1.0***	***1.3***	No
Fairbanks to Toledo	***7.3***	0.3	0.7	***1.0***	No
South of Toledo	***3.1***	0.2	0.4	0.6	No
North of Jeronimo	2.6	0.0	0.6	0.6	
Millenium to Ada	***3.3***	0.1	0.6	0.6	No
Ada to Technology	2.0	0.1	0.5	0.5	
Technology to I-5	1.8	0.1	0.5	0.6	
Bake Pkwy.					
Portola to SR-241	0.0	0.2	0.5	0.7	
Rockfield to Millennium	0.0	0.0	0.4	0.5	
Millennium to I-5	0.1	0.1	-0.9	-0.8	
South of I-5	***4.7***	0.1	-0.8	-0.8	No
North of Irvine Center Dr.	-0.7	0.2	-0.9	-0.7	
South of Irvine Center Dr.	--	0.0	-0.7	-0.7	
North of Lake Forest	--	0.0	-0.7	-0.7	
Portola Pkwy.					
Culver to Yale	***5.9***	0.8	0.1	0.8	Yes
Yale to Jeffrey	***6.7***	0.9	0.0	0.9	Yes
Jeffrey to Sand Canyon	***6.4***	***1.1***	0.1	***1.2***	No
Sand Canyon to SR-133	***8.1***	***1.9***	***1.5***	***3.4***	No
SR-133 to Research	***7.8***	***2.0***	***1.2***	***3.2***	No
Research to Millennium	***6.1***	***1.1***	-0.1	***1.1***	No
East of Millennium	***6.2***	***2.1***	-0.8	***1.4***	No
South of SR-241	***5.7***	0.5	0.4	0.9	No
North of SR-241	--	0.3	0.4	0.8	
West of Alton	***6.2***	0.2	0.4	0.6	Yes
Irvine Bl.					
West of Culver	1.2	0.8	-0.2	0.6	
Culver to Yale	2.3	***1.0***	-0.1	0.9	Yes
East of Yale	***4.1***	***1.2***	-0.1	***1.1***	Yes
West of Jeffrey	***4.2***	***1.0***	-0.2	0.8	Yes
East of Jeffrey	***5.3***	***1.7***	-0.1	***1.6***	No

1. Combined change may not be exact sum of individual changes due to project and OCX because of rounding.

Four road segments will experience traffic noise increases due to the combination of the project and the El Toro Aviation Plan of 1 dB or greater. For two of these road segments, Jeffrey between Irvine and Bryan and Irvine east of Yale, it is the project that causes the significant increase. The El Toro Aviation Plan does not significantly change the noise levels along these roadways. Along Irvine east of Yale future noise levels will remain below the City's 65 CNEL noise standard at the residences as discussed in Section 2.3.1. Section 2.3.1 shows that the noise levels at the residences along Jeffrey between Irvine and Bryan will exceed the 65 CNEL standard and the project will result in a significant impact. Mitigation is discussed in Section 3.2.1 and will be required to reduce future ultimate noise levels to below 65 CNEL.

Two road segments will experience traffic noise increases due to the combination of the project and the El Toro Aviation Plan of 1 dB or greater that do not experience this increase due the project or the El Toro Aviation Plan alone. These roads are Yale from Irvine to Bryan and Alton South of Portola. As discussed in Section 2.5.1 worst case future noise levels with the project will not exceed 65 CNEL at homes along Alton south of Portola. As discussed in Section 2.5.2 worst case future noise levels with the project will not exceed 65 CNEL at homes along Yale between Irvine and Bryan. Therefore, the project in combination will not result in a significant noise impact at these homes.

It should be noted that the El Toro Aviation Plan reduces noise levels along two road segments that will experience significant noise increases due to the project. These are Irvine Boulevard between Culver and Yale and West of Jeffrey. With the project and general plan the noise level increases due to the project are significant. With the project and the El Toro Aviation plan the increases are not significant. As discussed in Section 2.3.1 the future worst-case noise levels at residences along these roadway segments will be less than the City's 65 CNEL standard.

Five roadway segments are projected to have significant increases over existing conditions with the project and the El Toro Aviation Plan. These segments are, Jeffrey Road from I-5 to Irvine Center, Portola Parkway from Culver to Yale, Portola Parkway from Yale to Jeffrey, Portola Parkway West of Alton and Irvine Boulevard West of Jeffrey. The increases over existing conditions are significant with the project alone. These increases are discussed above in Sections 2.3.1 and 2.5.1. The contribution of the El Toro Aviation Plan to these increases is not significant.

2.5.5 With Spectrum Trip Reduction Plan

Noise level changes presented in Section 2.3.1 did not take into account the potential reductions in traffic due to the Spectrum Trip Reduction Plan. Table 10 presents the roadway segments that will have future (2040) with project noise levels affected by the Irvine Spectrum Trip Reduction Program. For all roadways not listed in the table the Trip Reduction Plan will not affect the noise levels generated by the roadways. The traffic study presents the details of the Trip Reduction Plan.

The first column of Table 10 lists the roadway segments. The second column shows change in existing CNEL noise levels in the Year 2040 with the project and the Irvine Spectrum Trip Reduction Plan. The next three columns show the contributions to this increase due to the project, Spectrum Trip Reduction Plan and the combined increase due to the project and the Spectrum Trip Reduction Plan. The final column shows if residential uses currently exist adjacent to the roadways with significant noise increases. Significant noise increases are shown in bold italics.

Table 10
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change From Existing Levels	Change In Future Due To: Project	Spectrum Trip Reduction Program	Project + Spectrum Trip Reduction Program[1]	Existing Res.?
Yale Ct.					
Sout of Portola	2.2	0.1	-0.1	0.0	
Jeffrey Rd.					
Alton to I-405	1.4	0.2	-0.1	0.2	
Sand Canyon Av.					
I-5 to Oak Canyon	***6.0***	0.5	-0.1	0.4	No
Oak Canyon to Irvine Center	***5.1***	0.5	-0.1	0.4	No
Irvine Center Dr. to Barranca	***5.0***	0.4	-0.1	0.3	No
Barranca to Alton	***4.6***	0.3	-0.1	0.2	Yes
Alton to I-405	***4.2***	0.2	-0.1	0.1	Yes
Central Park W.					
Irvine to W. Culture	--	***2.7***	-0.2	***2.6***	No
W. Culture to Trabuco	--	***2.8***	-0.1	***2.7***	No
E. Culture					
Millennium to Connector	--	0.9	-0.2	0.7	
W. Culture					
W. Culture to Millenium	--	***1.2***	-0.2	***1.1***	No
Alton Pkwy.					
Irvine Center Dr. to SR-133	2.0	0.0	-0.1	-0.1	
SR-133 to Laguna Canyon	1.8	0.0	-0.1	-0.1	
Laguna Cnyn to Sand Canyon	2.6	0.0	-0.3	-0.3	No
Bake Pkwy.					
South of Irvine Center Dr.	--	0.0	-0.1	-0.1	
North of Lake Forest	--	0.0	-0.1	-0.1	
Portola Pkwy.					
Culver to Yale	***6.0***	0.7	-0.1	0.6	Yes
Bryan Av.					
Yale to Jeffrey	***3.7***	0.9	-0.1	0.8	Yes
Trabuco Rd.					
East of Culver	0.5	0.3	-0.1	0.3	
Jeronimo Rd.					
Bake to Lake Forest	0.1	0.0	-0.1	-0.1	
Roosevelt Av.					
West of Sand Canyon	--	0.7	-0.1	0.6	

1. Combined change may not be exact sum of individual changes due to project and the Spectrum Trip Reduction Program because of rounding.

Table 10 (Continued)
Change in Traffic Noise CNEL Levels

Roadway & Segment	Change From Existing Levels	Change In Future Due To: Project	Spectrum Trip Reduction Program	Project + Spectrum Trip Reduction Program[1]	Existing Res.?
Walnut Av.					
Yale to Jeffrey	2.5	0.1	-0.1	0.1	
Technology Dr.					
North of Laguna Canyon Road	--	0.1	-0.1	0.1	
East of Barranca	2.6	0.1	-0.1	0.0	
Irvine Center Dr.					
Sand Canyon to Laguna Cnyn	***3.3***	0.2	-0.1	0.1	No
East of Alton	2.4	0.0	-0.1	-0.1	No
West of I-405	2.4	0.0	-0.1	-0.1	No
Barranca Pkwy.					
Paseo Westpark to Culver	0.9	0.1	-0.1	0.0	
E. Yale Loop to Jeffrey	2.0	0.1	-0.1	0.1	
Jeffrey to Sand Canyon	2.6	0.1	-0.1	0.0	
Sand Canyon to Laguna Canyon Road	2.1	0.1	-0.1	-0.1	
Laguna Canyon to SR-133	2.9	0.1	-0.3	-0.1	No
SR-133 to Irvine Center Dr.	0.9	0.0	-0.1	-0.1	
Irvine Center Dr. to I-5	1.7	0.0	-0.1	-0.1	
Technology to Ada	1.6	0.1	-0.1	0.0	
Ada to Millennium	2.5	0.1	-0.1	0.0	
Muirlands Bl.					
Bake to Lake Forest	0.2	0.0	-0.1	-0.1	
"B" St.					
East of Sand Canyon	--	0.0	-0.1	-0.1	
West of Laguna Canyon Road	--	0.0	-0.1	-0.1	
Laguna Canyon Rd.					
Sand Canyon to Technology	--	0.3	-0.1	0.2	
Technology to Irvine Center	--	0.3	-0.2	0.1	
Irvine Center Dr. to Barranca	***6.0***	0.2	-0.3	-0.1	No
Barranca to Alton	***5.7***	0.2	-0.5	-0.3	No
Alton to I-405	***6.4***	0.0	-0.3	-0.2	No
I-405 to "B" Street	***10.1***	0.0	-0.3	-0.3	No
"B" Street to SR-133	***11.0***	0.0	-0.2	-0.2	No

1. Combined change may not be exact sum of individual changes due to project and the Spectrum Trip Reduction Program because of rounding.

Table 10 shows that the Irvine Spectrum Trip Reduction Plan results in a slight reduction in the noise levels along roadways. Along all roadway segments with existing adjacent residential uses the Trip Reduction Plan only reduces noise levels by 0.1 dB. This level will not be discernable to local residents. The greatest reduction along any roadway is 0.5 dB, which is insignificant.

3.0 MITIGATION MEASURES

3.1 Temporary Impacts

It is unknown exactly what procedures will be used in the project's construction. It is anticipated that usual and customary construction methods and procedures will be employed as the area develops. In order to not result in a significant noise impact the construction activity will need to comply with the Noise Ordinance. The City of Irvine has adopted a Noise Ordinance that excludes control of construction activities during specific periods of time. Limiting construction to these hours will ensure that the construction of the project does not result in a significant noise impact.

> Control of Construction Hours - The City of Irvine has adopted a Noise Ordinance that excludes control of construction activities during the hours between 7 a.m. and 7 p.m. Monday through Friday 9 a.m. to 6 p.m. on Saturday and at no time on Sundays or national holidays. All noise generating construction activities within 500' of residential areas shall be limited to these hours.

3.2 Long Term Off-Site Impacts

3.2.1 Traffic Noise

The project is projected to result in a significant noise impact on the mobile homes and single-family residence west of Jeffrey road between Irvine and Bryan. To mitigate this impact the project will need to increase the height of the noise barrier so that future worst-case with project noise levels will be below the City's 65 CNEL standard. Preliminary calculations indicate that an 8-foot high wall will reduce future worst-case with project noise levels to below 65 CNEL. (The existing wall is currently 5'-9" high.)

Prior to issuance of Certificates of Occupancy for the 3750th residence, a noise barrier that will reduce future worst-case with project noise levels to below 65 CNEL shall be constructed. Prior to construction of the wall a detailed study should be performed by a qualified acoustical consultant to determine the specific height and location of the noise barrier required to reduce future worst-case with project noise levels to below 65 CNEL. This study shall be submitted to and approved by the City prior to construction of the noise barrier.

3.2.2 On-Site Activities

No off-site impacts are expected from on-site activities. Therefore, no mitigation is required. There is a slight possibility that specific tenants of the Research/Industrial portions of the project could generate noise levels that exceed the City of Irvine Noise Ordinance. In any case, all uses within the project will be subject to the requirements of the City of Irvine Noise Ordinance. Any specific uses that are capable of generating significant noise should be located away from existing or future residential areas. Detailed noise studies should be required for any potentially noise generating uses determined by city staff located near residential areas prior to the uses implementation. These studies should describe the noise levels generated by the use and show compliance with the City's Noise Ordinance Standards.

3.3 Long Term On-Site Impacts

3.3.1 Traffic Noise

Section 2.4.1 showed that the proposed uses for the project will be significantly impacted by traffic noise. Exterior noise levels at residential areas along the major roadways and toll-roads will exceed the City's 65 CNEL noise standard without mitigation. Interior noise levels at the residences will exceed the 45 CNEL standard without mitigation. Interior noise levels of the commercial/industrial areas will exceed the most stringent 50 CNEL standard for office areas without mitigation. Retail uses along the roadways would require mechanical ventilation to meet the 55 CNEL standard. Note that the impacts presented in Section 2.4.1 and the preliminary mitigation presented below are based on worst-case assumptions of with the use located directly along side the roadway. Site design could be effectively used to move rear residential yards and buildings away from the roadways and thus reducing the noise levels impacting these uses along with the measures required to meet the applicable noise standard.

To mitigate the significant on-site noise impact due to traffic noise, all uses within the project will need to incorporate appropriate measures to meet the noise standards presented in Table 11 below. As the plans for project are developed specific acoustical studies will be required to assure that the noise standards will be met and determine specific types of noise mitigation will be employed

Table 11
Noise Standards

Use	Standard (dB CNEL)
Residential Uses	
Exterior	65
Interior	45
Commercial Uses	
Exterior	none
Interior –Warehouse Manufacturing, Wholesale	65
Interior – Retail, Restaurant	55
Interior – Office, Research and Development	50

<u>Prior to the issuance of grading permits for any residential area a detailed acoustical study shall be prepared by a qualified acoustical consultant and submitted to the City. This report shall describe and quantify the noise sources impacting the area and the measures required to meet the 65 CNEL exterior residential noise standard. The measures described in the report shall be incorporated into the grading plans. Prior to issuance of building permits a detailed acoustical study shall be prepared by a qualified acoustical consultant and submitted to the City. This report shall describe and quantify the noise sources impacting the building(s) and the measures required to meet the appropriate interior noise standard given in Table 11. The measures described in the report shall be incorporated into the building plans.</u>

By requiring the project to meet the noise standards presented in Table 11 and providing a mechanism to ensure that these standards are met through the acoustical analyses required prior to issuance of permits the on-site significant noise impact will be mitigated. To ensure that it is feasible to meet the noise standards a preliminary analysis was performed to determine the potential worst-case measures to meet the outdoor and indoor noise standards. The results of this analysis are presented in Tables 12 and 13.

Table 12 shows the preliminary worst-case measures to meet the outdoor noise standard (65 CNEL) for residential areas. Specifically the measures are noise barriers located between the roadway and the residential areas. The analysis assumed that the barrier is 10 feet outside the roadway right of way and the roadway, base of barrier and residential pad are all at the same elevation. This assumption results in the worst-case height for the noise barrier unless there is a grade difference between the road and the pad and the barrier cannot be placed at the higher elevation. This is not expected to be the case anywhere for the project.

In the case of SR-241 the toll-road is located at a higher elevation than the residential areas. In this case the barrier was assumed to be located along the toll-road and likely in the toll-road right of way. This will require some coordination with Caltrans. It was assumed that the residential pads were 20 feet below the toll-road elevation and 150 feet from the centerline. The wall was assumed to be located 100 feet from the centerline of the toll-road.

Table 12
Preliminary Worst-Case Measures to Meet Outdoor Noise Standards

Roadway & Segment	Side	Land Use	Measure
Jeffrey Rd.			
South of Portola	West	Residential	6.5 Foot High Noise Barrier
South of Portola	East	Residential	6.5 Foot High Noise Barrier
North of Irvine	West	Residential	5.0 Foot High Noise Barrier
North of Irvine	East	Residential	7.0 Foot High Noise Barrier
Irvine to Bryan	East	Residential	5.0 Foot High Noise Barrier
South of Bryan	East	Residential	5.0 Foot High Noise Barrier
South of Bryan	West	Residential	5.0 Foot High Noise Barrier
Sand Canyon Av.			
South of Irvine	West	Residential	
North of Trabuco	West	Residential	7.5 Foot High Noise Barrier
Millennium Bl.			
South of Portola	West	Residential	
South of Portola	East	Residential	6.0 Foot High Noise Barrier

Table 12 (Continued)
Preliminary Worst-Case Measures to Meet Outdoor Noise Standards

Roadway & Segment	Side	Land Use	Measure
Portola Pkwy.			
West of Jeffrey	South	Residential	7.0 Foot High Noise Barrier
East of Jeffrey	North	Residential	6.5 Foot High Noise Barrier
East of Jeffrey	South	Residential	6.5 Foot High Noise Barrier
Research to Millennium	North	Residential	7.0 Foot High Noise Barrier
Research to Millennium	South	Residential	7.0 Foot High Noise Barrier
East of Millennium	North	Residential	7.5 Foot High Noise Barrier
East of Millennium	South	Residential	7.5 Foot High Noise Barrier
South of SR-241	North	Residential	7.0 Foot High Noise Barrier
South of SR-241	South	Residential	7.0 Foot High Noise Barrier
Irvine Bl.			
West of Jeffrey	North	Residential	7.0 Foot High Noise Barrier
East of Jeffrey	North	Residential	7.5 Foot High Noise Barrier
East of Jeffrey	South	Residential	7.5 Foot High Noise Barrier
West of Sand Canyon	South	Residential	7.0 Foot High Noise Barrier
Bryan Av.			
Yale to Jeffrey	South	Residential	5.0 Foot High Noise Barrier
Trabuco Rd.			
Yale to Jeffrey	North	Residential	5.5 Foot High Noise Barrier
Jeffrey to Road "A"	North	Residential	6.0 Foot High Noise Barrier
Road "A" to Collector St.	North	Residential	6.0 Foot High Noise Barrier
Collector St. to Road "C"	North	Residential	6.0 Foot High Noise Barrier
Road "C" Sand Canyon	North	Residential	6.0 Foot High Noise Barrier
SR-241			
West of Portola	South	Residential	4.0 Foot High Noise Barrier

Table 13 shows the preliminary worst-case measures to meet the indoor noise standards. The need for mechanical ventilation is shown along with the required outdoor-to-indoor noise reduction if the reduction is greater than 20 dB. For buildings requiring more than 12 dB but less than 20 dB of outdoor-to-indoor noise reduction to meet the appropriate standard, mechanical ventilation per the UBC will be required to assume that windows can remain closed. Windows do not need to be sealed shut, but closeable at the occupant's discretion. For buildings requiring more than 20 dB of noise reduction detailed engineering calculations will be required to determine additional building upgrades that are required to meet the applicable noise standard.

For buildings requiring between 20 and 24 dB of outdoor-to-indoor attenuation upgraded (thicker) windows may be required. For buildings requiring between 24 and 28 dB of noise reduction upgraded windows will be required. For buildings requiring between 28 and 33 dB of noise reduction structural building upgrades (e.g. thicker walls and/or roofs and attic vent baffles) will likely be required along with substantial window upgrades. It is quite difficult to achieve more than 33 dB of outdoor-to-indoor noise reduction. In no case is more than 33 dB of noise reduction required. Also note that the noise reduction listed in Table 13 is worst-case and could be significantly reduced through site design by moving buildings away from roadways.

Table 13
Preliminary Worst-Case Measures to Meet Indoor Noise Standards

Roadway & Segment	Side	Land Use	Measure
Jeffrey Rd.			
North of Portola	East	Residential	Mech. Vent.
South of Portola	West	Residential	Mech. Vent. + Bldg. Upgrds. (25 dB NR)
South of Portola	East	Residential	Mech. Vent. + Bldg. Upgrds. (21 dB NR)
North of Irvine	West	Residential	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
North of Irvine	East	Residential	Mech. Vent. + Bldg. Upgrds. (22 dB NR)
Irvine to Bryan	East	Residential	Mech. Vent. + Bldg. Upgrds. (23 dB NR)
South of Bryan	East	Residential	Mech. Vent. + Bldg. Upgrds. (23 dB NR)
South of Bryan	West	Residential	Mech. Vent. + Bldg. Upgrds. (28 dB NR)
Sand Canyon Av.			
South of Portola	West	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (21 dB NR)
South of Portola	West	Potential Retail	Mech. Vent.
South of Portola	East	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (21 dB NR)
North of Irvine	West	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (23 dB NR)
North of Irvine	West	Potential Retail	Mech. Vent.
North of Irvine	East	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (23 dB NR)
South of Irvine	West	Residential	Mech. Vent. + Bldg. Upgrds. (27 dB NR)
South of Irvine	West	Potential Retail	Mech. Vent.
South of Irvine	East	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (22 dB NR)
North of Trabuco	West	Residential	Mech. Vent. + Bldg. Upgrds. (28 dB NR)
North of Trabuco	West	Potential Retail	Mech. Vent.
North of Trabuco	East	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (22 dB NR)
Research			
South of Portola	West	Comm./Ind.	Mech. Vent.
South of Portola	East	Comm./Ind.	Mech. Vent.
North of Irvine	West	Comm./Ind.	Mech. Vent.
Millennium Bl.			
South of Portola	West	Residential	Mech. Vent. + Bldg. Upgrds. (25 dB NR)
South of Portola	East	Residential	Mech. Vent. + Bldg. Upgrds. (25 dB NR)
North of Irvine	West	Comm./Ind.	Mech. Vent.
North of Irvine	East	Comm./Ind.	Mech. Vent.

Table 13 (Continued)
Preliminary Worst-Case Measures to Meet Indoor Noise Standards

Roadway & Segment	Side	Land Use	Measure
Portola Pkwy.			
West of Jeffrey	South	Residential	Mech. Vent. + Bldg. Upgrds. (27 dB NR)
East of Jeffrey	North	Residential	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
East of Jeffrey	South	Residential	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
West of Sand Canyon	South	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (21 dB NR)
Sand Canyon to SR-133	South	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (24 dB NR)
Sand Canyon to SR-133	South	Potential Retail	Mech. Vent.
SR-133 to Research	North	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (23 dB NR)
SR-133 to Research	South	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (23 dB NR)
Research to Millennium	North	Residential	Mech. Vent. + Bldg. Upgrds. (27 dB NR)
Research to Millennium	South	Residential	Mech. Vent. + Bldg. Upgrds. (27 dB NR)
East of Millennium	North	Residential	Mech. Vent. + Bldg. Upgrds. (27 dB NR)
East of Millennium	South	Residential	Mech. Vent. + Bldg. Upgrds. (27 dB NR)
East of Millennium	South	Potential Retail	Mech. Vent.
South of SR-241	North	Residential	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
South of SR-241	North	Potential Retail	Mech. Vent.
South of SR-241	South	Residential	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
Irvine Bl.			
West of Jeffrey	North	Residential	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
East of Jeffrey	North	Residential	Mech. Vent. + Bldg. Upgrds. (27 dB NR)
East of Jeffrey	South	Residential	Mech. Vent. + Bldg. Upgrds. (27 dB NR)
West of Sand Canyon	North	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (22 dB NR)
West of Sand Canyon	Both	Potential Retail	Mech. Vent.
West of Sand Canyon	South	Residential	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
Sand Canyon to SR-133	North	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (22 dB NR)
Sand Canyon to SR-133	South	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (22 dB NR)
SR-133 to Research	North	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (22 dB NR)
Millennium to Connector	North	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (23 dB NR)
Bryan Av.			
Yale to Jeffrey	South	Residential	Mech. Vent. + Bldg. Upgrds. (21 dB NR)
Trabuco Rd.			
Yale to Jeffrey	North	Residential	Mech. Vent. + Bldg. Upgrds. (24 dB NR)
Jeffrey to Road "A"	North	Residential	Mech. Vent. + Bldg. Upgrds. (25 dB NR)
Road "A" to Collector St.	North	Residential	Mech. Vent. + Bldg. Upgrds. (24 dB NR)
Collector St. to Road "C"	North	Residential	Mech. Vent. + Bldg. Upgrds. (24 dB NR)
Road "C" Sand Canyon	North	Residential	Mech. Vent. + Bldg. Upgrds. (24 dB NR)
Road "C" Sand Canyon	North	Potential Retail	Mech. Vent.
Sand Canyon SR-133	North	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (22 dB NR)
SR-133 to Research	North	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (23 dB NR)

Table 13 (Continued)
Preliminary Worst-Case Measures to Meet Indoor Noise Standards

Roadway & Segment	Side	Land Use	Measure
SR-241			
East of SR-133	South	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (27 dB NR)
West of Portola	South	Residential	Mech. Vent. + Bldg. Upgrds. (32 dB NR)
West of Portola	South	Potential Retail	Mech. Vent. + Bldg. Upgrds. (22 dB NR)
SR-133			
South of SR-241	East	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
North of Irvine	West	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
North of Irvine	East	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (26 dB NR)
Irvine to Trabuco	West	Comm./Ind.	Mech. Vent. + Bldg. Upgrds. (26 dB NR)

Tables 12 and 13 show that it is feasible to meet the outdoor and indoor noise standards without requiring extraordinary measures. The measures presented in these table should be considered worst-case. Use of site design, locating uses away from roadways, would reduce and potentially eliminate many of the measures presented in the tables. As discussed above, detailed acoustical studies will be required to determine the specific measures required.

3.3.2 On-Site Activities

Retail sites and Research/Industrial uses directly adjacent to residential areas could generate noise levels in excess of the Noise Ordinance Standards. These uses will need to comply with the Noise Ordinance. Prior to issuance of grading permits for any retail sites or Research/Industrial uses that directly abut residential uses, a detailed noise assessment of the use and compliance with the Noise Ordinance shall be performed by a qualified acoustical consultant. The report shall address, at a minimum, parking lot noise, mechanical equipment noise and delivery truck noise. Other sources of noise potentially exceeding the Noise Ordinance shall be identified and analyzed. The report shall present any measures required to ensure that the noise generated by the retail use will not exceed the Noise Ordinance at any residential areas. These measures shall be incorporated into the project. The report shall be submitted to and approved by the City.

There is a slight possibility that specific tenants of the Research/Industrial portions of the project could generate noise levels in exceedence of the City of Irvine Noise Ordinance at the proposed residences. In any case, all uses within the project will be subject to the requirements of the City of Irvine Noise Ordinance. Any specific uses that are capable of generating significant noise should be located away from existing or future residential areas. Detailed noise studies should be required for any potentially noise generating uses determined by city staff located near residential areas prior to the uses implementation. These studies should describe the noise levels generated by the use and show compliance with the City’s Noise Ordinance Standards.

4.0 UNAVOIDABLE NOISE IMPACTS

There are no unavoidable significant noise impacts associated with the project.

APPENDIX

Traffic Volumes
Traffic Mixes

Table A-1
Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
Santiago Canyon Rd.												
Newport to Jamboree	1166	15,622	48,200	41,400	48,600	41,800	44,900	48,600	48,600	51,200	51,600	51,700
Jamboree to SR-241	1167	--	38,300	40,700	39,000	41,100	34,300	39,000	39,000	40,600	41,100	41,000
SR-241 to Handy Creek	1168	--	39,400	39,600	40,300	40,000	36,000	40,400	40,300	45,600	46,100	45,900
Handy Creek to Culver Loop	1169	6,833	24,400	27,000	25,300	27,500	23,200	25,300	25,300	28,500	29,200	29,000
Culver Loop to Culver	1170	6,833	21,000	24,800	21,600	25,200	21,600	21,600	21,600	24,500	25,000	25,000
Culver to "B" Street	1171	6,833	19,500	21,600	20,000	21,800	20,600	20,000	20,000	21,700	22,300	22,200
"B" Street to "C" Street	1172	6,833	22,800	25,000	23,400	25,100	24,400	23,500	23,500	25,200	25,900	25,800
"C" Street to Jeffrey	1173	6,833	18,700	17,000	19,400	17,200	17,800	19,400	19,500	18,300	19,100	19,000
East of Jeffrey	1174	6,833	20,400	17,900	21,100	18,200	20,700	21,100	21,200	19,800	20,400	20,300
Chapman Av.												
Newport to Jamboree	1184	11,781	33,400	34,400	34,900	35,200	30,600	34,900	34,900	37,700	38,600	38,600
Jamboree to SR-241	1185	16,363	20,900	23,400	21,900	23,900	18,300	21,900	21,900	24,300	25,000	25,100
Canyon View Av.												
Newport to Jamboree	1187	4,825	5,000	5,100	5,200	5,300	4,200	5,200	5,300	5,600	5,800	5,800
Handy Creek												
Jamboree to SR-261	1188	--	9,300	14,200	9,300	14,200	5,900	9,200	9,300	10,600	10,700	10,700
SR-261 to "A" Street	1189	--	14,000	21,900	14,300	22,000	7,200	14,300	14,300	22,000	22,300	22,200
"A" Street to Santiago Canyon	1190	--	6,500	11,300	6,700	11,300	6,300	6,700	6,800	10,800	11,000	11,000
"A" St.												
Handy Creek to Culver Loop	1191	--	5,700	7,000	5,900	7,100	900	5,800	5,800	9,100	9,300	9,300
Culver Loop												
Santiago Canyon to "A" Street	1192	--	6,100	4,400	6,600	4,600	2,200	6,600	6,600	9,500	9,600	9,500
"A" Street to Culver	1193	--	14,000	10,000	14,600	10,200	3,100	14,700	14,700	19,300	19,800	19,800
Headlands												
Culver to "E" Street	1194	--	9,700	9,600	10,100	9,600	3,300	10,100	10,100	16,700	17,200	17,100
"C" St.												
"D" Street to Santiago Canyon	1154	--	11,800	15,700	11,900	15,700	7,300	11,900	11,900	19,400	19,600	19,500
Santiago Canyon to Headlands	1155	--	8,000	7,000	8,300	7,000	3,100	8,300	8,300	12,800	13,100	13,100
Headlands to Jeffrey	1156	--	2,900	2,000	2,900	2,000	4,000	2,900	2,900	4,500	4,500	4,500
Tustin Ranch Rd.												
Jamboree to Portola	77	3,213	5,000	5,300	5,000	5,300	5,200	5,000	5,000	4,100	4,100	4,100

Jamboree Rd.												
North Lake to Santiago Canyon	1141	--	27,800	--	28,000	--	27,300	28,000	28,500	20,700	20,900	20,900

Table A-1
Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
Santiago Canyon to Chapman	1142	15,419	30,000	16,800	30,800	16,400	31,500	30,900	31,200	25,000	26,100	25,900
Chapman to Canyon View	1143	14,376	30,600	22,100	31,400	22,400	33,300	31,300	32,000	24,600	25,200	25,200
Canyon View to Handy Creek	1144	16,924	32,700	25,100	33,600	25,800	32,900	33,500	34,200	26,300	27,000	26,900
South of Handy Creek	1145	16,924	30,300	29,600	31,200	30,200	35,200	31,100	31,700	20,400	21,200	21,100
North of Tustin Ranch Rd.	124	18,654	29,300	28,600	29,900	29,100	33,000	29,900	30,400	22,800	23,300	23,200
Tusting Ranch Rd. to Portola	125	23,573	31,900	30,300	32,800	31,000	36,200	32,800	33,500	25,900	26,600	26,600
South of Portola	126	23,573	34,800	32,300	35,200	32,300	35,400	35,200	36,700	29,800	30,200	30,100
North of Irvine	127	28,395	40,100	38,000	40,500	38,100	41,000	40,400	41,900	35,200	35,500	35,400
Irvine to Bryan	128	32,766	43,900	42,700	44,800	43,200	45,600	44,800	46,100	40,600	41,500	41,400
Bryan to El Camino Real	129	40,436	47,900	47,800	48,700	48,300	49,400	48,600	50,000	43,700	44,100	44,000
El Camino Real to I-5	130	57,814	67,900	70,100	68,500	70,500	69,500	68,500	70,000	66,500	66,800	66,700
South of I-5	131	59,698	65,400	66,700	65,100	66,400	64,600	65,000	64,100	66,500	66,500	66,300
Culver Dr.												
Santiago Canyon to Headlands	1149	--	9,200	7,400	9,600	7,600	1,700	9,500	9,600	12,900	13,400	13,400
Headlands to SR-241	1150	--	16,800	14,900	17,700	15,200	4,300	17,700	17,900	28,000	28,900	28,800
SR-241 to Culver Loop	1151	--	22,800	10,000	23,900	10,200	3,100	24,000	24,100	26,000	26,800	26,800
South of Culver Loop	1152	--	21,700	--	22,600	--	--	22,700	22,700	20,300	21,000	21,000
North of Portola	204	--	17,900	4,600	17,900	4,600	5,400	17,900	18,000	20,400	20,400	20,300
South of Portola	205	6,144	22,400	11,300	22,500	11,700	13,000	22,600	23,500	22,700	22,800	22,800
North of Irvine	208	17,788	22,100	16,800	22,800	17,600	18,600	22,800	23,500	21,900	22,600	22,600
Irvine to Bryan	210	27,343	34,800	29,600	38,000	32,300	33,300	38,100	39,800	35,900	38,700	38,600
Bryan to Trabuco/I-5	212	36,614	45,800	42,100	49,500	45,100	47,200	49,400	51,400	46,700	49,600	49,600
Trabuco/I-5 to Walnut	213	45,305	53,200	51,800	55,400	53,700	52,600	55,000	55,300	53,300	55,400	55,200
Walnut to Irvine Center Dr.	216	42,228	47,200	45,800	47,900	46,600	46,400	47,900	48,200	46,900	48,100	48,000
Irvine Center Dr. to Warner	217	42,071	52,200	50,800	52,700	51,300	51,100	52,700	52,900	51,100	51,800	51,900
Warner to Barranca	218	44,997	50,600	49,600	51,000	49,800	49,500	50,800	51,300	50,800	51,400	51,200
Barranca to Alton	219	43,839	48,600	48,500	49,100	48,900	48,000	49,200	49,400	49,300	49,600	49,400
Alton to Main	220	46,766	50,400	50,100	50,600	50,300	49,500	50,600	50,600	51,400	51,400	51,400
Yale Ct.												
South of Portola	236	3,701	5,800	6,100	6,000	6,000	5,700	5,900	5,700	6,100	6,200	6,100
Yale Av.												
South of Meadowood	241	--	3,200	2,800	3,500	3,300	3,200	3,500	3,700	3,300	3,500	3,500
North of Irvine	242	16,457	8,800	8,600	9,400	9,400	9,400	9,400	9,600	8,800	9,400	9,400
Irvine to Bryan	243	9,569	12,800	12,700	15,600	15,100	15,900	15,700	16,600	12,900	15,300	15,300

Table A-1
Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
Bryan to Trabuco	254	12,198	13,900	13,700	15,600	15,200	16,000	15,700	17,100	13,800	15,500	15,400
Trabuco to Walnut	255	11,998	18,300	18,800	21,200	21,100	19,300	21,400	20,200	17,900	20,700	20,600
Walnut to Irvine Center Dr.	258	13,705	13,800	13,600	14,200	13,900	13,900	13,800	14,200	14,500	15,000	14,900
Irvine Center Dr. to Yale Loop	259	10,382	12,300	12,400	12,700	12,400	12,400	12,700	12,600	12,100	12,500	12,400
Jeffrey Rd.												
"D" Street to Santiago Canyon	1159	--	7,300	6,900	7,300	7,200	9,700	7,300	7,200	13,400	13,200	13,200
Santiago Canyon to "C" Street	1160	--	6,900	5,700	6,700	6,000	10,600	6,700	6,700	12,100	11,700	11,700
"C" Street to SR-241	1105	--	9,400	7,200	9,100	7,600	12,100	9,100	9,000	15,400	15,000	14,900
SR-241 to Portola	284	--	16,200	--	17,000	--	20,600	17,200	17,000	11,600	11,400	11,400
South of Portola	285	7,035	24,800	12,500	30,200	18,900	33,300	30,500	35,300	21,400	27,000	26,900
North of Irvine	286	7,035	24,800	12,500	37,900	27,000	40,900	38,200	43,000	21,400	34,300	34,200
Irvine to Bryan	287	13,476	32,500	22,600	49,900	41,900	52,600	50,000	55,800	30,500	47,700	47,600
Bryan to Trabuco	289	13,888	35,600	26,700	51,300	44,000	53,100	51,800	57,200	34,100	49,000	48,800
South of Trabuco	291	21,804	41,300	33,300	59,300	52,800	58,200	59,900	61,200	39,500	57,500	57,200
North of I-5	292	21,804	55,100	50,900	69,200	66,600	67,400	67,300	69,500	55,200	69,400	69,100
I-5 to Irvine Center Dr.	293	25,442	49,000	46,000	56,200	54,200	55,200	54,800	56,200	50,800	57,800	57,500
Irvine Center Dr. to Barranca	295	32,683	49,600	47,000	55,400	53,700	54,800	55,200	55,400	51,200	57,000	56,600
Barranca to Alton	297	33,153	51,200	49,800	55,200	54,900	54,900	55,100	54,700	53,300	57,400	56,800
Alton to I-405	300	41,745	52,000	53,700	54,800	57,600	55,300	54,700	54,500	55,400	58,300	57,600
Sand Canyon Av.												
South of Portola	304	6,594	18,700	10,800	24,400	19,600	27,400	24,400	38,300	13,100	19,800	19,700
North of Irvine	305	6,594	18,700	10,800	39,600	35,800	42,500	39,700	52,700	13,100	35,400	35,200
South of Irvine	306	10,986	18,200	12,500	45,300	42,800	49,700	45,400	58,600	14,100	42,700	42,500
North of Trabuco	307	10,986	18,200	12,500	45,300	42,800	49,700	45,400	58,600	14,100	42,700	42,500
Trabuco to Roosevelt	308	13,712	40,800	38,300	63,800	65,100	60,700	64,300	65,700	42,900	68,000	67,700
Roosevelt to Road "B"	1211	11,962	45,400	42,800	60,000	60,800	56,600	60,100	62,500	47,000	64,300	63,900
Road "B" to I-5	309	13,712	56,100	52,700	69,500	70,000	66,500	66,900	72,700	57,400	73,900	73,300
I-5 to Oak Canyon	310	18,646	58,000	57,100	64,700	65,200	62,200	61,500	58,800	67,200	75,500	74,200
Oak Canyon to Irvine Center Dr.	312	15,543	40,900	40,300	45,500	46,000	43,200	44,600	40,100	46,400	51,800	50,800
Irvine Center Dr. to Barranca	317	15,690	40,200	39,400	43,800	44,500	42,900	43,700	40,500	47,000	51,300	50,100
Barranca to Alton	319	15,208	36,700	35,400	38,800	38,700	39,000	39,000	37,200	41,900	45,300	44,000
Alton to I-405	321	19,361	44,000	42,800	45,600	45,500	45,600	45,800	44,000	49,400	51,800	50,600
I-405 to "B" Street	322	100	25,300	26,800	25,300	26,900	25,500	25,300	25,400	26,400	26,400	26,100
Research												
South of Portola	337	--	19,300	19,200	25,800	25,100	--	25,700	--	19,100	25,400	25,300
North of Irvine	338	--	19,300	19,200	25,800	25,100	--	25,700	--	19,100	25,400	25,300
Irvine to Trabuco	340	--	16,900	17,100	19,100	18,900	--	19,000	--	16,800	18,300	18,300
Trabuco to Marine	341	--	9,500	9,600	9,900	9,800	25,300	9,900	--	9,600	9,900	9,900
Airport Wy.												

Table A-1
Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
South of Irvine	339	--	--	--	--	--	--	--	23,700	--	--	--
North of Trabuco	340	--	--	--	--	--	--	--	73,200	--	--	--
Trabuco to Air Cargo	341	--	--	--	--	--	--	--	29,000	--	--	--
Air Cargo												
East of Airport	342	--	--	--	--	--	--	--	12,100	--	--	--
Central Park W.												
Irvine to W. Culture	1212	--	1,400	1,400	2,600	2,600	--	2,600	--	1,500	2,800	2,700
W. Culture to Trabuco	1215	--	2,300	2,500	3,900	4,100	--	4,000	--	2,000	3,800	3,700
Trabuco to Marine	1216	--	10,900	10,800	13,000	12,800	--	12,900	--	11,800	13,900	13,800
Marine to Millennium	607	--	15,600	15,500	15,100	15,300	5,400	15,100	--	15,400	15,400	15,300
Central Park E.												
Irvine to Trabuco	382	--	1,500	1,600	1,900	2,000	--	1,900	--	1,600	1,900	1,900
Trabuco to Astor	384	--	11,200	10,600	11,000	10,800	--	10,900	--	11,000	11,300	11,300
Astor to Millenium	608	--	11,900	11,500	11,500	11,400	11,600	11,400	--	11,700	11,800	11,800
E. Culture												
Millennium to Connector	554	--	2,300	2,500	2,500	2,600	--	2,500	--	1,800	2,200	2,100
Connector to Trabuco	380	--	1,200	1,100	1,300	1,200	--	1,400	--	1,200	1,400	1,400
Trabuco to Millennium	381	--	800	800	800	800	--	800	--	800	800	800
W. Culture												
Central Park W. to W. Culture	552	--	1,000	900	1,500	1,500	--	1,600	--	700	1,400	1,400
W. Culture to Millenium	553	--	2,000	1,900	2,400	2,300	--	2,500	--	1,800	2,400	2,300
W. Culture to Trabuco	1219	--	1,300	1,300	1,200	1,300	--	1,200	--	1,200	1,100	1,100
Trabuco to Millenium	1220	--	2,600	2,800	2,600	2,700	--	2,500	--	2,600	2,500	2,500
Millennium Bl.												
Sout of Portola	365	--	7,000	5,600	19,500	18,800	22,200	19,400	--	9,200	18,900	18,900
North of Irvine	366	--	7,000	5,600	23,800	23,800	27,200	23,700	--	9,200	22,800	22,800
Irvine to W. Culture	367	--	12,900	11,600	22,000	22,000	24,700	22,000	--	15,900	23,300	23,200
South of W. Culture	369	--	13,500	12,900	22,200	22,500	--	22,200	--	15,800	23,000	22,900
North of Trabuco	370	--	--	--	--	--	20,300	--	--	--	--	--
Trabuco to E. Culture	371	--	24,500	25,000	32,100	33,200	17,800	32,100	--	25,700	32,400	32,300
South of E. Culture	373	--	--	--	--	--	17,400	--	--	--	--	--

Table A-1
Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
North of Central Park E.	374	--	22,700	23,400	29,600	30,700	--	29,500	--	23,700	29,800	29,700
Central Park E. to Barranca	376	--	55,400	57,400	58,900	60,500	27,700	58,800	--	56,100	60,200	60,100
South of Barranca	377	--	--	--	--	--	17,900	--	--	--	--	--
North of Alton	644	--	38,800	40,200	41,600	43,300	18,000	41,600	--	38,500	41,200	41,200
Alton to Rockfield	645	--	46,200	48,200	48,400	50,700	23,200	48,400	16,100	47,900	50,200	49,900
Rockfield to Bake	646	--	30,800	31,700	31,700	33,200	--	31,700	--	32,600	33,800	33,600
Connector												
Irvine to E. Culture	378	--	5,000	5,300	4,800	5,000	--	4,900	--	4,500	4,400	4,400
Alton Pkwy.												
South of Portola	389	6,080	15,000	25,000	17,200	25,600	15,200	17,200	19,500	14,400	15,200	15,200
North of SR-241	391	--	34,400	41,800	36,400	42,200	31,800	36,400	37,000	43,200	44,600	44,500
SR-241 to Commercentre	393	--	58,200	66,700	59,500	67,100	48,000	59,400	54,100	50,000	51,500	51,300
Commercentre to Trabuco	394	--	59,500	68,700	60,500	69,500	45,100	60,500	50,800	50,300	51,900	51,700
Trabuco to Irvine	396	--	28,200	28,800	28,100	28,200	45,100	28,000	50,800	28,500	28,300	28,200
Irvine to Fairbanks	397	11,509	32,700	33,400	35,000	35,000	38,700	34,900	43,900	35,500	37,900	37,800
Fairbanks to Toledo	398	7,476	31,400	32,100	33,600	33,600	37,300	33,400	39,800	34,500	36,800	36,700
South of Toledo	399	23,092	41,300	43,100	43,100	44,100	47,100	42,900	47,500	44,200	46,000	45,900
North of Jeronimo	400	23,092	37,100	39,500	37,400	38,800	43,300	37,300	42,500	39,400	39,300	39,200
Jeronimo to Muirlands	401	28,621	42,700	45,600	42,800	44,800	46,900	42,700	44,900	44,500	44,200	43,900
Muirlands to Millennium	402	24,298	37,300	39,800	37,900	39,800	40,700	37,800	41,000	39,400	39,300	39,000
Millenium to Ada	404	24,298	44,700	48,400	45,300	48,300	47,200	45,200	51,700	44,300	44,400	44,000
Ada to Technology	406	28,997	40,600	43,900	41,300	44,000	42,300	41,100	46,000	40,500	40,500	40,200
Technology to I-5	407	43,994	58,600	62,200	59,600	62,300	62,200	59,300	66,600	67,600	67,700	67,400
I-5 to Irvine Center Dr.	408	22,634	42,400	44,500	42,400	44,400	43,700	42,300	43,200	41,300	41,200	40,900
Irvine Center Dr. to SR-133	410	14,893	25,400	28,900	25,300	28,500	26,200	25,300	26,100	24,200	24,100	23,600
SR-133 to Laguna Canyon Road	412	15,619	24,800	27,700	25,000	27,600	25,300	24,900	25,600	24,500	24,500	23,700
Laguna Canyon to Sand Canyon	797	18,294	35,400	36,200	35,600	36,400	36,100	35,500	36,600	35,100	35,300	33,000
Sand Canyon to Jeffrey	793	14,800	31,000	31,100	31,900	31,700	31,200	31,700	31,400	29,500	30,100	30,000
West of Jeffrey	791	28,238	36,000	37,300	37,300	38,500	36,800	37,300	37,100	34,600	35,800	35,600
East of Culver	784	24,488	32,200	31,500	33,000	32,100	32,600	32,900	32,400	29,800	30,500	30,500
West of Culver	783	25,642	30,800	29,700	31,700	30,300	31,400	31,700	31,300	28,900	29,500	29,600
Bake Pkwy.												
Portola to SR-241	416	26,704	22,900	26,700	24,000	26,700	23,900	24,000	26,700	21,700	22,000	22,000
SR-241 to Rancho Parkway	417	33,661	28,500	33,700	29,700	33,700	29,300	29,700	30,100	27,500	27,900	27,900
Rancho Pkwy to Commercecentre	418	33,661	44,000	41,400	44,200	41,900	42,800	44,200	43,700	40,900	40,700	40,700
Commercecentre to Trabuco	419	38,907	49,700	51,400	50,500	52,000	51,200	50,500	52,500	46,500	46,500	46,500
Trabuco to Toledo	420	46,085	49,900	51,000	51,000	51,800	53,200	51,000	54,500	49,100	49,800	49,700
Toledo to Jeronimo	421	48,546	55,200	56,600	55,900	57,000	58,600	55,900	59,500	54,100	54,300	54,200
Jeronimo to Muirlands	422	55,529	60,600	61,400	60,800	61,100	64,000	60,700	65,000	60,100	59,600	59,600
Muirlands to Rockfield	424	57,276	61,900	61,300	61,900	60,900	64,900	61,800	65,900	61,200	60,600	60,400
Rockfield to Millennium	425	68,854	62,100	62,400	62,300	61,900	67,900	62,200	68,900	61,600	61,000	60,800

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Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
Millennium to I-5	426	68,854	83,800	83,900	85,300	85,300	68,000	85,200	69,800	86,500	87,400	86,900
South of I-5	427	9,951	35,100	40,200	35,700	40,900	29,800	35,700	29,400	36,800	37,200	36,900
North of Irvine Center Dr.	428	9,583	9,600	8,300	10,100	8,300	8,000	9,800	8,200	10,300	10,400	10,300
South of Irvine Center Dr.	429	--	11,200	11,900	11,100	12,100	9,900	11,200	9,500	12,200	12,200	12,000
North of Lake Forest	430	--	11,200	11,900	11,100	12,100	9,900	11,200	9,500	12,200	12,200	12,000
South of Lake Forest	431	--	8,100	--	7,900	--	7,200	7,900	7,500	9,500	9,300	9,200
Lake Forest Dr.												
East of Irvine Center Dr.	445	20,792	32,500	33,200	32,700	33,100	32,900	32,700	32,800	32,700	32,900	32,800
Irvine Center Dr. to Scientific Wy.	446	7,708	19,100	17,200	19,200	17,200	19,100	19,200	19,100	18,000	18,100	18,000
Scientific Wy. to Bake	859	5,500	21,100	13,600	21,400	13,600	20,900	21,400	21,700	19,800	20,000	19,800
Bake to Laguna Canyon Road	857	--	24,900	--	25,700	--	25,400	25,600	26,900	22,900	23,200	23,000
Portola Pkwy.												
Tustin Ranch to Jamboree	467	3,992	10,800	11,500	10,700	11,400	11,300	10,600	10,700	8,300	8,200	8,200
Jamboree to SR-261	468	7,276	31,700	30,300	34,200	32,400	31,300	34,200	34,100	33,400	35,200	35,100
SR-261 to Culver	469	10,692	43,100	46,100	46,900	51,000	45,200	46,800	46,600	54,200	57,900	57,600
Culver to Yale	471	6,825	21,800	24,600	26,000	30,400	26,100	26,000	26,500	23,400	27,400	27,000
Yale to Jeffrey	473	7,200	26,900	28,500	33,100	35,800	31,400	33,100	33,400	29,800	35,600	35,300
Jeffrey to Sand Canyon	474	6,918	22,600	17,800	29,400	25,100	28,100	29,000	30,000	19,700	25,600	25,400
Sand Canyon to SR-133	476	8,500	24,700	15,300	38,400	30,800	40,500	38,300	54,600	16,400	30,400	30,400
SR-133 to Research	477	8,500	24,700	15,300	39,300	31,600	39,900	39,200	51,800	16,400	31,500	31,400
Research to Millennium	479	8,500	27,000	16,500	35,100	26,000	31,000	35,000	34,600	19,200	28,000	27,900
East of Millennium	480	8,500	25,700	11,900	42,100	30,600	43,500	42,100	35,400	20,400	34,700	34,600
South of SR-241	388	8,500	25,800	11,900	29,200	16,000	31,500	29,200	31,700	20,400	27,700	27,600
North of SR-241	387	--	24,500	--	26,500	--	28,600	26,500	29,200	15,700	16,900	16,800
West of Alton	481	6,059	21,900	10,300	23,000	10,300	24,600	23,000	25,200	15,200	15,800	15,700
Alton to Bake	482	12,195	24,800	17,400	26,000	17,300	25,800	26,000	25,600	17,900	18,900	18,800
Bake to Lake Forest	1079	27,497	30,900	28,100	31,200	27,900	31,100	31,200	31,300	24,000	23,700	23,700
Rancho												
Alton to Bake	1905	--	31,400	33,100	31,600	33,500	27,200	31,600	28,500	23,900	24,400	24,400
Bake to Lake Forest	1906	--	52,900	53,800	52,400	53,700	50,700	52,500	51,300	44,900	44,900	44,900
Irvine Bl.												
Tustin Ranch to Jamboree	501	24,463	42,900	42,100	44,800	44,800	44,200	44,600	43,900	42,600	44,300	44,200
Jamboree to SR-261	502	25,691	32,600	32,700	35,600	35,900	34,900	35,700	34,700	37,500	40,100	40,000
East of SR-261	503	24,247	38,200	36,600	42,200	40,800	40,600	42,300	41,200	37,700	41,500	41,300
West of Culver	504	24,247	27,900	27,000	33,300	32,300	32,700	33,400	31,900	27,300	32,200	32,000
Culver to Yale	505	21,220	29,500	27,800	37,200	35,400	36,500	37,300	36,000	28,300	35,500	35,300
East of Yale	507	16,778	33,100	30,400	44,100	40,900	43,100	44,100	42,700	32,200	42,000	41,900
West of Jeffrey	508	16,778	36,600	33,300	45,700	41,900	44,300	45,700	43,800	35,700	44,000	43,800
East of Jeffrey	509	15,086	34,900	29,800	51,600	46,700	49,400	51,300	50,800	33,000	48,400	48,000

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Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
West of Sand Canyon	510	15,086	34,900	29,900	41,700	38,700	38,800	41,400	39,700	33,000	41,100	40,700
Sand Canyon to SR-133	511	18,696	33,500	32,800	42,700	44,300	42,300	42,700	46,400	33,900	45,200	44,900
SR-133 to Research	512	19,089	40,800	42,000	50,800	51,100	43,600	50,900	46,400	40,900	51,000	50,800
Research to Central Park W.	513	19,089	39,600	42,200	47,600	49,400	43,600	47,800	65,300	36,200	44,200	44,100
Central Park W. to Millennium	515	19,089	38,300	40,900	45,600	47,300	43,600	45,800	59,500	34,900	42,000	41,900
Millennium to Connector	518	17,320	31,000	34,600	38,800	43,400	50,600	38,800	52,200	27,600	35,400	35,400
Connector to Central Park E.	519	17,320	35,600	39,500	42,600	47,500	50,600	42,700	52,200	31,400	38,900	38,800
Central Park E. to Trabuco	521	17,320	35,100	39,200	41,700	46,500	50,600	41,900	52,200	31,000	38,000	37,900
Trabuco to Alton	523	17,320	34,200	36,000	38,900	41,100	50,000	38,900	50,100	31,900	36,600	36,600
Bryan Av.												
West of Jamboree	538	13,218	13,200	13,700	13,400	14,300	13,200	13,500	13,200	17,200	17,900	18,000
East of Jamboree	539	11,880	16,600	17,300	17,800	18,000	17,400	17,900	17,400	21,500	22,300	22,300
West of Culver	540	11,880	17,500	17,800	19,200	19,600	19,200	19,200	18,800	17,100	18,600	18,600
Culver to Yale	541	7,481	8,500	8,700	9,400	9,600	9,300	9,400	9,100	8,300	9,100	9,100
Yale to Jeffrey	550	5,171	9,700	10,300	12,200	13,000	11,800	12,200	11,700	10,100	12,400	12,200
El Camino Real												
Tustin Ranch to Jamboree	1205	13,620	22,500	22,100	22,600	22,100	22,600	22,600	22,500	26,200	26,400	26,400
East of Jamboree	1206	--	29,800	29,900	30,500	30,600	32,600	30,600	30,200	28,200	28,900	28,900
Trabuco Rd.												
East of Culver	561	23,209	24,300	24,100	26,700	26,200	24,800	26,100	25,000	24,100	26,100	25,800
West of Yale	562	12,595	20,600	20,500	23,500	23,100	21,500	23,500	21,600	19,100	21,400	21,300
Yale to Jeffrey	564	3,060	18,000	18,500	22,300	22,600	19,000	22,600	19,800	16,400	20,700	20,600
Jeffrey to Road "A"	565	2,021	24,700	25,700	29,100	29,100	23,500	29,700	26,300	22,600	26,600	26,400
Road "A" to Collector St.	1208	2,600	23,000	24,500	28,000	28,700	21,500	27,700	23,700	21,300	26,000	25,800
Collector St. to Road "C"	1910	2,600	23,000	--	26,100	--	19,200	25,700	21,600	21,300	24,400	24,200
Road "C" Sand Canyon	566	2,021	24,700	26,400	27,400	28,500	19,400	26,900	21,600	23,400	26,000	25,800
Sand Canyon SR-133	567	--	38,900	44,200	44,500	48,700	29,100	44,300	42,400	43,500	47,600	47,300
SR-133 to Research	568	--	63,000	68,600	67,100	71,800	38,200	67,200	50,700	61,100	63,500	63,200
Research to Central Park W.	569	--	49,000	55,000	51,900	57,200	28,600	51,800	--	46,200	47,500	47,200
Central Park W. to W. Culture	572	--	39,100	45,500	40,700	46,600	--	40,600	--	33,100	33,400	33,300
W. Culture to Millennium	573	--	37,800	44,000	39,300	45,200	--	39,300	--	31,700	32,100	31,900
Millennium to E. Culture	575	--	37,000	43,300	38,200	44,300	--	38,200	--	30,300	30,800	30,700

Table A-1
Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
E. Culture to Central Park E.	577	--	34,200	41,000	35,700	41,900	--	35,700	--	27,100	28,200	28,000
Central Park E. to Irvine	386	--	43,300	49,500	44,200	50,400	--	44,200	--	35,800	37,000	36,900
Irvine to Alton	385	--	33,800	42,100	35,500	43,900	--	35,500	--	25,100	27,400	27,200
East of Alton	525	22,905	51,300	50,800	55,100	55,700	51,600	55,200	57,900	47,600	51,600	51,400
West of Bake	526	22,905	42,000	41,600	44,800	45,400	42,500	44,900	47,800	39,100	41,900	41,700
East of Bake	527	25,462	30,300	30,400	31,200	31,300	28,200	31,200	30,400	27,100	27,900	27,800
Toledo Wy.												
Alton to Bake	610	8,613	5,200	5,400	5,200	5,300	5,400	5,200	5,400	5,300	5,200	5,200
Bake to Lake Forest	611	8,994	9,900	10,400	10,000	10,400	9,500	10,000	9,300	9,100	9,000	9,000
Jeronimo Rd.												
Alton to Bake	618	10,943	8,000	9,000	7,900	9,000	8,100	7,900	7,600	9,100	9,000	9,000
Bake to Lake Forest	619	9,983	10,600	11,000	10,600	10,900	10,100	10,600	10,000	10,300	10,300	10,100
Roosevelt Av.												
East of Jeffrey	1207	--	31,500	31,100	31,500	31,000	30,600	33,300	31,400	30,700	30,600	30,400
West of Sand Canyon	1209	--	9,700	10,200	11,400	11,700	11,800	9,800	11,900	9,900	11,500	11,300
Rd "B"												
Road "A" to Sand Canyon	1210	--	14,500	15,000	14,100	14,300	13,900	12,900	13,900	14,600	14,600	14,500
Walnut Av.												
West of Culver	597	16,112	28,300	27,600	29,400	28,900	28,300	29,300	28,400	28,200	29,200	29,000
Culver to Yale	598	20,937	27,600	27,700	28,300	28,200	27,600	28,400	27,500	27,100	27,800	27,700
Yale to Jeffrey	601	9,430	16,400	16,600	16,700	17,000	16,500	16,800	16,800	16,600	17,100	16,900
Marine Wy.												
Sand Canyon to Research	603	--	19,600	20,400	19,000	19,700	17,400	19,000	300	19,700	19,200	19,100
West of Research	605	--	19,100	19,900	18,100	18,800	13,600	18,100	--	19,100	18,300	18,200
East of Central Park W.	606	--	--	--	--	--	6,400	--	--	--	--	--
Technology Dr.												
North of Laguna Canyon Road	1911	--	11,000	11,400	11,300	11,700	12,500	11,800	13,300	15,000	15,500	15,200
East of Barranca	363	17,800	21,100	21,400	21,400	21,600	22,000	21,500	23,400	32,400	32,900	32,400
Irvine Center Dr.												
West of Culver	676	16,901	34,900	35,800	35,900	36,800	35,400	36,000	35,500	34,200	35,200	35,000
Culver to Yale	677	20,389	37,100	38,000	38,600	39,400	38,000	38,600	37,800	35,600	36,700	36,500
Yale to Jeffrey	678	16,413	39,100	40,000	40,800	41,500	40,100	40,700	40,100	38,500	39,800	39,600
Jeffrey to Sand Canyon	680	21,250	46,800	46,900	48,000	48,000	47,400	46,900	47,700	47,500	49,000	48,600
Sand Canyon to Laguna Canyon	684	13,137	29,100	30,500	30,100	31,600	31,000	30,000	33,000	27,500	28,500	28,100
East of Laguna Canyon Road	686	11,242	37,000	38,900	37,700	39,800	39,300	38,000	40,900	36,100	36,500	36,300
West of Barranca	687	13,717	32,400	34,100	32,800	34,500	33,900	33,000	35,100	31,600	31,700	31,500
East of Barranca	688	11,019	29,700	31,100	30,200	31,500	31,200	30,300	31,600	29,600	29,600	29,400
West of Alton	689	11,019	30,000	33,300	30,700	33,900	32,200	30,800	32,500	29,800	29,900	29,700
East of Alton	690	26,499	45,800	52,700	46,200	52,700	48,300	46,300	48,800	46,600	46,400	45,700
West of I-405	691	26,499	46,400	52,800	46,600	52,700	49,100	46,800	49,100	46,900	46,600	46,000
East of I-405	692	30,170	50,600	69,700	51,000	69,600	52,800	51,100	54,300	47,800	47,800	47,300

Table A-1
Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
West of Bake	693	24,729	34,100	50,900	34,400	50,200	34,900	34,300	35,800	31,600	31,700	31,400
Bake to Scientific Wy.	694	32,454	33,500	49,700	33,700	48,800	33,700	33,700	34,200	32,500	32,500	32,500
Scientific Wy. to Lake Forest	697	32,454	45,100	55,800	45,400	55,900	43,100	45,400	43,400	40,600	40,600	40,400
Moulton Pkwy.												
South of Lake Forest	698	32,992	44,100	57,300	44,100	57,500	42,600	44,100	42,500	40,700	40,800	40,600
Warner Av.												
Paseo Westpark to Culver	732	5,159	18,700	19,300	19,000	19,800	19,000	19,000	18,900	18,100	18,400	18,300
Culver to W. Yale Loop	733	7,627	10,400	10,500	10,500	10,900	10,600	10,600	10,500	10,000	10,100	10,000
Barranca Pkwy.												
Paseo Westpark to Culver	748	23,869	29,500	30,300	30,400	31,300	30,400	30,500	30,300	29,100	29,700	29,300
Culver to W. Yale Loop	749	28,246	33,900	34,600	34,600	35,300	34,100	34,700	34,600	33,400	33,900	33,600
E. Yale Loop to Jeffrey	757	20,916	32,200	33,200	33,700	34,800	33,500	33,900	33,900	32,900	34,000	33,300
Jeffrey to Sand Canyon	759	9,972	17,100	17,400	17,500	17,700	17,600	17,500	17,400	18,300	18,600	18,100
Sand Canyon to Laguna Canyon	764	9,576	15,700	16,000	16,100	16,200	16,400	16,100	16,900	16,000	16,200	15,700
Laguna Canyon Road to SR-133	361	9,000	16,800	18,200	17,600	18,800	17,600	17,500	18,100	18,000	18,600	17,400
SR-133 to Irvine Center Dr.	360	16,396	17,000	18,000	17,600	18,600	17,700	17,500	19,000	20,400	20,300	20,000
Irvine Center Dr. to I-5	358	17,559	20,900	22,100	21,200	22,300	22,500	21,100	24,500	26,100	26,000	25,700
I-5 to Technology	627	20,983	24,000	25,000	24,200	25,200	25,500	24,100	27,600	29,700	29,500	29,200
Technology to Ada	628	15,431	21,300	22,600	21,500	22,800	22,000	21,600	23,600	22,500	22,900	22,500
Ada to Millennium	630	13,446	22,500	24,300	22,900	24,700	19,900	23,000	20,400	23,700	24,200	23,800
Millennium to Alton	633	13,446	27,600	29,300	27,900	29,000	27,000	28,000	20,300	27,200	27,700	27,600
Muirlands Bl.												
Alton to Bake	635	12,400	14,300	14,600	14,000	14,400	14,500	14,100	13,600	16,300	16,300	16,300
Bake to Lake Forest	636	13,849	16,300	17,000	16,200	17,000	15,500	16,200	14,600	14,800	14,700	14,500
Rockfield Bl.												
Millennium to Bake	647	--	17,000	17,800	18,100	18,600	24,700	18,100	14,100	17,200	18,100	18,000
Bake to Lake Forest	648	17,117	30,100	31,200	31,000	31,900	32,700	30,900	28,900	31,400	32,000	31,800
"B" St.												
East of Sand Canyon	855	--	23,500	24,900	23,500	25,000	23,700	23,500	23,600	23,400	23,400	23,100
West of Laguna Canyon Road	856	--	13,200	11,600	13,100	11,500	13,100	13,000	13,100	12,800	12,700	12,500
Road "A"												
North of Oak Canyon	1936	--	--	--	--	--	--	7,000	--	--	--	--
Oak Canyon Rd.												
West of Sand Canyon	624	--	--	--	--	--	--	15,700	--	--	--	--
Laguna Canyon Rd.												
Sand Canyon to Technology	1692	--	16,300	16,300	17,300	17,400	18,300	18,600	18,800	18,300	19,500	19,100
Technology to Irvine Center Dr.	329	--	10,500	10,400	11,100	11,200	11,700	11,600	11,100	12,600	13,500	12,900
Irvine Center Dr. to Barranca	331	2,263	8,100	8,000	8,500	8,500	8,600	8,700	8,400	9,300	9,700	9,100
Barranca to Alton	332	3,195	12,500	11,900	13,000	12,400	13,000	13,200	12,900	12,800	13,300	11,900

Table A-1
Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
Alton to I-405	334	4,097	19,000	16,900	19,100	17,100	19,600	19,300	19,300	18,700	18,900	17,700
I-405 to "B" Street	335	1,492	16,500	12,300	16,600	12,400	17,000	16,700	16,700	16,500	16,600	15,400
"B" Street to SR-133	336	1,492	20,300	14,700	20,400	14,700	20,500	20,300	20,500	19,600	19,600	18,600
SR-133 to Lake Forest	346	28,512	78,000	41,100	79,400	41,500	80,300	79,400	83,700	70,800	71,700	71,100
Lake Forest to Bake	347	28,512	53,200	41,100	53,800	41,500	54,800	53,800	56,900	47,900	48,500	48,100
SR-241												
North Lake to SR-261	1147	44,000	118,700	124,400	120,400	126,600	113,500	120,500	119,900	168,300	169,900	169,300
SR-261 to Culver	1148	31,000	104,400	99,700	107,200	101,100	97,000	107,200	106,800	133,800	137,100	136,600
Culver to Jeffrey	1107	31,000	96,600	92,300	100,200	94,800	98,400	100,200	99,700	128,600	132,900	132,200
Jeffrey to SR-133	323	31,000	89,700	99,100	92,300	102,000	89,900	92,100	91,800	132,600	137,000	136,200
SR-1333 to Portola	1108	41,000	80,600	85,000	83,500	89,300	86,900	83,500	90,900	147,800	152,800	152,500
Portola to Alton	1109	44,000	74,600	87,200	78,200	93,800	81,600	78,200	84,600	138,200	143,200	143,000
Alton to Lake Forest	1110	36,000	69,900	77,300	72,100	81,200	72,200	72,100	74,700	125,900	128,900	128,600
SR-261												
SR-241 to Portola	160	21,000	35,300	52,400	35,800	54,100	39,800	35,800	36,000	67,000	67,300	67,200
Portola to Irvine	161	19,000	36,200	44,200	36,600	44,600	38,800	36,500	36,800	76,400	76,800	76,700
Irvine to I-5	162	19,000	37,100	40,800	38,700	42,100	39,300	38,700	38,900	59,600	61,600	61,500

SR-133												
SR-241 to Irvine	324	46,000	83,900	91,700	86,900	96,100	86,900	86,700	90,400	142,600	147,200	146,800
Irvine to Trabuco	325	43,000	85,700	90,700	93,800	97,700	94,700	93,600	145,400	134,800	144,300	143,900
Trabuco to I-5	326	43,000	105,200	109,500	116,700	119,000	106,500	115,600	144,000	140,500	150,700	150,300
I-5 to Barranca	343	19,240	39,600	35,800	43,300	38,900	41,600	42,900	48,800	49,600	53,100	52,600
Baranca to I-405	344	20,000	39,200	34,600	41,500	36,300	40,000	41,400	45,700	47,200	49,300	49,300
I-405 to Laguna Canyon Road	345	28,512	67,000	44,200	68,600	44,700	69,300	68,400	72,800	61,000	62,300	62,100
I-5 Fwy.												
Tustin Ranch to Jamboree	559	275,000	321,700	330,300	327,800	336,900	325,500	328,000	322,400	299,300	305,100	304,500
Jamboree to Culver	560	271,000	325,700	331,200	332,800	338,400	330,100	332,800	327,700	302,100	308,400	307,600
Culver to Jeffrey	582	257,000	324,600	330,000	330,400	336,600	329,000	330,100	327,900	301,800	308,000	307,000
Jeffrey to Sand Canyon	602	255,000	328,700	333,400	334,200	339,600	332,300	333,500	332,700	305,500	311,000	309,800
Sand Canyon to SR-133	653	247,000	291,500	293,400	294,400	296,800	300,500	294,200	300,100	259,200	261,900	261,000
SR-133 to Alton	654	220,000	273,100	281,800	278,300	287,100	283,000	278,000	300,700	249,100	253,900	253,600
Alton to I-405	655	180,000	226,300	233,700	228,600	236,500	232,700	228,700	242,700	201,600	203,300	203,200
I-405 to Bake	656	350,000	402,300	418,800	403,600	421,200	406,800	403,700	415,400	350,000	350,000	350,000
Bake to Lake Forest	657	340,000	394,800	401,000	395,300	403,000	393,500	395,600	398,700	340,000	340,000	340,000
I-405 Fwy.												
Jeffrey to Sand Canyon	836	237,000	274,100	273,100	276,600	275,700	275,800	276,700	275,400	237,000	237,000	237,000
Sand Canyon to SR-133	837	231,000	255,400	256,000	256,900	256,000	255,600	256,700	257,100	231,000	231,000	231,000

Table A-1
Traffic Volumes Used For Noise Modeling

Roadway & Segment	Link #	Exist	2025 No Proj BO	2025 NoProj Const	2025 wProj BO	2025 wProj Const	2025 wNAPFP	2025 wOak Cnyn OC	2025 wOCX	2040 NoProj	2040 wProj	2040 wSpect Trip Red
SR-133 to Irvine Center Dr.	838	210,000	211,200	232,300	210,800	231,700	213,100	210,800	213,500	162,100	162,600	161,800
Irvine Center Dr. to I-5	839	170,000	172,500	181,900	171,800	181,200	174,600	171,800	173,400	124,500	124,800	124,400

Table A-2
Traffic Mixes Used For Noise Modeling
1. Arterial Roadways

	Day	Eve	Night
Auto	75.51%	12.57%	9.34%
MT	1.56%	0.09%	0.19%
HT	0.64%	0.02%	0.08%

2. SR-133

	Day	Eve	Night
Auto	73.94%	11.38%	9.48%
MT	2.00%	0.31%	0.26%
HT	2.05%	0.32%	0.26%

3. Transportation Corridors

	Day	Eve	Night
Auto	67.03%	18.31%	9.66%
MT	2.25%	0.19%	0.56%
HT	1.50%	0.23%	0.37%

Table A-3
Data Used To Calculate Existing Traffic Noise Levels

Roadway & Segment	Volume	Speed	Mix
Yale Av.			
Irvine to Bryan	9,569	45	1
Bryan to Trabuco	12,198	45	1
Trabuco to Walnut	11,998	45	1
Jeffrey Rd.			
South of Portola	7,035	55	1
North of Irvine	7,035	55	1
Irvine to Bryan	13,476	55	1
Bryan to Trabuco	13,888	55	1
South of Trabuco	21,804	55	1
North of I-5	21,804	55	1
I-5 to Irvine Center Dr.	25,442	55	1
Irvine Center Dr. to Barranca	32,683	55	1
Sand Canyon Av.			
South of Portola	6,594	55	1
North of Irvine	6,594	55	1
South of Irvine	10,986	55	1
North of Trabuco	10,986	55	1
Trabuco to Roosevelt	13,712	55	1
Roosevelt to Road "B"	11,962	55	1
Road "B" to I-5	13,712	55	1
I-5 to Oak Canyon	18,646	55	1
Oak Canyon to Irvine Center Dr.	15,543	55	1
Irvine Center Dr. to Barranca	15,690	55	1
Alton Pkwy.			
South of Portola	6,080	50	1
Portola Pkwy.			
Culver to Yale	6,825	50	1
Yale to Jeffery	7,200	50	1
Jeffery to Sand Canyon	6,918	50	1
Sand Canyon to SR-133	8,500	65	1
SR-133 to Research	8,500	65	1
Research to Millennium	8,500	65	1
East of Millennium	8,500	65	1
South of SR-241	8,500	50	1

Table A-3
Data Used To Calculate Existing Traffic Noise Levels

Roadway & Segment	Volume	Speed	Mix
Irvine Bl.			
East of SR-261	24,247	50	1
West of Culver	24,247	50	1
Culver to Yale	21,220	50	1
East of Yale	16,778	50	1
West of Jeffery	16,778	50	1
East of Jeffery	15,086	50	1
West of Sand Canyon	15,086	50	1
Sand Canyon to SR-133	18,696	50	1
SR-133 to Research	19,089	50	1
Research to Central Park W.	19,089	50	1
Central Park W. to Millennium	19,089	50	1
Millennium to Connector	17,320	50	1
Connector to Central Park E.	17,320	50	1
Central Park E. to Trabuco	17,320	50	1
Trabuco to Alton	17,320	50	1
Bryan Av.			
Yale to Jeffery	5,171	50	1
Trabuco Rd.			1
West of Yale	12,595	50	1
Yale to Jeffery	3,060	50	1
Jeffery to Road "A"	2,021	50	1
Road "A" to Collector St.	2,600	50	1
Collector St. to Road "C"	2,600	50	1
Road "C" Sand Canyon	2,021	50	1
SR-133			
Trabuco to I-5	43,000	65	2

Table A-4
Data Used to Calculate Traffic Noise Levels Along Potential Off-Site Traffic Noise Impact Segments

Roadway & Segment	Volume	Speed	Mix
Jeffery Road			
Irvine to Bryan	55,800	55	1
I-5 to Irvine Center Drive	57,800	50	1
Culver			
South of Portola	22,800	50	1
Jamboree Road			
South of Handy Creek	35,200	55	1
Portola Parkway			
Yale to Culver	30,400	50	1
Yale to Jeffery	35,800	50	1
East of Alton	25,200	55	1
Irvine Boulevard			
Culver To Yale	37,300	55	1
Yale to Jeffery	45,700	55	1
Bryan Avenue			
Yale To Irvine	12,400	50	1
Trabuco Road			
Yale To Irvine	22,600	50	1
Alton Parkway			
South of Portola	25,600	50	1
Yale Avenue			
Bryan to Irvine	16,600	45	1

Table A-5
Data Used To Calculate Future Traffic Noise Levels Impacting Project

	Volume	Speed	Mix
Jeffrey Rd.			
SR-241 to Portola	20,600	55	1
South of Portola	35,300	55	1
North of Irvine	43,000	55	1
Irvine to Bryan	55,800	55	1
Bryan to Trabuco	57,200	55	1
Sand Canyon Av.			
South of Portola	38,300	55	1
North of Irvine	52,700	55	1
South of Irvine	58,600	55	1
North of Trabuco	58,600	55	1
Research			
South of Portola	25,800	55	1
North of Irvine	25,800	55	1
Millennium Bl.			
Sout of Portola	22,200	55	1
North of Irvine	27,200	55	1
Portola Pkwy.			
Yale to Jeffery	35,800	55	1
Jeffery to Sand Canyon	30,000	55	1
Sand Canyon to SR-133	54,600	55	1
SR-133 to Research	51,800	55	1
Research to Millennium	35,100	55	1
East of Millennium	43,500	55	1
South of SR-241	31,700	55	1
Irvine Bl.			
West of Jeffery	45,700	55	1
East of Jeffery	51,600	55	1
West of Sand Canyon	41,700	55	1
Sand Canyon to SR-133	46,400	55	1
SR-133 to Research	51,100	55	1
Millennium to Connector	52,200	55	1

Table A-5
Data Used To Calculate Future Traffic Noise Levels Impacting Project

	Volume	Speed	Mix
Bryan Av.			
Yale to Jeffery	13,000	50	1
Trabuco Rd.			
Yale to Jeffery	22,600	50	1
Jeffery to Road "A"	29,700	50	1
Road "A" to Collector St.	28,700	50	1
Collector St. to Road "C"	26,100	50	1
Road "C" Sand Canyon	28,500	50	1
Sand Canyon SR-133	48,700	50	1
SR-133 to Research	71,800	50	1
SR-241			
Culver to Jeffery	132,900	65	3
Jeffery to SR-133	137,000	65	3
SR-1333 to Portola	152,800	65	3
Portola to Alton	143,200	65	3
SR-133			
SR-241 to Irvine	147,200	65	2
Irvine to Trabuco	145,400	65	2

Background Discussion of Cumulative Impacts

The purpose of this section is to analyze the additional incremental impact that the proposed project is likely to cause over and above any existing exceedance of the OCP-2000 growth projections due to already approved projects in the City and its sphere, as well as at the subregional level.

Methodology

OCP-2000 projections for population, housing and employment will be used as one benchmark for evaluating the incremental and cumulative population, housing and employment impact of the proposed project against the backdrop of existing development, approved projects. OCP-2000 projects population, housing and employment growth by City and Regional Statistical Area within Orange County, which allows examination of the proposed project's incremental impacts at both the City and subregional levels. OCP-2000 projections are based on city and county General Plans, and special district, public agency, service provider and private sector information.

Cumulative impacts will also be evaluated against the City of Irvine General Plan and relevant regional and state policies. These include the Southern California Association of Governments' Regional Comprehensive Plan and Guide, and the state fair share housing production mandate.

Table A-4-1 summarizes OCP-2000 projections for the City, County and Regional Statistical Area in which the proposed project is located:

Table A-4-1
OCP-2000 Growth Projections, 2000 and 2025

	Total Population		**Total Dwelling Units**		**Total Employment**	
	2000	**2025**	**2000**	**2025**	**2000**	**2025**
Irvine	144,802	194,913	53,750	68,883	176,986	261,309
RSA E-44	165,226	249,044	61,095	88,441	170,046	341,921
County	2,853,757	3,416,037	978,004	1,115,823	1,502,434	2,043,665

Source: Orange County Projections-2000

Projects to be Analyzed

The following discussion summarizes the population, housing and employment characteristics of approved projects and proposed project in the City of Irvine and its subregions. Some of the projects are located in the RSA E-44 subregion, while others are located nearby in RSA F-39. The locations of all projects described below are indicated on previous Exhibit 3-2.

Approved Projects. A number of projects have been recently approved within the proposed project vicinity. The cumulative impact analysis will examine the extent to which the proposed project causes a cumulative impact in conjunction with these projects. As noted above, the projects will be evaluated in light of city, regional , and state plans, and against OCP-2000 projections.

The following General Plan Amendments have been approved in the proposed project vicinity since the adoption of OCP-2000: Spectrum 8 (commercial/industrial); Planning Area 17 (housing) and Planning Area 27 (housing). In addition, the City has approved the Millennium II project for reuse of the MCAS El Toro property, consisting of commercial and housing development of the former air base site.

At the present time, the former MCAS El Toro site is contained in the City of Irvine's sphere of influence. The City of Irvine proposes to annex the El Toro site, as provided for by the Millennium II plan. In the meantime, the County of Orange has jurisdiction over the airport land use. It has designated the former MCAS El Toro site for airport uses in its General Plan, and a Final EIR for reuse of the El Toro site as a commercial airport was certified by the County Board of Supervisors on October 23, 2001. Therefore, this section examines the potential cumulative impacts of the proposed project combined with a package of approved projects that includes a commercial airport at El Toro operating at 28.8 million annual passengers by 2020.

Proposed Project. The proposed project will be analyzed in terms of its 2025 build-out characteristics: a net increase of 17,667 jobs, 12,350 housing units, and 34,833 population.

Cumulative Impacts Resulting from Approved Projects Together with the Proposed Project.

This section examines the incremental and cumulative impacts of approved projects and the proposed project when compared to OCP-2000 projections in 2025. This quantitative analysis is balanced with a consideration of the cumulative impact in light of city, state and regional plans and policies.

The proposed project is compared with two different packages of approved plans to account for two mutually exclusive plans for the former MCAS El Toro site: Millennium II and Orange County International Airport.

Cumulative impacts are examined at two geographic levels. The RSA E-44 level places the proposed project in a regional policy setting that includes portions of the County of Orange and the cities of Tustin, Orange, Costa Mesa, and Santa Ana. The City and sphere level examines the area addressed by the Irvine General Plan.

<u>Cumulative Impacts of Proposed Project with Approved Projects including Millennium II</u>

Table A-4-2 recaps the incremental impact on OCP-2000 employment projections of approved projects, including the City's adopted Millennium II plan for the former MCAS El Toro site. Table A-4-2 also identifies the proposed project's additional increment of growth over and above

OCP-2000 projections for 2025.

Table A-4-2 **Cumulative Employment Impacts with Millennium Plan II**				
	RSA	**OCP-2000**	**Project**	**Increment of Growth**
		2025	Jobs	Above/Below OCP-2000
Approved Projects				
Spectrum 8	E-44	7,985	26,187	+18,202
Planning Area 17	F-39	2,422	2,344	-78
Planning Area 27	F-39	157	157	0
Millennium Plan II	E-44	28,931	30-35,000 onsite*	+6,069
Subtotal		*39,495*	*63,688*	*+24,193*
Proposed Project	E-44	24,010	15,973	-8,037
Source: Compiled by Carla Walecka Planning ** In addition to employment onsite, the City estimates job growth of 60-70,000 countywide.*				

Cumulative Employment Impact at the RSA E-44 Level

Cumulatively, approved projects located within RSA E-44 (including Millennium II) exceed OCP-2000 projections for their project areas by 24,271 jobs in 2025. The proposed project's 15,973 jobs are below OCP-2000 projections for 2025 by 8,037 jobs. Although the proposed project reduces the cumulative impact on RSA E-44's 2025 employment projections from 24,271 jobs to 8,106 jobs, a 66% reduction, the cumulative employment impact at the RSA level with the proposed project remains significant.
While the proposed project's employment growth is consistent with OCP-2000 projections for its area, the project exceeds General Plan square footage allowances for Planning Areas 5B, 6, 8A, and 9. By concentrating and clustering employment above General Plan levels in this portion of RSA E-44, the proposed project addresses regional policies aimed at reducing auto travel, congestion and air pollutants by intensifying employment near transportation facilities in order to increase ride-sharing, transit and alternative forms of transportation. The proposed project's jobs will also help balance the housing-rich nature of adjacent RSA C-43 and D-40 in south Orange County.

The proposed project, together with approved projects, results in a cumulative employment impact at the RSA E-44 level. This impact is considered to be significant but not adverse because of the project's benefits in terms of concentrated employment near transportation and transit facilities that reduces travel, congestion and emissions.

Cumulative Employment Impact at the City and Sphere Level
Cumulatively, approved projects (with Millennium II) within the City and its sphere exceed the OCP-2000 projections for their project areas by 24,193 jobs. The proposed project falls below

OCP-2000 employment projections for the project area by 8,037 jobs. When added to the cumulative exceedance due to approved projects with Millennium II, the proposed project's employment helps reduce the exceedance due to approved projects on the City's 2025 employment to 16,156 jobs, a 33% reduction.

The proposed project exceeds General Plan employment-generating land uses programmed for the project area in the City General Plan. In doing so, the project furthers regional policies designed to concentrate employment near major transportation facilities in order to create a critical mass of employees to support programs such as ridesharing and transit that cut travel, congestion and air pollutants.

The proposed project therefore results in a cumulative employment impact at the City and sphere level. However, in light of the project's regional policy benefits, the proposed project's cumulative employment impact at the City and sphere level is considered to be significant, but not adverse.

Cumulative Impact of Proposed Project with Approved Projects including Commercial Airport

Table A-4-3 recaps the incremental employment impacts on OCP-2000 projections of approved projects, including the County of Orange's plan for a commercial airport at the former MCAS El Toro site. Table A-4-3 also identifies the proposed project's additional increment of employment growth in comparison to approved OCP-2000 projections for 2025.

Table A-4-3
Employment Impacts Associated with Approved Projects/ Commercial Airport Compared with the Proposed Project

	RSA	**OCP-2000**	**Project**	**Increment of Growth**
		2025	Jobs	Above/Below OCP-2000
Approved Projects				
Spectrum 8	E-44	7,985	26,187	+18,202
Planning Area 17	F-39	2,422	2,344	-78
Planning Area 27	F-39	157	157	0
Orange County Intern'l Airport	E-44	28,931	23,500 (El Toro)	-5,431
	F-39	2,792	1,258 (JWA)	+1,258
Subtotal		*42,287*	*53,446*	*+13,951*
Proposed Project	E-44	24,010	15, 973	-8,037
Source: Compiled by Carla Walecka Planning				

Cumulative Employment Impact at the RSA E-44 Level

Cumulatively, approved projects located within RSA E-44 (including a commercial airport) exceed OCP-2000 projections for their project areas by 12,771 jobs in 2025. The proposed project's 15,973 net jobs fall below OCP-2000 projections for 2025 by 8,037 jobs. The proposed project reduces the cumulative impact on RSA E-44's 2025 employment projections from 12,771 jobs above OCP-2000 to 4,734 jobs above the projections for the project areas.

The project exceeds General Plan square footage allowances for Planning Areas 5B, 6, 8A, and 9. By concentrating and clustering employment above General Plan levels in this portion of RSA E-44, the proposed project addresses regional policies aimed at reducing auto travel, congestion and air pollutants by intensifying employment near transportation facilities in order to increase ride-sharing, transit and alternative forms of transportation. The proposed project's jobs will also help balance the housing-rich nature of adjacent RSA C-43 and D-40 in south Orange County.

The proposed project, together with approved projects, results in a significant, but not adverse, cumulative employment impact at the RSA E-44 level. This impact is considered to be significant, but not adverse, because the proposed project's employment growth is consistent with OCP-2000 projections for its area; because the project is beneficial in helping to reduce the difference between approved employment and OCP-2000 projections for the project area; and because the project provides regional jobs/housing balance and trip reduction policy benefits.

Cumulative Employment Impact at the City and Sphere Level

Cumulatively, approved projects (with a commercial airport) within the City and its sphere exceed OCP-2000 projections for their respective project areas by 13,951 jobs in 2025. The proposed project falls below OCP-2000 employment projections for the project area by 8,037 jobs. The proposed project helps reverse the cumulative employment exceedance associated with approved projects to 5,914 jobs above OCP-2000 projections for the project areas.

The proposed project exceeds City of Irvine General Plan employment growth allocated to the project area. In doing so, the project reinforces regional policies by intensifying employment near major transportation and transit facilities in a manner that encourages trip-reduction programs. This results in reduced congestion and pollutant emissions.

Taking these factors into consideration, the proposed project results in a cumulative employment impact at the City and sphere level. However, given the project's consistency with the latest growth projections and its regional policy benefits, these impacts are considered to be significant but not adverse.

Cumulative Housing Impacts

This section examines the incremental and cumulative housing impacts of approved projects and the proposed project in the proposed project vicinity when compared to OCP-2000 projections for their areas in 2025. This quantitative analysis is balanced with a consideration of the cumulative impact in light of city, state and regional plans and policies.

The proposed project is compared with two different packages of approved plans to account for two mutually exclusive plans for the former MCAS El Toro site, specifically Millennium II and Orange County International Airport. Cumulative impacts are examined at two geographic levels. The RSA E-44 level places the proposed project in a regional policy setting that includes portions of the County of Orange and the cities of Tustin, Orange, Costa Mesa, and Santa Ana. The City and sphere level examines the area addressed by the Irvine General Plan.

Cumulative Housing Impact of Proposed Project with Approved Projects including Millennium II

Table A-4-4 identifies the incremental housing impact on OCP-2000 projections of approved projects, including the City's Millennium II plan for the former MCAS El Toro site. Table A-4-4 also identifies the proposed project's additional increment of housing growth over and above OCP-2000 projections for 2025.

Table A-4-4
Cumulative Housing Impacts with Millennium Plan II

	RSA	**OCP-2000***	**Project**	**Increment of Growth**
		2025	Housing Units	Above/Below OCP-2000
Approved Projects				
Spectrum 8	E-44	0	0	0
Planning Area 17	F-39	2,169	2,375	+206
Planning Area 27	F-39	2,169	2,155	-14
Millennium Plan II	E-44	2,069	3,261	+1,192
Subtotal		*6,407*	*7,791*	*+1,384*
Proposed Project	E-44	6,367	12,350	+5,983

Source: Compiled by Carla Walecka Planning
** OCP-2000 housing figures reflect a 4% vacancy rate.*

Cumulative Housing Impact at the RSA E-44 Level

Approved projects located within RSA E-44 (including Millennium II) exceed OCP-2000 projections for their project areas by 1,192 housing units (58%) in 2025. The proposed project's 12,350 housing units exceed OCP-2000 projections for 2025 by 5,983 units. Cumulatively, the proposed project increases the total number of housing units approved for RSA E-44 to 7,175 total dwelling units (56%) above the OCP-2000 projections for their combined areas.

While the proposed in combination with approved projects exceeds OCP-2000 growth projections, the proposed project's housing growth is consistent with the total amount of housing accommodated in the City General Plan. The proposed project also reinforces City Housing Element policies that call for housing in each planning area, and a better match between housing and job opportunities. Further, the proposed project's housing helps achieve state housing production mandates, and addresses regional policies that encourage housing production in job-rich subregions.

Together with approved projects, the proposed project results in a cumulative housing impact at the RSA E-44 level. In light of the project's consistency with Irvine's General Plan, Housing Element policies, state fair share housing objectives and regional housing and jobs housing balance policies, this impact is considered to be significant but not adverse.

Cumulative Housing Impact at the City and Sphere Level

The recently approved projects (with Millennium II) within the City and its sphere exceed the OCP-2000 projections for their project areas by 1,384 total dwelling units. The proposed project exceeds OCP-2000 housing projections for its project area by 5,983 total units. When added to the exceedance caused by already approved projects with Millennium II, the proposed project results in a total exceedance of the City's 2025 OCP-2000 housing projections of 7,367 total units.

However, the proposed project's housing growth falls within the limits allowed by the City General Plan. As noted above, the project's housing growth provides benefits that address the City's Housing Element goals and objectives for housing in each planning area and a better match between job and housing opportunities within the City. The proposed project housing also contributes to improved jobs/housing balance at the city level and subregional level, as encouraged by regional policies.

Thus, the proposed project results in a cumulative housing impact at the City and sphere level. This cumulative impact is considered to be significant but not adverse, because it is consistent with the amount of housing allowed by the General Plan; helps meet future City and state housing production targets; helps address the City's General Plan goal of increasing housing production within each planning area; and diminishes the City's imbalance between the amount of jobs and housing.

Cumulative Housing Impact of Proposed Project with Approved Projects with Commercial Airport

Table A-4-5 summarizes the cumulative impact on OCP-2000 housing projections of approved projects, including the County of Orange's plan for a commercial airport at the former MCAS El Toro site. Table A-4-5 also identifies the proposed project's additional increment of growth in relation to OCP-2000 projections for 2025.

Cumulative Housing Impact at the RSA E-44 Level

The approved project located within RSA E-44 (a commercial airport) falls below OCP-2000 projections for its project area by 2,069 total housing units in 2025. By providing less housing than projected by OCP-2000 for its area, the approved project in RSA E-44 does not contribute to achieving state housing production targets, increasing housing opportunities to meet the demand generated by jobs, and diminishing jobs/housing imbalances at the city, RSA and County levels - all goals of state, regional and local plans and policies described in detail in Section 4.12.2.

The proposed project's 12,350 housing units exceed OCP-2000 projections for 2025 by 5,983 units. When combined with the approved project's 2,069 units below OCP-2000 projections, the proposed project results in an 3,914 total dwelling units (31%) above the OCP-2000 projections for their respective areas in RSA E-44.

Table A-4-5
Cumulative Housing Impacts with Commercial Airport

	RSA	**OCP-2000***	**Project**	**Increment of Growth**
		2025	Housing (Total DU)	Above/Below OCP-2000
Approved Projects				
Spectrum 8	E-44	0	0	0
Planning Area 17	F-39	2,169	2,375	%206
Planning Area 27	F-39	2,169	2,155	-14
Orange County Intern'l Airport	E-44	2,069	0	-2,069
Proposed Project	E-44	6,367	12,350	%5,983

Source: Compiled by Carla Walecka Planning

** OCP-2000 total dwelling unit projections have been adjusted to include a 4% housing vacancy rate, to allow direct comparability with total project units.*

However, the proposed project provides housing units that are anticipated and accommodated by the City of Irvine General Plan. In addition, the proposed project's incremental housing impact helps compensate for the lack of housing benefits that approved RSA E-44 projects would contribute to meeting state housing production targets, meeting housing demand generated by jobs, and improving jobs/housing balance through increased housing production relative to job growth.

Therefore, the proposed project results in a cumulative housing impact at the RSA E-44 level. This impact is significant, but not adverse, due to the proposed project's benefits in terms of local, regional, and state plans and policies noted above.

Cumulative Housing Impact at the City and Sphere Level

The recently approved projects (with a commercial airport) within the City and its sphere fall below the OCP-2000 projections for their project areas by 1,877 total dwelling units. The proposed project exceeds OCP-2000 housing projections for its project area by 5,983 total units. Taking into account that the approved projects with a commercial airport fall below OCP-2000 projections, the proposed project results in a cumulative impact on the City's 2025 housing projections of 4,106 total units (32%) above OCP-2000 projections for their project areas within the City in 2025.

While the proposed project exceeds OCP-2000 housing projections for its project area for 2025, the project's housing is consistent with the total amount of housing allowable under the City of Irvine General Plan. The project addresses Housing Element goals designed to meet state-mandated housing production goals in the future; addresses Housing Element goals that encourage housing in each planning area, and responds to regional policies that encourage housing production in job-rich areas in order to reduce trips and associated emissions.

Thus, the proposed project together with approved projects results in a cumulative housing impact at the City and sphere level. This impact is significant, but not adverse, because it is consistent with the City's General Plan; helps meet the City's fair share housing targets; helps address the City's General Plan goal of increasing housing production within each planning area, and addresses regional goals of diminishing the subregion's imbalance between the amount of jobs and housing.

Cumulative Population Impacts

Cumulative Population Impact of Proposed Project with Approved Projects including Millennium II

Table A-4-6 identifies the cumulative population impact on OCP-2000 projections of approved projects, including the City's Millennium II project for the former MCAS El Toro site. Table A-4-6 also identifies the proposed project's additional increment of housing growth over and above OCP-2000 projections for 2025.

Table A-4-6 Cumulative Population Impacts with Millennium Plan II				
	RSA	**OCP-2000***	**Total Project**	**Increment of Growth**
		2025	Population	Above/Below OCP-2000
Approved Projects				
Spectrum 8	E-44	0	0	0
Planning Area 17	F-39	5,379	6,175	+796
Planning Area 27	F-39	5,840	5,783	-57
Millennium Plan II	E-44	5,468	8,674	+3,206
Subtotal		*16,687*	*26,632*	*+3,945*
Proposed Project	E-44	18,173	34,833	+16,660
Source: Compiled by Carla Walecka Planning .				
* *OCP-2000 total dwelling unit projections have been adjusted to reflect a 4% housing vacancy rate, to allow direct comparability with actual project units.*				

Cumulative Population Impact at the RSA E-44 Level

Taken together, approved projects located within RSA E-44 (including Millennium II) exceed OCP-2000 population projections for their project areas by 3,206 residents in 2025. The proposed project's expected population of 34,833 exceeds OCP-2000 projections for 2025 by 16,660 residents. The cumulative impact of approved projects plus the proposed project is 19,899 residents (57%) above OCP-2000 projections for their project areas within RSA E-44 in 2025.

Although the proposed project increases the cumulative impact of approved projects on OCP-2000 projections for 2025, the resident population associated with the projects is consistent with the amount of housing anticipated in the City General Plan. The project's housing growth is also consistent with the City General Plan; state and regional policies that encourage increased housing production and consequent resident population in job-rich areas to achieve a better jobs/housing balance; and increased housing production and associated population to address fair share housing needs.

Thus, the proposed project increases the cumulative housing impact already associated with approved projects at the RSA E-44 level. This impact is considered to be significant, but not adverse, in light of the project's consistency with the General Plan, and state and regional policies that encourage housing production and jobs/housing balance.

Cumulative Population Impact at the City and Sphere Level

The recently approved projects (with Millennium II) within the City and its sphere exceed the OCP-2000 population projections for their project areas by 3,945 residents in 2025. Cumulatively, approved projects in this scenario exceed OCP-2000 population projections for their areas within the City in 2025 by 24%.

The proposed project exceeds OCP-2000 population projections for its project area by 16,660 residents. When added to the cumulative impact of approved projects with Millennium II, the proposed project's resident population increases the cumulative impact in their project areas within the City to 20,605 residents.

While the proposed project exceeds OCP-2000 projections for its area in 2025, the project remains consistent with the population that would result from the total amount of housing allowed under the City General Plan. Further, the project locates resident population in a jobs-rich planning area in response to both city Housing Element and regional jobs/housing balance policies.

Taking into account both the project's fit with OCP-2000 and with city, state and regional plans and policies, the proposed project results in a cumulative housing impact at the City and sphere level. However, this impact is considered to be significant but not adverse because it results from helping to provide the housing stock accommodated in the City's General Plan , it helps address the City's General Plan goal of increasing housing production within each planning area , and it addresses the local and regional goal of diminishing the City's imbalance between the amount of jobs and housing.

Cumulative Population Impact of Proposed Project with Approved Projects including Commercial Airport Option

Table A-4-7 recaps the cumulative impact of approved projects on OCP-2000 population projections for 2025. This scenario includes the County of Orange's plan for a commercial airport at the former MCAS El Toro site. Table A-4-7 also identifies the proposed project's additional increment of growth in relation to OCP-2000 population projections for 2025.

Table A-4-7 Population Impacts Associated with Approved Projects/Commercial Airport Compared with the Proposed Project				
	RSA	**OCP-2000***	**Project**	**Increment of Growth**
		2025	Population	Above/Below OCP-2000
Approved Projects				
Spectrum 8	E-44	0	0	0
Planning Area 17	F-39	5,379	6,175	+796
Planning Area 27	F-39	5,840	5,783	-57
Orange County Intern'l Airport	E-44	5,468	0 (El Toro)	-5,468
Subtotal		16,687	11,958	4,729
Proposed Project	E-44			+16,660
Source: Compiled by Carla Walecka Planning				

Cumulative Population Impact at the RSA E-44 Level

Approved projects located within RSA E-44 (including a commercial airport) fall below OCP-2000 projections for their project areas by 5,468 residents in 2025. However, the proposed project's 34,883 residents exceed OCP-2000 projections for 2025 by 16,660 residents. The proposed project increases the total number of residents approved for RSA E-44 under this scenario to 11,192 residents above the OCP-2000 projections for their combined areas. Cumulatively, the proposed project with approved projects results in housing units that exceed OCP-2000 projections for their project areas within RSA E-44 by 71% in 2025.

The proposed project contains more housing than projected by OCP-2000 for its area within RSA E-44. In doing so, the proposed project results in population that is consistent with the amount of housing accommodated in the city General Plan. The proposed project also contributes to housing units and resulting resident population that help achieve the City's fair share housing targets, increase housing opportunities to meet the demand generated by jobs, and diminish jobs/housing imbalances at the city, RSA and County levels - all goals of state, regional and local plans and policies described in detail in Section 4.12.2.

Thus, the proposed project results in a cumulative population impact at the RSA E-44 level. This impact is significant but not adverse because the project's population and accompanying housing contributes to meeting housing needs, meeting state housing production targets, meeting housing demand generated by jobs, and improving jobs/housing balance through increased housing and resident population relative to job growth.

Cumulative Population Impact at the City and Sphere Level

The recently approved projects (with a commercial airport) within the City and its sphere fall below the OCP-2000 projections for 2025 for their project areas by 4,729 residents. The proposed project exceeds OCP-2000 population projections for its project area by 16,660 residents. When added to the approved projects, the proposed project results in a total of 11,931 new residents, which is 34% above OCP-2000 projections for these project areas within the City and sphere in 2025.

However, the proposed project's residential population will occupy housing units that are consistent with the amount of housing accommodated in the City General Plan. Further, the proposed project's population growth is a direct consequence of helping to meet the City's fair share housing needs, addressing the City's General Plan goal of increased housing production within each planning area, and diminishing the City's imbalance between the amount of jobs and housing. The project population is also a consequence of addressing regional housing and jobs/housing balance policies.

Therefore, the proposed project results in a cumulative population impact at the City and sphere level. This impact is considered to be significant but not adverse due to the project's benefits for the City plan and city, state and regional housing production and jobs/housing balance policies.

Sensitivity Analysis of Potential Cumulative Impacts of Probable Future Projects in the Proposed Project Vicinity

A number of other probable future projects, in various stages of discussion and environmental documentation, have been identified as of the time that this DEIR is being prepared. Although these projects are not approved, and some of them may not be fully pursued, this section provides a sensitivity analysis that describes their potential additional impact on population, housing and employment beyond the cumulative effects of the proposed project in combination with approved projects.

The following probable future projects are included in this sensitivity analysis:

- *Great Park:* The City of Irvine has announced a third proposal for the MCAS El Toro site and is in the process of preparing an EIR. It would result in annexation of the El Toro site to the City, which is currently outside the City's jurisdiction. At present, the Great Park concept consists of 200 housing units, and retail and office uses that would generate 12,244 jobs. The specific amount of development is still being refined by the City of Irvine. If eventually approved, the Great Park proposal would replace the City's Millennium II Plan. (G. Worthington, City of Irvine).

  This sensitivity analysis assumes that the Great Park proposal replaces either the City of Irvine's approved Millennium II plan or the County of Orange's approved commercial airport plan for the former MCAS El Toro property.

- *Spectrum Housing:* A Final EIR is being prepared by the City of Irvine for the addition of 2,500 housing units in the Spectrum office/industrial complex. (General Plan Amendment 41359 and Zone Change 41360, City of Irvine).

- *Lower Peters Canyon:* The Irvine Company has proposed a reduction of 490 housing units in the previously approved Lower Peters Canyon Project in exchange for commercial development that would generate an estimated 1,470 jobs within the same project. This project is in the discussion stage.

- *Woodbridge General Plan Amendment Zone Change:* A Negative Declaration has been prepared to add 85,000 square feet of mini-warehouse uses to the Woodbridge area. The Negative Declaration determined that no residential uses are involved and that employment impacts are de minimus (M. Philbrick, City of Irvine).

- *Open Space Dedication.* The Irvine Company intends to expand permanent open space on the Irvine Ranch in the East Orange and North Ranch Policy Planning Area. This intent would ultimately be implemented through conservation easements. When finalized, this expansion of permanent open space would prohibit development in these areas, which have previously been slated for residential and commercial development during the 2000 to 2025 time period. Thus, the open space expansion would result in a population, housing and employment reduction that impacts the City of Irvine, RSA E-44 and the County as a whole.

  A portion of the East Orange planning area south of Santiago Canyon Road falls within RSA E-44. The sensitivity analysis of the potential future increment of growth captured by probable future projects will focus on the impact of this portion of the open space expansion. This portion of the expanded open space would result in no jobs,
  Housing units or population within this part of RSA E-44, which OCP-2000 projects would otherwise include 7,714 jobs, 1,048 housing units , and 2,551 residents in 2025.

This sensitivity analysis examines cumulative impacts at two different geographic levels: RSA E-44 and the City and Sphere level. The RSA E-44 level places the probable future projects in a regional policy setting that includes portions of the County of Orange and the cities of Tustin, Orange, Costa Mesa, and Santa Ana. All of the probable future projects lie within RSA E-44. The City and sphere level examines the area addressed by the Irvine General Plan. The Open Space Dedication project, located in the East Orange area, is the only probable future project which is not within the City of Irvine and its sphere.

Since these potential projects are not yet approved, the amount of population, housing and employment associated with them may change. The sensitivity analysis is based on information available at the time this DEIR was prepared.

Table A-4-8 summarizes the project characteristics associated with these probable future projects:

Table A-4-8 Potential Additional Growth Impacts Associated with Potential Future Projects			
	OCP-2000 Employment 2025	**Potential Project**	**Increment of Growth Above/Below OCP-2000**
Great Park (Preliminary Estimate)*	28,931	12,244*	-16,687
Spectrum Housing	45,375	0	0
Lower Peters Canyon	8,031	1,470**	+1,470
Woodbridge GPA	3,969	0***	0***
	OCP-2000 Housing 2025	**Potential Project**	**Increment of Growth Above/Below OCP-2000**
Great Park (Preliminary Estimate)*	2,069	200*	-1,869
Spectrum Housing	0	2,500	+2,500
Lower Peters Canyon	10,557	-490***	-490
Woodbridge GPA	8,825	0***	0***
	OCP-2000 Population 2025	**Potential Project**	**Increment of Growth Above/Below OCP-2000**
Great Park (Preliminary Estimate)*	5,468	440*	-5,028
Spectrum Housing	0	5,325	+5,325
Lower Peters Canyon	29,433	-1,495**	-1,495
Woodbridge GPA	26,715	0***	0***

Source: Compiled by Carla Walecka Planning

* *All figures for Great Park are the best available estimates provided by G. Worthington, City of Irvine, and are subject to further refinement.*

** *All figures for Lower Peters Canyon are estimates provided by The Irvine Company, and are subject to further refinement.*

*** *Woodbridge GPA was a proposed project at the time the Notice of Preparation was issued, and has been subsequently approved by the City of Irvine.*

Potential Additional Employment Impacts

Two of the five probable future projects would result in employment growth. The Great Park project and Lower Peters Canyon intensity transfer would capture 13,714 jobs by 2025.

RSA Level. Approved projects in combination with the proposed project add 10,165 jobs more than OCP-2000 projects for their respective project areas in 2025. Probable future projects would result in 22,931 jobs less than predicted for their areas within RSA E-44 in 2025. Cumulatively, this scenario results in a total of 12,766 jobs below OCP-2000 projections for 2025.

Probable future projects would reduce job growth to levels well below those projected by OCP-2000. In doing so, probable future projects would improve jobs/housing balance within the RSA by decreasing anticipated job growth in a jobs-rich subregion, consistent with City General Plan and SCAG regional policies favoring jobs/housing balance.

On balance, probable future projects would not result in an additional potential cumulative employment impact.

City and Sphere Level. Probable future projects would result in 22,931 fewer jobs than projected by OCP-2000 for their respective project areas within the City and sphere in 2025. This would decrease the cumulative impact from prior approved projects together with the proposed project of 10,087 jobs above OCP-2000 to 12,848 jobs below OCP-2000 for their combined project areas within the City and its sphere in 2025, thereby eliminating the cumulative impact at the City and sphere level .

Probable future projects would result in employment growth at levels below those currently anticipated by the Irvine General Plan. Taking these factors together, the potential future projects would not result in an additional potential cumulative employment impact.

Potential Additional Housing Impacts. Taken together, probable future projects would result in 2,210 new housing units by 2025.

RSA E-44 Level. Probable future projects would result in 907 housing units above projected OCP-2000 levels for the project areas within RSA E-44 for 2025. This would increase the cumulative impact of prior approved projects together with the proposed project above OCP-2000 levels for project areas within RSA E-44 in 2025.

The housing growth resulting from probable future projects would respond to City General Plan policies that call for increased housing production to meet housing demand generated by job opportunities within the city, as well as state housing production mandates. Probable future project housing growth also addresses SCAG regional policies that encourage more housing in job-rich areas such as RSA E-44 to improve jobs/housing balance, congestion and emissions.

Therefore, probable future projects would increase the existing cumulative housing impact resulting from approved projects in combination with the proposed project in RSA E-44. This impact is significant but not adverse in light of the projects' consistency with City General Plan, state housing, and regional jobs/housing balance policies.

City and Sphere Level: Probable future projects would increase the 6,175 unit cumulative housing impact on OCP-2000 projections at the City level due to prior approved projects together with the proposed project by 907 units, for a total potential impact of 7, 082 units above OCP-2000 projections for the combined project areas in RSA-E-44 in 2025.

The potential future projects, as a group, would exceed OCP-2000 projections for their project areas within the City and sphere. However, this housing growth would address City General Plan policies calling for increased housing production to meet housing demand generated by job opportunities within the city, as well as state housing production mandates. The proposed but not approved projects would also address SCAG regional policies that encourage more housing in job-rich areas to improve hobs/housing balance, congestion and emissions.

Taking these factors into account, probable future projects would result in a significant potential cumulative housing impact. This potential cumulative impact is not considered to be adverse due the projects' benefits for housing production and jobs/housing balance consistent with the City General Plan, and state and regional policies.

Potential Additional Population Impacts: Probable future projects would result in 4,270 new residents by 2025.

RSA E-44 Level. Approved projects plus the proposed project result in 16,660 residents above OCP-2000 projections for their project areas in 2025. Probable future projects would decrease population by 3,749 residents from OCP-2000 projections for the project areas within RSA E-44. This results in a potential cumulative increase of 12,911 residents above OCP-2000 projections for the combined approved, proposed, and probable future project areas within RSA E-44.

The population increase due to probable future projects is consistent with the amount of housing included in the projects. In turn, the housing growth is consistent with the City's General Plan as well as SCAG's regional policies that encourage more housing in job-rich areas to improve jobs/housing balance, congestion and emissions. Thus, the project population that results from these units also supports these regional policies.

Taking these factors together, probable future projects would reduce the existing cumulative population impact associated with prior approved projects in combination with the proposed project, but a significant cumulative impact would remain. This cumulative population impact at the RSA level is considered to be significant, but not adverse, because the population growth associated with the potential projects is a necessary consequence of providing housing per regional jobs/housing balance and housing production policies.

City and Sphere Level. Probable future projects would decrease population by 1,198 residents from OCP-2000 2025 projections for project areas in the City of Irvine and its sphere. The City would already experience a 17,399 resident exeedance of OCP-2000 projections for 2025 due to prior approved projects together with the proposed project. This results in a total cumulative increase of 13,650 new residents.

Probable future projects include projects that would increase population (and associated housing) from previous General Plan levels within jobs-rich planning areas, thus improving jobs/housing balance and providing residential opportunities within all planning areas, per city General Plan Housing Element policies. Probable future projects also include projects, which would decrease resident population from previously planned levels in the City General Plan.

On balance, probable future projects would lessen the cumulative population impact associated with the approved projects and proposed project at the City and sphere level, but would not reduce it to a level of insignificance. This potential remaining cumulative population impact is considered to be significant but not adverse because the population growth is consistent with housing growth that implement City General Plan housing provisions, as well as state housing and regional housing and jobs/housing policies.

CITY OF IRVINE
NORTHERN SPHERE AREA ZONE CHANGE AND GENERAL PLAN AMENDMENT

Traffic Study

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EXECUTIVE SUMMARY

The following summary presents the findings of a traffic study carried out for proposed development in an unincorporated part of Orange County northeast of the City of Irvine boundary which is referred to as the Irvine Northern Sphere Area. Although this area is in the County, it is in the City of Irvine's Sphere of Influence and is being processed through the City of Irvine for entitlement purposes. Specifically, the City of Irvine is processing a pre-zone General Plan Amendment and Zone Change for the project area which is planned to be developed with a mix of residential and non-residential uses. The purpose of the study is to evaluate the potential impacts of the proposed project and to provide a traffic analysis for the Zone Change and General Plan Amendment proposed for the Irvine Northern Sphere Area. Supporting material for the findings is contained in the overall traffic report accompanying this summary and the related technical appendices. The traffic study was conducted in accordance with the requirements of a Scope of Work that was reviewed and approved by the City of Irvine in June 2001 and with the City's traffic study guidelines.

THE PROPOSED PROJECT

The Northern Sphere Area project includes proposed development in Planning Areas 5B, 6, 8A and 9 (PA5B, PA6, PA8A and PA9) of the City of Irvine General Plan. The proposed project also incorporates a transfer of General Plan residential units from other planning areas as follows:

NCCP Bank	3,888
Planning Area 2	1,220
Planning Area 5A	955
Planning Area 8	804
Planning Area 11	1,825
Planning Area 12	858
Planning Area 15	2,537
TOTAL	12,087

However, in order to identify impacts exclusively due to development in the Northern Sphere Area, the transfer of residential units from these planning areas are included in both the no-project and with-project conditions.

The proposed project is assumed to be partially built by 2007 and built out by 2025. For 2007 conditions, 400 residential units in PA8A and 3,100 residential units and 150,000 square feet of retail uses in PA9 are assumed. Buildout of the project includes 1,900 residential units in PA5B, 4,500 residential units, 300,000 square feet of retail uses and 2,400,000 square feet of office and research and development (R&D) uses in PA6, 400 residential units in PA8A, and 5,550 residential units, 450,000 square feet of retail and 4,166,000 square feet of office and R&D uses in PA9 for a total development of 12,350 residential units, 750,000 square feet of retail uses, and 6,566,000 square feet of office and R&D uses. Exhibit A shows the project site and the study area used for this traffic analysis. There are currently agricultural uses in some parts of the project area. It is recognized that the results of this study may establish a trip cap for the project, the details of which will be outlined in the zoning document for this project. Vehicle trip generation for the proposed land uses can be summarized as follows:

	AM Peak Hour	PM Peak Hour	Daily Vehide Trips
2007			
Planning Area 8A	280	371	3,577
Planning Area 9	3,228	3,847	42,474
TOTAL	3,508	4,218	46,051
BUILDOUT			
Planning Area 5B	1,913	1,920	19,264
Planning Area 6	7,685	8,797	94,770
Planning Area 8A	280	371	3,577
Planning Area 9	11,388	12,585	137,262
TOTAL	21,266	23,673	254,873

The trip generation is based on the City of Irvine's adopted trip rates. The trip generation based on the model output is presented in Appendix A.

As can be seen from the above table, the buildout of the proposed project generates approximately 254,900 average daily trips (ADT) with eight and nine percent occurring in the AM and PM peak hour, respectively. Approximately 18 percent of the buildout trip generation is assumed to occur by 2007.

Also included with the project are two modifications to the City of Irvine Master Plan of Arterial Highways (MPAH): 1) reclassify Jeffrey Road between the SR-241 and Portola Parkway from a six-lane major arterial to a four-lane primary arterial (which would make it consistent with the County of Orange MPAH); and 2) eliminate from the City of Irvine's MPAH an unnamed north-south secondary arterial extending from Irvine Boulevard to Trabuco Road between Jeffrey Road and Sand Canyon Avenue.

PROJECT IMPACTS

Project impacts are based on changes to the traffic volumes that may occur on a roadway as a result of the development of a project. From a traffic circulation perspective, an increase in the traffic volume on a roadway is not necessarily considered an adverse impact if the roadway continues to operate at an acceptable level of service. The project impact analysis in this report is conducted in accordance with the standards of the City of Irvine and of other involved jurisdictions. These standards are discussed in more detail in Chapter 1.0.

Project impacts for years 2025 and Post-2040 have been identified based on the full implementation of the City's MPAH and Current General Plan (including the recently approved Millennium Plan II) land uses. For year 2025 two model networks were developed: 1) a circulation system which assumes only those improvements which exist or are committed for construction or would be constructed as part of previously entitled development by this time frame (referred to as "constrained"); and 2) buildout of the circulation system in accordance with the City of Irvine's General Plan and County of Orange MPAH (referred to as "2025 buildout"). Project impacts for year 2007 have also been identified based on land use assumptions provided by the City of Irvine and a circulation system which exists or is committed for construction by 2007.

The forecasts are based on an adopted version of the City of Irvine's traffic model, the Irvine Transportation Analysis Model (ITAM) 3.01, which has been updated to include additional analysis roadway link and intersection locations within the City of Irvine and the surrounding area. The updated model also has incorporated the Orange County Projections 2000 (OCP-2000) socioeconomic growth projections for the unincorporated county areas and local jurisdictions' updated General Plans, as available, into the forecasts and has been re-calibrated with a year 2000 validation. This model is based on the countywide "parent" traffic model, the Orange County Transportation Analysis Model (OCTAM) 3.1.

Project impacts are identified based on comparison of with and without project conditions. Road and intersection volumes were compared for without and with project land uses. Significant project impact that would require mitigation is defined when a location does not meet the level of service (LOS) criteria (LOS "E" in City of Irvine's PA33 and PA36, LOS "D" elsewhere), and when the project either causes the deficiency or increases the deficiency by .02 or more. Certain intersections defined in the Congestion Management Program (CMP) are evaluated based on the CMP guidelines where the acceptable criteria is LOS "E" or if contribution to an already deficient location is not greater than .03.

The impact analysis sections of this report showed that there are no roadway link locations adversely impacted by the project according to the City of Irvine's Link Capacity Analysis guidelines which require roadway links exceeding LOS "D" (V/C ratio of .90) or LOS "E" (V/C ratio of 1.00) in PA33 or PA36 be further examined using peak hour data. If the roadway link peak hour data meets the basic performance criteria then the roadway capacity is deemed to meet City of Irvine Standards.

Several intersections, as summarized in Exhibit B, show significant increases in intersection capacity utilization (ICU) value. As seen in Exhibit B, the proposed project adversely impacts three intersection locations for 2007, 31 intersections for 2025 with constrained network, 23 intersections for 2025 with buildout circulation system and 23 intersections for Post-2040. Mitigation measures have been identified to address the project impacts at these locations. In addition, Exhibit B presents the results of the mitigation measures presented in the next section.

MITIGATION MEASURES

The recommended mitigation measures (see resulting ICUs in Exhibit B) for the impacted intersections are presented in Exhibit C. It should be noted that the mitigation measures identified

(Text continued on page 14)

Exhibit B
SUMMARY OF IMPACTED INTERSECTIONS AND MITIGATION RESULTS

	NO-PROJECT		WITH-PROJECT		DIFFERENCE		IMPACT		W/MITIGATION		RESULT	
LOCATION	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
2007												
127. Jamboree Rd at El Camino Real	.65	.94	.66	.96	.01	.02	-	c	.61	.91	-	mp
133. Jamboree Rd at Edinger Av	1.03	.64	1.05	.65	.02	.01	c	-	1.00	.60	ma	-
485. Sand Cyn Av at Road "B"	.81	1.19	.82	1.21	.01	.02	-	c	.56	.84	-	ma
2025 CONSTRAINED												
34. Red Hill Av at Irvine Bl	.94	1.04	.97	1.05	.03	.01	c	-	.94	1.00	mp	-
									.92 [1]	1.00 [1]	mp	-
91. Tustin Ranch Rd at Irvine Bl	1.14	1.09	1.18	1.11	.04	.02	c	c	1.11	1.05	mp	mp
									1.13 [1]	1.06 [1]	mp	mp
127. Jamboree Rd at El Camino Real	.65	.92	.67	.95	.02	.03	-	c	.62	.90	-	ma
223. Culver Dr at I-5 SB Ramps	.74	.93	.75	1.02	.01	.09	-	c	.75	.92	-	mp
									.65 [1]	.84 [1]	-	ma
224. Culver Dr at Walnut Av	.90	.87	.93	.91	.03	.04	p	p	.83	.86	ma	ma
									.78 [1]	.86 [1]	ma	ma
235. Culver Dr at University Dr[2]	.89	.94	.92	.96	.03	.02	p	c	.81	.90	ma	ma
249. Yale Av at Irvine Bl	.90	.68	.99	.79	.09	.11	p	-	.84	.76	ma	-
282. Jeffrey Rd at Portola Pkwy	.76	1.27	.95	.73	.19	-.54	p	-	.84	.73	ma	-
283. Jeffrey Rd at Irvine Bl	.77	.75	.99	.90	.22	.15	p	-	.78	.90	ma	-
284. Jeffrey Rd at Bryan Av	.92	.44	.99	.62	.07	.18	c	-	.80	.64	ma	-
285. Jeffrey Rd at Trabuco Rd	.95	.78	.96	1.02	.01	.24	-	p	.84	.82	-	ma
286. Jeffrey Rd at Roosevelt	1.27	.84	1.26	.91	-.01	.07	-	p	1.11	.87	-	ma
289. Jeffrey Rd at ICD	.87	1.00	.87	1.08	.00	.08	-	c	.80	.98	-	mp
									.75 [1]	.96 [1]	-	mp

Exhibit B (cont.)
SUMMARY OF IMPACTED INTERSECTIONS AND MITIGATION RESULTS

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
2025 CONSTRAINED (cont.)												
301. Sand Cyn Av at Irvine Bl	.67	.59	.96	.74	.29	.15	p	-	.83	.74	ma	-
302. Sand Cyn Av at Trabuco Rd	1.00	1.00	1.08	1.12	.08	.12	c	c	.89	1.00	ma	mp
303. Sand Cyn Av at I-5 NB Ramps	.71	.81	.92	1.00	.21	.19	p	p	.74	.80	ma	ma
304. Sand Cyn Av at Marine Way	.94	1.21	1.00	1.32	.06	.11	c	c	.92	1.06	mp	mp
305. Sand Cyn Av at I-5 SB Ramps	1.08	.97	1.26	1.10	.18	.13	c	c	1.01	.83	mp	ma
311. Sand Cyn Av at I-405 NB Ramps	.91	.55	.95	.55	.04	.00	c	-	.91	.49	mp	-
317. SR-133 NB Ramps at Irvine Bl	.84	.69	.91	.82	.07	.13	p	-	.85	.76	ma	-
									.86 [1]	.77 [1]	ma	-
362. Bake Pkwy at Irvine Bl	1.24	.81	1.27	.86	.03	.05	c	-	1.11	.86	mp	-
364. Bake Plwy at Jeronimo Rd	1.19	.90	1.14	.91	-.05	.01	-	p	1.10	.87	-	ma
366. Bake Pkwy at Rockfield Bl	.89	.94	.91	.95	.02	.01	p	-	.83	.87	ma	-
									.86 [1]	.90 [1]	ma	-
367. Bake Pkwy at I-5 NB Ramps	1.01	.63	1.03	.65	.02	.02	c	-	.88	.61	ma	-
368. Bake Pkwy at I-5 SB Ramps	.88	.92	.89	.94	.01	.02	-	c	.81	.84	-	ma
484. Sand Cyn Av at Roosevelt Av	.80	.81	.84	1.01	.04	.20	-	p	.72	.83	-	ma
485. Sand Cyn Av at Road "B"	.85	1.14	.95	1.24	.10	.10	p	c	.78	.87	ma	ma
490. Research Dr at Trabuco Rd	.79	.90	.83	.91	.04	.01	-	p	.81	.86	-	ma
507. Bake Pkwy at Millennium Bl	.95	.98	.99	1.02	.04	.04	c	c	.95	.94	mp	mp
512. Irvine Bl at Trabuco Rd	.87	.86	.92	.90	.05	.04	p	-	.83	.90	ma	-
515a. Bake Pkwy at Rancho Pkwy N	.98	1.22	1.00	1.22	.02	.00	c	-	.83	1.19	ma	-

Exhibit B (cont.)
SUMMARY OF IMPACTED INTERSECTIONS AND MITIGATION RESULTS

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
2025 BUILDOUT												
34. Red Hill Av at Irvine Bl	.95	1.03	.97	1.06	.02	.03	c	c	.94	1.01	mp	mp
									.92 [1]	1.01 [1]	mp	mp
91. Tustin Ranch Rd at Irvine Bl	.96	.93	.97	.95	.01	.02	-	c	.90	.90	-	ma
									.92 [1]	.90 [1]	-	ma
125. Jamboree Rd at Irvine Bl	.97	.85	1.01	.88	.04	.03	c	-	.96	.83	mp	-
223. Culver Dr at I-5 SB Ramps	.72	.90	.77	1.00	.05	.10	-	p	.77	.87	-	ma
									.69 [1]	.85 [1]	-	ma
224. Culver Dr at Walnut Av	.91	.87	.94	.91	.03	.04	c	p	.85	.86	ma	ma
									.80 [1]	.86 [1]	ma	ma
249. Yale Av at Irvine Bl	.99	.73	1.03	.84	.04	.11	c	-	.88	.81	ma	-
284. Jeffrey Rd at Bryan Av	.94	.45	1.03	.62	.09	.17	c	-	.85	.65	ma	-
285. Jeffrey Rd at Trabuco Rd	.89	.87	1.02	1.04	.13	.17	p	p	.88	.83	ma	ma
286. Jeffrey Rd at Roosevelt	1.25	.84	1.25	.92	.00	.08	-	p	1.09	.87	-	ma
289. Jeffrey Rd at ICD	.86	1.00	.90	1.08	.04	.08	-	c	.83	1.00	-	mp
301. Sand Cyn Av at Irvine Bl	.81	.71	.94	.84	.13	.13	p	-	.81	.84	ma	-
302. Sand Cyn Av at Trabuco Rd	.91	.90	1.05	1.00	.14	.10	c	p	.86	.90	ma	ma
303. Sand Cyn Av at I-5 NB Ramps	.55	.83	.67	.95	.12	.12	-	p	.67	.67	-	ma
304. Sand Cyn Av at Marine Wy	.59	1.01	.67	1.04	.08	.03	-	c	.55	.91	-	mp
305. Sand Cyn Av at I-5 SB Ramps	.94	.78	1.07	.86	.13	.08	c	p	.89	.79	ma	-
311. Sand Cyn Av at I-405 NB Ramps	.95	.56	.97	.56	.02	.00	c	-	.93	.50	mp	-

Exhibit B (cont.)
SUMMARY OF IMPACTED INTERSECTIONS AND MITIGATION RESULTS

	NO-PROJECT		WITH-PROJECT		DIFFERENCE		IMPACT		W/MITIGATION		RESULT	
LOCATION	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
2025 BUILDOUT (cont.)												
321. Laguna Cyn Rd at Old Laguna Cyn Rd	.86	.90	.88	.94	.02	.04	-	p	.86	.87	-	ma
406. Laguna Cyn Rd at Lake Forest Dr	1.13	.89	1.15	.95	.02	.06	c	p	1.13	.90	mp	ma
484. Sand Cyn Av at Roosevelt Av	.78	.83	.83	1.02	.05	.19	-	p	.71	.82	-	ma
485. Sand Cyn Av at Road “B”	.88	1.16	.95	1.22	.07	.06	p	c	.75	.86	ma	ma
507. Bake Pkwy at Millennium Bl	.94	.93	.96	.96	.02	.03	c	c	.94	.91	mp	mp
515a. Bake Pkwy at Rancho Pkwy N	.88	1.22	.91	1.21	.03	-.01	p	-	.79	1.18	ma	-
515b. Bake Pkwy at Rancho Pkwy S	.89	.82	.92	.84	.03	.02	p	-	.83	.80	ma	-
POST-2040												
34. Red Hill Av at Irvine Bl	.93	1.01	.95	1.02	.02	.01	c	-	.93	.98	mp	-
									.90[1]	.97[1]	ma	-
91. Tustin Ranch Rd at Irvine Bl	.93	.88	.96	.89	.03	.01	c	-	.90	.86	ma	-
									.91[1]	.84[1]	mp	-
223. Culver Dr at I-5 SB Ramps	.74	.93	.76	.98	.02	.05	-	c	.76	.86	-	ma
									.70[1]	.84[1]	-	ma
224. Culver Dr at Walnut Av	.93	.87	.96	.91	.03	.04	c	p	.87	.86	ma	ma
									.82[1]	.86[1]	ma	ma
249. Yale Av at Irvine Bl	.94	.73	1.02	.83	.08	.10	c	-	.87	.79	ma	-
284. Jeffrey Rd at Bryan Av	.96	.46	1.02	.65	.06	.19	c	-	.85	.68	ma	-
285. Jeffrey Rd at Trabuco Rd	.90	.88	1.00	1.05	.10	.17	p	p	.86	.86	ma	ma
286. Jeffrey Rd at Roosevelt	1.25	.85	1.27	.93	.02	.08	c	p	1.11	.88	mp	ma

Exhibit B (cont.)
SUMMARY OF IMPACTED INTERSECTIONS AND MITIGATION RESULTS

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
POST-2040 (cont.)												
289. Jeffrey Rd at ICD	.86	1.04	.91	1.11	.05	.07	p	c	.84	1.03	ma	mp
301. Sand Cyn Av at Irvine Bl	.78	.69	.95	.83	.17	.14	p	-	.82	.83	ma	-
302. Sand Cyn Av at Trabuco Rd	.95	.94	1.07	1.01	.12	.07	c	c	.88	.91	ma	mp
303. Sand Cyn Av at I-5 NB Ramps	.55	.88	.65	1.07	.10	.19	-	p	.65	.72	-	ma
304. Sand Cyn Av at Marine Way	.59	1.05	.69	1.12	.10	.07	-	c	.60	.97	-	mp
305. Sand Cyn Av at I-5 SB Ramps	.95	.82	1.10	.92	.15	.10	c	p	.93	.86	mp	ma
306. Sand Cyn Av at Oak Cyn	.82	.88	.89	.93	.07	.05	-	p	.64	.75	-	ma
311. Sand Cyn Av at I-405 NB Ramps	1.00	.59	1.05	.61	.05	.02	c	-	1.00	.53	mp	-
316. SR-133 SB Ramps at Irvine Bl	.89	.56	.98	.68	.09	.12	p	-	.82	.63	ma	-
452. Jamboree Rd at Santiago Cyn Rd	.88	.89	.91	.90	.03	.01	p	-	.85	.90	ma	-
484. Sand Cyn Av at Roosevelt Av	.78	.84	.84	1.05	.06	.21	-	p	.73	.87	-	ma
485. Sand Cyn Av at Road “B”	.89	1.14	.99	1.23	.10	.09	p	c	.78	.87	ma	ma
490. Research Dr at Trabuco Rd	.72	.85	.73	.91	.01	.06	-	p	.71	.83	-	ma
507. Bake Pkwy at Millennium Bl	.95	.98	.97	1.00	.02	.02	c	c	.95	.96	mp	mp
515a. Bake Pkwy at Rancho Pkwy N	.89	1.11	.90	1.14	.01	.03	-	c	.74	1.11	-	mp

Note: See Exhibit C for proposed mitigation measures.

[1] Alt. Mit. - Alternative mitigation

[2] ATMS credit of .05 reflected

p - Project causes deficiency
c - Project contributes to deficiency

ma - Mitigated to an adequate level of service
mp - Project portion of impact mitigated, LOS remains less than adequate

Exhibit C

MITIGATION LANES FOR IMPACTED INTERSECTIONS

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
34. Red Hill at Irvine	25C,25B,BO	1	2	0	1	3	0	2	1	1	1	3	0
	Mit.						d						
	Alt. Mit.	ATMS (City of Tustin)											
91. Tustin Ranch at Irvine	25C	1	3	f	2	2	1	1	3	1	2	3	1
	25B,BO					3							
	Mit.							2					
	Alt. Mit.	ATMS (City of Tustin)											
125. Jamboree at Irvine	25B	2	3	f	2	3	d	2	3	1	2	3	1
	Mit.	ATMS (City of Tustin)					(mit. not needed at BO)						
127. Jamboree at El Camino Real	07,25C	1	4	d	2	2	0	2	4	1	1	1	2
	Mit.	ATMS (City of Tustin)					(mit. not needed at 25B or BO)						
133. Jamboree at Edinger	07	2	0	1	2	3	1	2	0	f	2	3	1
	Mit.	ATMS (City of Tustin)					(mit. not needed at 25C,25B or BO)						
223. Culver at I-5 SB Ramps	25C	0	3	f	0	0	0	0	3	f	1.5	0	1.5
	25B,BO										2		2
	Mit.								4				
	Alt. Mit.										3		2
224. Culver at Walnut	25C,25B,BO	2	3	d	2	2	d	2	3	1	2	2	0
	Mit.					3							d
	Alt. Mit.	ATMS &											d
235. Culver at University	25C	1	3	0	2	3	d	1	3	d	2	3	0
	Mit.	(mit. not needed at 25B or BO)							2	2			
249. Yale at Irvine Bl	25C,25B,BO	1	2	d	1	3	d	1	2	d	1	3	d
	Mit.	2											
282. Jeffrey at Portola	25C	0	1	1	2	3	0	1	1	f	1	2	1
	Mit.	(mit. not needed at 25B or BO)										3	0
283. Jeffrey at Irvine	25C	2	3	1	2	2	1	2	3	1	1	2	1
	Mit.	(mit. not needed at 25B or BO)										3	
284. Jeffrey at Bryan	25C,25B,BO	1	3	1	1	1	0	2	3	d	1.5	.5	d
	Mit.										1		1.5
285. Jeffrey at Trabuco	25C,25B,BO	1	3	d	1	2	0	2	3	1	1	2	1
	Mit.	2	4		2		d				2		
286. Jeffrey at Roosevelt	25C,25B,BO	2	3	d	2	1	1	1	4	d	1	1	1
	Mit.					2	d					2	d
289. Jeffrey at ICD	25C,25B,BO	2	3	1	2	3	1	2	3	1	2	4	f
	25C Mit.	3							4				
	25C Alt. Mit.	3	& ATMS										
	25B,BO Mit.	3											

Continued

Exhibit C (cont.)
MITIGATION LANES FOR IMPACTED INTERSECTIONS

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
301. Sand Cyn at Irvine	25C,25B,BO	2	3	1	2	3	1	2	3	1	2	3	1
	Mit.											4	
302. Sand Cyn at Trabuco	25C,25B,BO	2	3	d	2	2	0	2	3	1	2	2	1
	Mit.				3	3						3	
303. Sand Cyn at I-5 NB Ramps	25C	1	2	1	1	1	0	2	2	0	1.5	.5	1
	25C Mit.			f					3				
	25B,BO	0	3						3		2	1	
	25B,BO Mit.			f									
304. Sand Cyn at Marine	25C	2	2	0	1	0	1	0	2	1	0	0	0
	25C Mit.								3				
	25B,BO		3		2				3	2			
	25B,BO Mit.								4				
305. Sand Cyn at I-5 SB Ramps	25C	2	2	0	0	0	0	0	2	d	1.5	0	1.5
	25C Mit.								3		2.5		
	25B,BO		3						3				
	25B,BO Mit.										2.5		
306. Sand Cyn at Oak Cyn.	BO	1	3	d	2	1	1	1	3	1	2	1	d
	Mit.	2				.5	1.5						
311. Sand Cyn at I-405 NB Ramps	25C,25B,BO	0	2	f	.5	0	1.5	0	2	f	0	0	0
	Mit.				1		2						
316. SR-133 SB Ramps at Irvine	BO	1.5	0	1.5	1	3	0	0	0	0	0	3	d
	Mit.											4	
317. SR-133 NB Ramps at Irvine	25C	0	0	0	0	3	0	1	0	2	0	3	f
	Mit.							1.5		2.5			
	Alt. Mit.	ATMS (mit. or alt. mit. not needed at 25B or BO)											
321. LCR at Old LCR	25B	0	3	1	0	0	0	2	3	0	3	0	f
	Mit.	(mit. not needed at BO)						3					
362. Bake at Irvine	25C	2	3	1	2	3	1	1	3	1	2	3	1
	Mit.	(mit. not needed at 25B or BO)						2		d			
364. Bake at Jeronimo	25C	1	3	d	1	2	0	1	3	d	2	2	1
	Mit.*				2								
	Alt. Mit.	ATMS (mit. or alt. mit. not needed at 25B or BO)											
366. Bake at Rockfield	25C	2	4	1	2	2	f	2	4	f	1	2	f
	Mit.		5	0									1
	Alt. Mit.	ATMS (mit. or alt. mit. not needed at 25B or BO)											
367. Bake at I-5 NB Ramps	25C	0	3	f	1.5	0	1.5	0	4	f	0	0	0
	Mit.						2.5	(mit. not needed at 25B or BO)					
368. Bake at I-5 SB Ramps	25C	0	3	f	0	0	0	0	3	f	3	0	2
	Mit.	(mit. not needed at 25B or BO)							4				

(Continued)

Exhibit C (cont.)
MITIGATION LANES FOR IMPACTED INTERSECTIONS

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
406. LCR at Lake Forest	25B	2	3	0	1	0	f	0	3	1	0	0	0
	Mit.				2		(mit. not needed at BO)						
452. Jamboree at Santiago Cyn	BO	2	3	d	2	3	d	2	2	1	2	2.5	1.5
	Mit.		4										
484. Sand Cyn at Roosevelt	25C,25B,BO	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d			d			d			d
485. Sand Cyn at Road “B”	07,25C,25B,BO	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d	2		d	2					1
490. Research at Trabuco	25C,BO	1	1	f	1	3	1	1	1	1	2	3	1
	Mit.	(mit. not needed at 25B)						2					
507. Bake at Millennium	25C,25B,BO	1	4	f	2	2	0	2	4	1	2	1	f
	25C Mit.		5	0									
	25B,BO Mit.					3	d					2	
512. Irvine at Trabuco	25C	2	3	f	2	3	f	2	3	d	2	3	f
	Mit.		4		(mit. not needed at 25B or BO)								
515a. Bake at Rancho North	25C,25B,BO	1	2	0	2	0	2	0	2	d	0	0	0
	Mit.				2.5		1.5						
515b. Bake at Rancho South	25B	0	2	1	0	0	0	1	2	0	2	0	1
	Mit.			f	(mit. not needed at BO)								

* Due to right-of-way constraints, the need for mitigation at this intersection will be re-evaluated in future studies to determine if an alternative mitigation is acceptable.

Abbreviations (in alphabetical order):

Alt. Mit.	Alternative mitigation (for locations within the City of Irvine improvements are subject to approval by the City)
07	2007 Conditions
25B	2025 Buildout Toll Conditions
25C	2025 Constrained Toll Conditions
ATMS	Advanced Transportation Management System - The use of ATMS as a mitigation measure is discretionary and subject to subsequent review and approval by the Director of Public Works. The ATMS program involves a variety of actions such as camera surveillance and centralized system control, and is part of traffic signal system improvements planned for implementation over time.
BO	Post-2040 Buildout Toll-Free Conditions
Cyn	Canyon
d	de facto right-turn
f	free right-turn
ICD	Irvine Center Drive
LCR	Laguna Canyon Road
L,T,R	left, through, right
Mit.	Mitigation
SB,WB,NB,EB	southbound, westbound, northbound, eastbound

here would be studied further by each Master Tentative Map (or equivalent) traffic analysis. The timing and need for these improvements would be based on an updated traffic study to maintain satisfactory levels of service. The mitigation measures presented here are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts. A modified set of mitigation measures are also provided in this report in the event the City of Irvine's performance criteria guidelines are amended to recognize LOS "E" as the acceptable level of service standard in the Irvine Spectrum (parts of Irvine Planning Areas 13, 30 through 32, 34, and 35) and other portions (Planning Areas 9 and 51) of the project study area for select intersections or allows reduced peak hour trip rates in Planning Area 13/Irvine Spectrum 4 and Planning Area 32/Irvine Spectrum 3 based on recent trip generation monitoring counts (see Chapter 7.0).

CONCLUSIONS

With implementation of the required mitigation measures by the project, the planned local arterial highway circulation systems analyzed for 2007, 2025 (constrained and buildout network assumptions) and Post-2040 have adequate capacity to accommodate the proposed project land uses or those locations on the circulation system adversely impacted by the project have been mitigated to maintain the same levels of service under no-project conditions. The mitigation measures presented in this traffic study are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts.

In addition, the traffic forecasts presented in this study for 2025 with buildout toll conditions and Post-2040 toll-free conditions showed that the re-designation of Jeffrey Road between SR-241 and Portola Parkway from a six-lane major to a four-lane primary arterial and the elimination of an unnamed collector between Irvine Boulevard and Trabuco Road would not cause any unmitigated impacts.

Chapter 1.0
INTRODUCTION

This report summarizes the results of a traffic study carried out for proposed development in an unincorporated part of Orange County northeast of the City of Irvine boundary which is referred to as the Irvine Northern Sphere Area. Although this area is in the County, it is in the City of Irvine's Sphere of Influence and is being processed through the City of Irvine for entitlement purposes. Specifically, the City of Irvine is processing a pre-zone General Plan Amendment and Zone Change for the project area which is planned to be developed with a mix of residential and non-residential uses. The purpose of the study is to evaluate the potential impacts of the proposed project and to provide a traffic analysis for the Zone Change and General Plan Amendment proposed for the Irvine Northern Sphere Area. Supporting material for the findings is contained in the overall traffic report accompanying this summary and the related technical appendices. The traffic study was conducted in accordance with the requirements of a Scope of Work (see Appendix F) that was reviewed and approved by the City of Irvine in June 2001 and with the City's traffic study guidelines (see Reference 1).

ANALYSIS SCOPE AND METHODOLOGY

The Northern Sphere Area project includes proposed development in Planning Areas 5B, 6, 8A and 9 (PA5B, PA6, PA8A and PA9) of the City of Irvine General Plan. The proposed project also incorporates the transfer of General Plan residential units from other planning areas as follows:

NCCP Bank	3,888
Planning Area 2	1,220
Planning Area 5A	955
Planning Area 8	804
Planning Area 11	1,825
Planning Area 12	858
Planning Area 15	2,537
TOTAL	12,087

However, in order to identify impacts exclusively due to development in the Northern Sphere Area, the transfer of residential units from these planning areas are included in both the no-project and with-project conditions.

The proposed project is assumed to be partially built by 2007 and built out by 2025. For 2007 conditions, 400 residential units in PA8A and 3,100 residential units and 150,000 square feet of retail uses in PA9 are assumed. Buildout of the project includes 1,900 residential units in PA5B, 4,500 residential units, 300,000 square feet of retail uses and 2,400,000 square feet of office and research and development (R&D) uses in PA6, 400 residential units in PA8A, and 5,550 residential units, 450,000 square feet of retail and 4,166,000 square feet of office and R&D uses in PA9 for a total development of 12,350 residential units, 750,000 square feet of retail uses, and 6,566,000 square feet of office and R&D uses. Figure 1-1 shows the project site and the study area used for this traffic analysis. There are currently agricultural uses in some parts of the project area. It is recognized that the results of this study may establish a trip cap for the project, the details of which will be outlined in the zoning document for this project. Also, level of service "E" for select locations within the study area are being considered with the project application, an analysis of which is presented in Chapter 7.0, Section 5.

Also included with the project are two modifications to the City of Irvine Master Plan of Arterial Highways (MPAH): 1) reclassify Jeffrey Road between the SR-241 and Portola Parkway from a six-lane major arterial to a four-lane primary arterial (which would make it consistent with the County of Orange MPAH); and 2) eliminate from the City of Irvine's MPAH an unnamed north-south secondary arterial extending from Irvine Boulevard to Trabuco Road between Jeffrey Road and Sand Canyon Avenue.

The traffic analysis study area shown in Figure 1-1 was determined based upon preliminary forecasts of the project area and includes portions of the Cities of Irvine, Tustin, Orange and Lake Forest and unincorporated county and is bounded by Jamboree Road from I-5 to Chapman Avenue/Santiago Canyon Road, Santiago Canyon Road to Jeffrey Road, Jeffrey Road to SR-241, SR-241 to Portola Parkway, Portola Parkway to Bake Parkway, Bake Parkway to Irvine Center Drive, Irvine Center Drive to Lake Forest Drive, Lake Forest Drive to SR-133, SR-133 to Old Laguna Canyon Road, Old Laguna Canyon Road to "B" Street, "B" Street to Sand Canyon Avenue, Sand Canyon Avenue to Alton Parkway, Alton Parkway to Culver Drive, Culver Drive to I-5 and I-5 to Jamboree

fig. 1-1

Road. Within this area, the traffic impacts on the circulation system are identified. Also, in response to requests made by the City of Lake Forest and the City of Irvine's Transportation and Infrastructure Commission certain intersections outside this defined study have also been included. Preliminary traffic forecasts also indicated the need to include additional intersections outside the defined study area because of project impacts along the periphery. The 16 intersections outside the defined study area also analyzed in this report are as follows:

Additional intersections near periphery of defined study area:

Newport Avenue at Irvine Boulevard
Red Hill Avenue at Irvine Boulevard
Browning Avenue at Irvine Boulevard
Tustin Ranch Road at Irvine Boulevard

Requests by City of Irvine's Transportation and Infrastructure Commission:

Jamboree Road Southbound and Northbound at Walnut Avenue
Jamboree Road at Edinger Avenue
Jamboree Road Southbound and Northbound at Warner Avenue
Jamboree Road at Barranca Parkway
Culver Drive at I-405 Northbound and Southbound Ramps
Culver Drive at University Drive
Jeffrey Road/University Drive at I-405 Northbound and Southbound Ramps

Requests by City of Lake Forest

Lake Forest Drive at Portola Parkway

This traffic analysis addresses the proposed project in three time frames. The first is for 2007, and represents the amount of growth that is projected to occur in the next five to seven years. This 2007 time period is consistent with County Growth Management Plan (GMP) and Congestion Management Program (CMP) guidelines.

The second time frame is for 2025 with two separate circulation systems assumed: 1) a circulation system which assumes only those improvements which exist or are committed for construction (i.e., public agency Capital Improvement Programs, state transportation improvement program, etc.) or would be constructed as part of previously entitled development by this time frame (referred to as "2025 constrained"); and 2) buildout of the circulation system in accordance with the

City of Irvine's General Plan and County of Orange MPAH (referred to as "2025 buildout"). For year 2025, completion of the project and toll conditions on the SR-133 (north of I-5), SR-241 and SR-261 are assumed. Within the City of Irvine, land use assumptions for the year 2025 were provided by the City. Outside the City of Irvine, Orange County Projections 2000 (OCP-2000) were utilized with the following exceptions:

> 1) The recently approved City of Irvine Millennium Plan II (land uses and circulation) was used for the former Marine Corps Air Station (MCAS) El Toro site. It should be noted that a separate sensitivity analysis is presented which reflects a 28.8 million annual passengers (MAP) aviation alternative for the former MCAS El Toro site.
>
> 2) The recently approved City of Tustin's proposed reuse (land uses and circulation) of the former MCAS Tustin site is assumed (see Reference 13).
>
> 3) The recently approved Santiago Hills II development was assumed in East Orange just north of the project (see Reference 15), and the remainder of the East Orange area is based on land uses presented in the East Orange General Plan Environmental Impact Report (EIR) (see Reference 16).
>
> 4) Updated land uses in the Tustin Ranch area in the City of Tustin north of the project reflects existing and approved land uses.
>
> 5) City of Irvine land uses are assumed for Planning Areas 1 and 2, which are in the City's sphere.

The third time frame is for Post-2040 and is based on the full implementation of the City of Irvine's MPAH and Current General Plan land uses and buildout of the surrounding land uses. Toll-free conditions are assumed on the SR-133 (north of I-5), SR-241 and SR-261. For this time frame, the City's General Plan (GP) land use and circulation information adopted by the City in March 2000 was utilized. OCP-2000 socioeconomic projections and County of Orange MPAH circulation system with the same exceptions outlined for year 2025 are reflected outside the City. Land uses according to the East Orange General Plan have also been included (see Reference 16).

The forecasts are based on an adopted version of the City of Irvine's traffic model, the Irvine Transportation Analysis Model (ITAM) 3.01. ITAM 3.01 has been updated to include additional analysis roadway link and intersection locations within the City of Irvine and the surrounding area. The distances assumed for Culver Drive and Jeffrey Road north of Portola Parkway have been based on conceptual alignment studies for those facilities (see References 17 and 18). The updated model also has incorporated the Orange County Projections 2000 (OCP-2000) socioeconomic growth projections for the unincorporated county areas and local jurisdictions' updated General Plans, as available, into the forecasts and has been re-calibrated with a year 2000 validation. ITAM is based on the countywide "parent" traffic model, the Orange County Transportation Analysis Model (OCTAM) 3.1 and is the principal tool for transportation planning in the City of Irvine (see Reference 3 for the model description and validation report).

PERFORMANCE CRITERIA

The traffic analysis utilizes a set of performance criteria for evaluating roadway and intersection capacity to determine potential project impact. The performance criteria adopted by the City of Irvine in May 1992 (see Reference 1) are summarized in Table 1-1. Also included here are the criteria used in this traffic analysis for other jurisdictions within the study area. The performance criteria include an intersection capacity utilization (ICU) analysis and an arterial link analysis. The intersection capacity analysis examines AM and PM peak hour volumes and ICUs at the intersections being studied in the defined study area. It should be noted that use of the ICU methodology is consistent with City of Irvine guidelines for impact analyses. The arterial link analysis uses ADT volumes and involves the calculation of volume/capacity (V/C) ratios.

Caltrans, in their comments to the Notice of Preparation (NOP) for this project, has requested that the project traffic analysis assess impacts to the freeways and tollways. As a result, freeway/tollway mainline and ramp forecast data are presented in the impact analysis chapters (4.0 through 6.0) of this report. Those locations not meeting the criteria summarized in Tables 1-2 and 1-3 are identified in these chapters. The criteria presented here for freeway/tollway mainline and ramp analyses have been used by other jurisdictions. For General Plan/Zoning land use development proposals and analyses used by jurisdictions, levels of service for mainline freeway and tollway segments determined in this analysis are based on V/C ratios and level of service (LOS) relationships specified in the 2000 Highway Capacity Manual (HCM). The approach in the V/C assessment of freeway/tollway mainline segments is consistent with the level of planning analysis typically conducted for environmental impact analyses.

Table 1-1

TRAFFIC ANALYSIS PERFORMANCE CRITERIA

I. ADT ARTERIAL LINK VOLUMES

Level of Service to be determined based on average daily traffic (ADT) volume-to-capacity (V/C) ratios using the following ADT capacities:

City of Irvine				
Major Arterial	8 lane	72,000		
	6 lane	54,000	6 lane (augmented)	65,000
Primary Arterial	4 lane	32,000	4 lane (augmented)	42,000
Secondary Arterial	4 lane	28,000		
Commuter	2 lane	13,000		
City of Orange				
Major Arterial	6 lane	56,300	augmented (8 lane)	75,000
Primary Arterial	4 lane	37,500	augmented (6 lane)	56,300
Secondary Arterial	4 lane	24,000	augmented (4 lane)	37,500
Collector	2 lane	15,000		
Cities of Tustin and Lake Forest and County of Orange				
Major Arterial	8 lane	75,000		
	6 lane	56,300	6 lane (augmented)	67,600
Primary Arterial	4 lane	37,500	4 lane (augmented)	45,000
Secondary Arterial	4 lane	25,000	4 lane (augmented)	30,000
Collector	2 lane	12,500		

Performance Standard

Non-CMP or non-Irvine Center (PA33) roadways - Level of Service D (ADT V/C less than or equal to .90)
CMP or PA33 roadways - Level of Service E (ADT V/C less than or equal to 1.00)

Mitigation Requirement

For V/C greater than the acceptable level of service, mitigation of the project contribution is required to bring link location back to acceptable level of service or to no-project conditions if project contribution is .02 or greater or greater than .03 for CMP roadways).

II. PEAK HOUR INTERSECTION CAPACITY UTILIZATION (ICU)

Level of service to be based on peak hour ICU values calculated using the following assumptions:

Saturation Flow Rate: 1,700 vehicles/hour/lane
Clearance Interval: .05
Right-Turn-On-Red Utilization Factor*: .75 for Cities of Orange, Irvine, Tustin and Lake Forest intersections, .00 for County of Orange intersections

* "De-facto" right-turn lane is used in the ICU calculation if 19 feet from edge to outside of thru-lane exists and parking is prohibited during peak periods.

Performance Standards

Non-CMP or PA33 intersections - Level of Service D (peak hour ICU less than or equal to .90)
CMP or PA33 or Bake Parkway/I-5 northbound ramps intersections - Level of Service E (peak hour ICU less than or equal to 1.00)

Mitigation Requirement

For ICU greater than the acceptable level of service, mitigation of the project contribution is required to bring intersection back to acceptable level of service or to no-project conditions if project contribution is greater than .03 at CMP locations (the impact threshold specified in the CMP), .02 or greater at Cities of Orange, Irvine, Tustin and Lake Forest locations, and .01 or greater at County of Orange locations (the impact threshold specified in the GMP).

Abbreviations: CMP - Congestion Management Program GMP - Growth Management Plan

Table 1-2

FREEWAY/TOLLWAY MAINLINE PERFORMANCE CRITERIA

V/C Calculation Methodology

Level of service to be based on ADT volume/capacity (V/C) ratios calculated using the following capacities per City of Irvine Traffic Study Guidelines:

21,000 average vehicles per day per lane for freeway/tollway segment with 10 or more lanes
22,000 average vehicles per day per lane for freeway/tollway segment with 8 lanes
22,500 average vehicles per day per lane for freeway/tollway segment with 4 to 6 lanes

Performance Standard

Level of Service E (peak hour V/C less than or equal to 1.00)

Threshold of Significance

If based on a comparison with the No Project scenario, a project alternative V/C increase is greater than 0.03 (the impact threshold specified in the CMP) for a freeway/tollway mainline segment that is forecast to operate worse than the performance standard, then the impact of that project alternative is considered significant.

Abbreviations: ADT - average daily traffic
CMP - Orange County Congestion Management Program

Table 1-3

FREEWAY/TOLLWAY RAMP PERFORMANCE CRITERIA

V/C Calculation Methodology

Level of service to be based on peak hour volume/capacity (V/C) ratios calculated using the following ramp capacities:

Freeway/Tollway to Arterial Road Interchanges

Metered On-Ramps

A maximum capacity of 900 vehicles per hour (vph) for a one-lane metered on-ramp with only one mixed-flow lane at the meter.

A maximum capacity of 1,080 (20 percent greater than 900) vph for a one-lane metered on-ramp with one mixed-flow lane at the meter plus one HOV preferential lane at the meter.

A maximum capacity of 1,500 vph for a one-lane metered on-ramp with two mixed-flow lanes at the meter.

A maximum capacity of 1,800 vph for a two-lane metered on-ramp with two mixed-flow lanes at the meter.

Toll Ramps (On-Ramps and Off-Ramps)

A maximum capacity of 1,500 vph for a one-lane toll ramp with one cash (stopped) lane and one FasTrak (unstopped lane).

Non-Metered On-Ramps and Off-Ramps

A maximum capacity of 1,500 vph for a one-lane ramp.

A maximum capacity of 2,250 (50 percent greater than 1,500) vph for a two-lane on-ramp that tapers to one merge lane at or beyond the freeway mainline gore point and for a two-lane off-ramp with only one auxiliary lane.

A maximum capacity of 3,000 vph for a two-lane on-ramp that does not taper to one merge lane and for a two-lane off-ramp with two auxiliary lanes.

Performance Standard

Level of Service E (peak hour V/C less than or equal to 1.00)

Thresholds of Significance

For a freeway/tollway ramp that is forecast to operate worse than the performance standard, the impact of a given project alternative is considered to be significant if, based on a comparison with the No Project scenario, the project alternative V/C increase is as follows:

0.01 or greater for ramps at County of Orange intersections (the impact threshold specified in the GMP).

0.02 or greater for ramps at Cities of Orange, Irvine, Tustin and Lake Forest intersections.

Greater than 0.03 for ramps at CMP intersections (the impact threshold specified in the CMP).

Abbreviations: CMP - Orange County Congestion Management Program
GMP - Orange County Growth Management Plan

Source: July 1995 *Caltrans Highway Design Manual* and the January 2000 *Caltrans Ramp Meter Design Manual*

It should be noted that no additional mainline capacity has been assumed for auxiliary lanes that are located between the on-ramp and off-ramp of two adjacent interchanges (i.e., auxiliary lanes that do not extend beyond two adjacent interchanges).

The ramp capacities described in Table 1-3 are applied to freeway and tollway ramps throughout the traffic analysis study area with the exception of the northbound direct-on ramp at the I-5/Bake Parkway interchange. None of the various on-ramp configurations listed in Table 1-3 accurately describes the existing northbound direct on-ramp from Bake Parkway since it is a two-lane on-ramp that extends for over one-half of a mile (essentially as part of the I-5/I-405 interchanges' collector/distributor roadway system) before tapering to a single lane that becomes an I-5 auxiliary lane. Also, although a meter is installed on the ramp, the meter is not currently activated during the AM and PM rush hours. Based on preliminary discussions with Caltrans Staff regarding an appropriate capacity to assume for this particular on-ramp, it is estimated that this ramp provides a carrying capacity roughly equivalent to that of a mainline freeway lane in an area of heavy merge/diverge activity. Accordingly, a capacity of 3,400 vehicles per hour (vph) (based on the 1,700 vph per lane capacity assumed for mainline mixed-flow lanes on the SR-55 Freeway) is applied for the northbound direct on-ramp at the Bake Parkway/I-5 interchange.

The ramp capacities identified here correspond to LOS "E" conditions and are applied in this analysis to calculate peak hour ramp V/C ratios. As presented in Table 1-3, LOS "E" (V/C less than or equal to 1.00) is the performance standard that is applied to freeway and tollway ramps. In other words, a freeway or tollway ramp is considered deficient (LOS "F") when the V/C ratio is greater than 1.00.

The performance criteria specifies levels of service on the arterial highway system. Traffic levels of service (LOS) are designated "A" through "F." Table 1-4 summarizes the V/C ranges that correspond to LOS "A" through "F" for arterial roads and freeway/tollway segments. The V/C ranges listed for arterial roads are designated in the Orange County Congestion Management Program (CMP) as well as the General Plans for the County of Orange and the Cities within the study area. The V/C ranges listed for freeway and tollway segments are based on the V/C and LOS relationships specified in the 2000 Highway Capacity Manual (HCM 2000) for basic freeway sections.

Table 1-4

VOLUME/CAPACITY RATIO LEVEL OF SERVICE RANGES

Volume/Capacity (V/C) Ratio Range	Level of Service (LOS)
ARTERIAL ROADS	
0.00 - 0.60	A
0.61 - 0.70	B
0.71 - 0.80	C
0.81 - 0.90	D
0.91 - 1.00	E
Above 1.00	F
FREEWAY/TOLLWAY SEGMENTS	
0.00 - 0.30	A
0.31 - 0.50	B
0.51 - 0.71	C
0.72 - 0.89	D
0.90 - 1.00	E
Above 1.00	F

The target LOS is "D" or better (or LOS "E" for a CMP identified location or locations in Planning Areas 33 and 36), which is equivalent to a maximum ICU value of .90 (or 1.00 for CMP, PA33 and PA36 locations). It is important to note that exceeding the target roadway link V/C ratio does not necessarily indicate a roadway link deficiency. Specific guidelines included in the City of Irvine's peak hour link capacity analysis are followed for assessing facility performance when link locations exceed these target LOS (see Reference 4).

Tables 1-5, 1-6 and 1-7 summarize the general LOS descriptions for arterial highways, intersections and freeways/tollways, respectively.

RELATIONSHIP TO OTHER STUDIES

Several studies that have been carried out in this area are of relevance to the traffic analysis presented here. The projects and studies below have all been approved by the City of Irvine and have been incorporated into the 2007, 2025 (constrained toll and buildout toll) and Post-2040 forecasts as documented in Appendix A. These can be briefly summarized as follows:

Millennium Plan - Phase II Traffic Impact Analysis (Reference 3) - This study was carried out by the City of Irvine to analyze an urban center development, which mostly includes technology industries, within the former MCAS El Toro site. In March 2000, the City of Irvine adopted the land uses and circulation associated with the Millennium Plan II into its General Plan. The findings of this report have been incorporated into this traffic study by reflecting buildout land uses and full circulation system of Millennium Plan II (MPII) by 2025 and Phase 1 land uses and partial circulation system of MPII for 2007.

Planning Area 40/Spectrum 8 Traffic Study (Reference 5) - This report summarizes the results of a traffic study carried out for the recently approved project development in an unincorporated part of Orange County near the City of Irvine boundary. The purpose of the study was to provide traffic analysis data for the Zone Change and General Plan Amendment (GPA) applications for this area. Buildout land uses and full circulation system assumptions proposed for the Planning Area 40 (PA40)

Table 1-5

LEVEL OF SERVICE DESCRIPTIONS - URBAN STREETS

The average travel speed along an urban street is the determinant of the operating level of service (LOS). The travel speed along a segment, section, or entire length of an urban street is dependent on the running speed between signalized intersections and the amount of control delay incurred at signalized intersections. The following general statements characterize LOS along urban streets and show the relationship to free flow speeds (FFS)

LOS	DESCRIPTION	PERCENT OF FFS
A	LOS A describes primarily free-flow operations at average travel speeds, usually about 90 percent of the FFS for the given street class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Control delay at signalized intersections is normal.	90
B	LOS B describes reasonably unimpeded operations at average travel speeds, usually about 70 percent of the FFS for the street class. Vehicles are completely unimpeded in their ability to maneuver with the traffic stream. Control delay at signalized intersection is minimal.	70
C	LOS C describes stable operations; however, ability to maneuver and change lane in midblock locations may be more restricted than at LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50 percent of the FFS for the street class	50
D	LOS D borders on a range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors. Average travel speeds are about 40 percent of FFS.	40
E	LOS E is characterized by significant delays and average travel speeds of 33 percent of less of the FFS. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.	33
F	LOS F is characterized by urban street flow at extremely low speeds, typically one-third to one-fourth of the FFS. Intersection congestion is likely at critical signalized locations, with high delays, high volumes, and extensive queuing.	25

Source: Highway Capacity Manual 2000, Transportation Research Board, National Research Council

Table 1-6

LEVEL OF SERVICE DESCRIPTIONS - SIGNALIZED INTERSECTIONS

Levels of service (LOS) for signalized intersections are defined in terms of control delay as follows:

LOS	DESCRIPTION	DELAY PER VEHICLE (secs)
A	LOS A describes operations with low control delay, up to 10 seconds per vehicle. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.	< 10
B	LOS B describes operations with control delay greater than 10 and up to 20 seconds per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than the LOS A, causing higher levels of delay.	10 - 20
C	LOS C describes operations with control delay greater than 20 and up to 35 seconds per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level.. Cycle failure occurs when a given green phase does not serve queued vehicles, and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.	20 - 35
D	LOS D describes operations with control delay greater than 35 and up to 55 seconds per vehicle. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, and high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	35 - 55
E	LOS E describes operations with control delay greater than 55 and up to 80 seconds per vehicle. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent.	55 - 80
F	LOS F describes operations with control delay in excess of 80 seconds per vehicle. This level, considered unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of lane groups. It may also occur at high V/C ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.	> 80

Source: Highway Capacity Manual 2000, Transportation Research Board, National Research Council

Table 1-7

LEVEL OF SERVICE DESCRIPTIONS - FREEWAYS/TOLLWAYS

LOS	DESCRIPTION
A	LOS A describes free-flow operations. Free-flowspeeds (FFS) prevail. Vehicles are almost completely unimpeded in their ability to maneuver with the traffic stream. The effects of incidents or point breakdowns are easily absorbed at this level.
B	LOS B represents reasonably free-flow, and FFS are maintained. The ability to maneuver with the traffic stream is only slightly restricted, and the general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents and point breakdowns are still easily absorbed.
C	LOS C provides for flow with speeds at or near the FFS of the freeway/tollway. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver. Minor incidents may still be absorbed, but the local deterioration in service will be substantial. Queues may be expected to form behind any significant blockage.
D	LOS D is the level at which speeds begin to decline slightly with increasing flows and density begins to increase somewhat more quickly. Freedom to maneuver within the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort levels. Even minor incidents can be expected to create queuing, because the traffic stream has little space to absorb disruptions.
E	At its highest density value, LOS E describes operation at capacity. Operations at this level are volatile, because there are virtually no usable gaps in the traffic stream. Vehicles are closely spaces, leaving little room to maneuver with the traffic stream at speeds that still exceed 49 miles per hour. Any disruption of the traffic stream, such as vehicles entering from a ramp or a vehicle changing lanes, can establish a disruption wave that propagates throughout the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate even the most minor disruption, and any incident can be expected to produce a serious breakdown with extensive queuing. Maneuverability with the traffic stream is extremely limited, and the level of physical and psychological comfort afforded the driver is poor.
F	LOS F describes breakdowns in vehicular flow. Such conditions generally exist within queues forming behind breakdown points, and are the result of a bottleneck downstream point. LOS F is also used to describe conditions at the point of the breakdown or bottleneck and the queue discharge flow that occurs at speeds lower than the lowest speed for LOS E, as well as the operations within the queue that forms upstream. Whenever LOS F conditions exist, they have the potential to extend upstream for significant distances.

Source: Highway Capacity Manual 2000, Transportation Research Board, National Research Council

project and any identified project mitigation measures are included in this current traffic study. The PA40 project is assumed to be built out by year 2007.

Planning Area 17 Tentative Tract Map Traffic Study (Reference 6) - This report presents the findings of a traffic study carried out for the recently approved Planning Area 17 (PA17) tentative tract map development in the City of Irvine. The purpose of the study was to evaluate potential impacts of the proposed PA17 project and to provide traffic analysis data at a more detailed level for the Vesting Tentative Tract Map (No. 16177) application for this area. Buildout land uses and full circulation system assumptions proposed for the PA17 project are included in this current traffic study. The PA17 project is assumed to be completed by the year 2007.

Planning Area 13 (Spectrum 4) and Planning Area 31 (Spectrum 6) (Reference 7) - This traffic study was carried out to determine the impacts of a recently approved intensity transfer in which building intensity (gross square footage) and related trips in Planning Area 13 (PA13)/Irvine Spectrum 4 were reduced, and building intensity (gross square footage) and related trips in Planning Area 31 (PA31)/Irvine Spectrum 6 were increased. These assumptions are included in the background conditions of this report.

Mariners Church Expansion in Planning Area 27 (Reference 19) - This traffic study presents data to determine the impacts of an expansion of the existing Mariners Church in the City of Irvine's Planning Area 27 by 328,250 square feet of additional church uses and a 35,000 square foot health club. Buildout of the church expansion is assumed to be completed by year 2007.

REFERENCES

1. "Traffic Study Guidelines," City of Irvine Community Development Department Transportation Services Adopted May 26, 1992.

2. "Draft EIR Revised City of Irvine Planning Areas 51, 35 and 30 Annexation, General Plan Amendment, Pre-Zoning, and Zoning Change-Appendix A: Millennium Plan - Phase II Traffic Impact Analysis," Robert Kahn, John Kain & Associates, November 1999.

3. "ITAM 3.01 Primary Study Area Database Expansion Technical Supplement," Urban Crossroads, Inc., November 2001.

4. "Peak Hour Link Capacity Analysis Methodology," City of Irvine, December 1996.

5. "City of Irvine Planning Area 40/Spectrum 8 Traffic Study," Austin-Foust Associates, Inc., December 2000.

6. "City of Irvine Planning Area 17 Tentative Tract Map Traffic Study," Austin-Foust Associates, Inc., May 2001.

7. "City of Irvine Planning Area 13 (Spectrum 4) and Planning Area 31 (Spectrum 6) Traffic Study," Austin-Foust Associates, Inc., March 2001.

8. "Highway Capacity Manual 2000," Transportation Research Board, National Research Council.

9. "Highway Design Manual," Caltrans, July 1995.

10. "Ramp Meter Design Manual," Caltrans, January 2000.

11. "2000 Traffic Volumes on the California State Highway System," Caltrans & Transportation Corridor Agencies (TCA).

12. "1998 Circulation Phasing Analysis Report," Transportation Planning, Department of Public Works, City of Irvine, 1998.

13. "Appendix F to the FEIS/EIR for Disposal and Reuse of Marine Corps Air Station (MCAS) Tustin Final Traffic Technical Report," Austin-Foust Associates, Inc., November 1999.

14. "MCAS El Toro Local Redevelopment Authority Airport System Master Plan TR11 Traffic Analysis Addendum," Austin-Foust Associates, Inc., April 2001.

15. "Santiago Hills II Final Environmental Impact Report 1278," BonTerra Consulting, May 2000.

16. "East Orange General Plan Environmental Impact Report 1278," Michael Brandman and Associates, December 1989.

17. "Culver Drive Extension Feasibility Assessment," Robert Bein, William Frost & Associates, Inc., November 22, 2000.

18. "Jeffrey Road Extension Alternative Alignment Study," Robert Bein, William Frost & Associates, Inc., July 10, 2001.

19. "City of Irvine Mariners Church Expansion Traffic Study," Austin-Foust Associates, Inc., May 2001.

20. "Culver Drive MPAH Amendment Traffic Analysis," Austin-Foust Associates, Inc., November 2000.

Chapter 2.0
PROJECT DESCRIPTION

This chapter describes the traffic characteristics of the proposed project. The project site and its proposed land uses are summarized, and the associated project trip generation and distribution are presented. This data is used in later chapters of this report to analyze the 2007, 2025 (constrained and buildout toll networks) and Post-2040 impacts of the project.

PROJECT SITE

Located in unincorporated county near the City of Irvine boundary, the project involves four City Planning Areas (5A, 6, 8A and 9) and is referred to as the Irvine Northern Sphere Area. The zoning map for each planning area is illustrated in Figures 2-1 through 2-4). Proposed buildout of the project includes a total development of 12,350 residential units, 750,000 square feet of retail uses, and 6,566,000 square feet of office and research and development (R&D) uses.

Providing direct access to the project are Jeffrey Road, Sand Canyon Avenue, Portola Parkway, Irvine Boulevard, Bryan Avenue and Trabuco Road. Regional accessibility will be via the I-5, I-405, SR-133, SR-241, SR-261 and arterial components of the regional transportation system such as SR-133/Laguna Canyon Road and Irvine Boulevard.

Also included with the project are two modifications to the City of Irvine Master Plan of Arterial Highways (MPAH): 1) reclassify Jeffrey Road between the SR-241 and Portola Parkway from a six-lane major arterial to a four-lane primary arterial (which would make it consistent with the County of Orange MPAH); and 2) eliminate from the City of Irvine's MPAH an unnamed north-south secondary arterial extending from Irvine Boulevard to Trabuco Road between Jeffrey Road and Sand Canyon Avenue.

Fig. 2-1

fig. 2-2

fig. 2-3

fig. 2-4

The project includes the following roadway improvements:

a) Widening of Irvine Boulevard to its ultimate six-lane width between Yale Avenue and SR-133 including parkway and median improvements.

b) Widening of Sand Canyon Avenue to its ultimate four- to six-lane width between Trabuco Road and Portola Parkway including parkway and median improvements.

c) Full width widening of Trabuco Road between Jeffrey Road and SR-133 including parkway and median improvements.

d) Full width improvements to Portola Parkway between Jeffrey Road and SR-241 including parkway and median improvements.

PROJECT LAND USE AND TRIP GENERATION

A land use and trip generation summary for the project is given in Table 2-1. The trip generation is based on the City of Irvine's adopted trip rates. The trip generation based on the model output is also given. The proposed project is assumed to be partially built by 2007 and built out by 2025. For 2007 conditions, 400 residential units in PA8A and 3,100 residential units and 150,000 square feet of retail uses in PA9 are assumed. Buildout of the project includes 1,900 residential units in PA5B, 4,500 residential units, 300,000 square feet of retail uses and 2,400,000 square feet of office and research and development (R&D) uses in PA6, 400 residential units in PA8A, and 5,550 residential units, 450,000 square feet of retail and 4,166,000 square feet of office and R&D uses in PA9 for a total development of 12,350 residential units, 750,000 square feet of retail uses, and 6,566,000 square feet of office and R&D uses. Detailed land use assumptions for the proposed project by traffic analysis zone are summarized in Appendix A. There are currently agricultural uses in some parts of the project area. It should be noted that retail (commercial) uses are assumed for the purpose of presenting a "worst case" analysis when the zoning designation is multi-use.

As can be seen from Table 2-1, the buildout of the proposed project generates approximately 254,900 average daily trips (ADT) with eight and nine percent occurring in the AM and PM peak hour, respectively. Approximately 18 percent of the buildout trip generation is assumed to occur by 2007. The City of Irvine's socioeconomic-based model shows that the project generates 200,200 ADT under

Table 2-1

PROPOSED PROJECT LAND USE AND TRIP GENERATION SUMMARY

LAND USE TYPE	UNITS		AM PEAK HOUR IN	AM PEAK HOUR OUT	AM PEAK HOUR TOTAL	PM PEAK HOUR IN	PM PEAK HOUR OUT	PM PEAK HOUR TOTAL	ADT
PROPOSED PROJECT - 2007									
101 Single Family Detached	1,343.00	DU	255	739	994	886	470	1,356	12,826
102 Cluster A	882.00	DU	114	450	564	494	212	706	7,056
103 Cluster B	1,275.00	DU	115	536	651	536	255	791	8,250
109 Commercial (EQ)	135.50	TSF	234	216	450	401	417	818	10,493
113 Restaurant	6.50	TSF	51	51	102	57	49	106	1,008
114 Fast Food Restaurant	7.00	TSF	198	191	389	133	123	256	4,425
116 Gas Station	1.00	SITE	44	44	88	61	61	122	1,012
136 Elementary, Middle	900.00	STU	162	108	270	18	45	63	981
TOTAL (using vehicle trip rates below)			1,173	2,335	3,508	2,586	1,632	4,218	46,051
TOTAL (model-based)			714	1,894	2,608	1,672	1,118	2,790	31,922
PROPOSED PROJECT - Buildout (Post-2020 and 2025)									
101 Single Family Detached	6155.00	DU	1,170	3,387	4,557	4,061	2,156	6,217	58,782
102 Cluster A	4070.00	DU	530	2,077	2,607	2,280	976	3,256	32,560
103 Cluster B	2125.00	DU	191	894	1,085	894	425	1,319	13,750
109 Commercial (EQ)	672.25	TSF	935	863	1,798	1,597	1,662	3,259	41,798
113 Restaurant	32.50	TSF	255	255	510	285	244	529	5,039
114 Fast Food Restaurant	40.25	TSF	1,141	1,096	2,237	766	705	1,471	25,443
116 Gas Station	5.00	SITE	220	220	440	305	305	610	5,060
121 Office (EQ)	2298.10	TSF	1,729	517	2,246	494	1,651	2,145	24,664
(Equation base = 300.00 TSF)									
125 R&D	4267.90	TSF	3,629	767	4,396	682	3,843	4,525	42,508
136 Elementary, Middle	4600.00	STU	828	552	1,380	92	230	322	5,014
139 Park	51.00	ACRE	4	6	10	12	8	20	255
TOTAL (using vehicle trip rates below)			10,632	10,634	21,266	11,468	12,205	23,673	254,873
TOTAL (model-based)			7,542	8,526	16,068	8,998	8,653	17,651	200,265
VEHICLE TRIP RATES									
101 Single Family Detached		DU	.19	.55	.74	.66	.35	1.01	9.55
102 Cluster A		DU	.13	.51	.64	.56	.24	.80	8.00
103 Cluster B		DU	.09	.42	.51	.42	.20	.62	6.47
113 Restaurant		TSF	7.85	7.85	15.70	8.78	7.48	16.26	155.00
114 Fast Food Restaurant		TSF	28.34	27.22	55.56	19.00	17.53	36.53	632.12
116 Gas Station		SITE	43.50	43.50	87.00	61.00	61.00	122.00	1,012.00
125 Research and Development		TSF	.85	.18	1.03	.16	.90	1.06	9.96
136 Elementary, Middle		STU	.18	.12	.30	.02	.05	.07	1.09
139 Park		ACRE	0.08	0.12	0.20	0.24	0.16	0.40	5.00

VEHICLE TRIP EQUATION RATES

	UNITS	Coefficients A	Coefficients B	AM PEAK HOUR PK/ADT RATIO	AM PEAK HOUR IN	AM PEAK HOUR OUT	PM PEAK HOUR PK/ADT RATIO	PM PEAK HOUR IN	PM PEAK HOUR OUT
Commercial EQ	TSF	.625	5.985	.043	52%	48%	.078	49%	51%
Office (EQ)	TSF	.756	3.765	.091	77%	23%	.087	23%	77%

(EQ) Equation - based trip rate with equation form: LN(T) = A x LN (X) + B where X = Land Use Amount and T = Daily Trips project buildout conditions. It should be noted that socioeconomic data is used for areawide analyses while City of Irvine adopted land use trip rates are used for site specific analyses.

The project also includes the transfer of General Plan residential units from other planning areas as follows:

NCCP Bank	3,888
Planning Area 2	1,220
Planning Area 5A	955
Planning Area 8	804
Planning Area 11	1,825
Planning Area 12	858
Planning Area 15	2,537
TOTAL	12,087

However, in order to identify the impacts exclusively due to the development of the Northern Sphere Area, the transfer of residential units from these planning areas are included in both the no-project and with-project conditions. In addition, no land uses other than those existing are assumed in Planning Areas 5B, 8A, 6 and 9 for no-project conditions in order to identify the impacts of the development in the Northern Sphere Area.

PROJECT TRIP DISTRIBUTION

The 2007, 2025 (constrained and buildout toll networks) and Post-2040 toll-free trip distributions for the project are shown in Figures 2-5 through 2-8. These trip distributions were derived from the ITAM and are based on ADT volumes. Differences in surrounding land uses together with the different regional accessibility afforded by changes in regional transportation facilities (such as toll versus toll-free), cause slight differences in the project distribution for each time frame. These percentages differ slightly in the peak hours, and the traffic model uses the individual peak distributions to assign peak hour trips. According to ITAM, the internal capture of project generated traffic is approximately three percent for 2007 conditions in which the project is assumed partially built and approximately 11 percent for 2025 (constrained and buildout toll conditions) and Post-2040 (toll-free conditions) in which the project is assumed built out.

Chapter 3.0
TRANSPORTATION SETTING

This chapter describes the transportation setting for the proposed project. Existing conditions are described, followed by discussions of the 2007, 2025 toll constrained, 2025 toll buildout and Post-2040 toll-free buildout circulation system assumptions.

EXISTING CONDITIONS

The existing arterial highway system in the study area is illustrated in Figure 3-1. Shown here are the current midblock lanes. Planned improvements anticipated occurring in the 2007, 2025 and Post-2040 as depicted in the Cities of Tustin, Orange and Lake Forest General Plan Circulation Elements, City of Irvine's Master Plan of Arterial Highways (MPAH), and the County of Orange MPAH in unincorporated county areas are discussed in later sections.

Current average daily traffic (ADT) volumes and volume/capacity (V/C) ratios are illustrated in Figure 3-2. The arterial volumes are traffic counts carried out in late 2000, early 2001. The volumes on the I-5, I-405, SR-133, SR-241 and SR-261 are from 2000 counts provided by Caltrans and the Transportation Corridor Agencies (see Reference 11 in Chapter 1.0).

The V/C ratios given here for the existing arterial system are based on the ADT capacity values listed under the performance criteria in the first chapter. According to the criteria outlined in Chapter 1.0, all arterials in the study area, are operating at an acceptable level of service, with exception of the following seven roadway link locations:

Roadway Segment	Lanes	ADT	Capacity	V/C	LOS
Jamboree Road south of I-5	6	60,000	54,000	1.11	F
Bake Parkway between I-5 and Rockfield Boulevard	8	69,000	72,000	.96	E
Bake Parkway between Muirlands Boulevard and Jeronimo Road	6	56,000	54,000	1.04	F
Bake Parkway between Jeronimo Road and Toledo Way	6	49,000	54,000	.91	E
Bake Parkway between Irvine Bl/Trabuco Road to Commercentre Dr	4	39,000	37,500	1.04	F
Bake Parkway north of Commercentre Drive	4	34,000	37,500	.91	E
Laguna Canyon south of Old Laguna Canyon Road	3	29,000	24,000	1.21	F

fig. 3-1

fig. 3-2

Peak hour intersection turn movement counts were assembled for the intersection locations shown in Figure 3-3. Intersection capacity utilization (ICU) values for these counts are summarized in Appendix C. For actual turn movement volumes and lane configurations assumed at each intersection see Appendix C. It should be noted that use of the ICU methodology is consistent with City of Irvine guidelines for impact analyses, and by practice the ICU methodology assumes that intersections are signalized. According to the criteria outlined in Chapter 1.0, all locations with exception of seven intersections in the study area are operating at or below the target LOS. These intersections are:

Intersection	Peak Hour	ICU	LOS
Jamboree Road at Barranca Parkway	AM	1.09	F
Culver Drive at Trabuco Road	PM	.96	E
Culver Drive at University Drive	PM	.91	E
Jeffrey Road at Alton Parkway	AM	1.06	F
Laguna Canyon Road at Old Laguna Canyon Road	AM	1.36	F
	PM	1.03	F
Bake Parkway at Jeronimo Rd	AM	.92	E
Lake Forest Drive at Portola Parkway	AM	.94	E

It should be noted that the existing ADT roadway link and peak hour intersection turn movement volumes presented in this report are more recent and may differ from those in the model description report (Reference 3 in Chapter 1.0) because City of Irvine traffic study guidelines require counts to be no later than one year old from the date of project application. The existing traffic count data are on file and available for review at City of Irvine Public Works Department.

Freeway/Tollway Mainline and Ramp Analysis

Analysis of the existing freeway/tollway mainline segments (see Figure 3-2 for V/C ratios) reveals that the following seven locations are operating at unacceptable levels of service according to the criteria outlined in Chapter 1.0:

Freeway Segment	Lanes	ADT	Capacity	V/C	LOS
I-5 between Tustin Ranch Road and Jamboree Road	12	275,000	252,000	1.09	F
I-5 between Jamboree Road and Culver Drive	12	271,000	252,000	1.08	F
I-5 between Culver Drive and Jeffrey Road	12	257,000	252,000	1.02	F
I-5 between Jeffrey Road and Sand Canyon Avenue	12	255,000	252,000	1.01	F
I-5 between Bake Parkway and Lake Forest Drive	14	340,000	294,000	1.16	F
I-405 between Jeffrey Road and Sand Canyon Avenue	10	237,000	210,000	1.13	F
I-405 between Sand Canyon Avenue and SR-133	10	231,000	210,000	1.10	F

fig. 3-3

This section presents information for the potential deficiencies at on- and off-ramps within the study area. The freeway ramp analysis presented here differs from the previous peak hour analysis which included ramp intersections with arterial streets. The analysis here involves the peak hour V/C of the ramp itself as a means to assess any deficiency whereas the previous analysis attributed deficiency by reviewing the ICU value of the ramp intersection with the arterial street. Analysis of the freeway ramps reveals that one location is operating at an unacceptable level of service during PM peak hour conditions (see Appendix D for the detailed ramp analysis and Figure 3-4 for ramps analyzed). This location is the I-5 southbound off-ramp to Culver Drive (V/C = 1.72).

2007 CIRCULATION SYSTEM

Over the next five to seven years, improvements are planned for the circulation system within or near the study area. This year 2007 circulation system assumes only those improvements which exist or are committed for construction (i.e., public agency Capital Improvement Programs, state transportation improvement program, etc.) or would be constructed as part of previously entitled development by this time frame. Figure 3-5 shows the midblock lanes for the 2007 circulation system. At the regional level, the SR-133 (north of I-5), SR-241 and SR-261 are toll facilities. (See Reference 3 in Chapter 1.0 for a list of 2007 circulation system assumptions.)

2025 (CONSTRAINED) CIRCULATION SYSTEM

Figure 3-6 presents the year 2025 "constrained" conditions. This year 2025 circulation system assumes only those improvements which exist or are committed for construction (i.e., public agency Capital Improvement Programs, state transportation improvement program, etc.) or would be constructed as part of previously entitled development by this time frame. Toll conditions are assumed on the SR-133 (north of I-5), SR-241 and SR-261. (See Reference 3 in Chapter 1.0 for a list of 2025 (constrained toll network) circulation system assumptions.)

fig. 3-4

fig. 3-5

fig. 3-6

BUILDOUT (2025 AND POST-2040) CIRCULATION SYSTEM

For the 2025 buildout scenario and Post-2040 circulation system conditions, full buildout of the Cities of Tustin, Orange, Lake Forest General Plan Circulation Elements and City of Irvine and County of Orange Master Plan of Arterial Highways (MPAH) are assumed. This buildout roadway network is illustrated in Figure 3-7, and the facility type designations are shown in Figure 3-8. These facility types are based on the Cities of Tustin, Orange, Lake Forest General Plan Circulation Elements and City of Irvine MPAH and correspond to the County MPAH. At the regional level, the SR-133 (north of I-5), SR-241 and SR-261 are assumed free facilities under Post-2040 conditions and a toll facility under year 2025 conditions. (See Reference 3 in Chapter 1.0 for a list of 2025 (buildout toll network) and Post-2040 (toll-free network) circulation system assumptions.)

Chapter 4.0
2007 ANALYSIS

This chapter describes traffic conditions for a short-term year 2007 time frame. Traffic volumes and capacity evaluation results for the 2007 circulation system under partial project buildout conditions are presented and with and without project conditions are summarized to identify project mitigation requirements.

2007 TRAFFIC IMPACTS

Figures 4-1 and 4-2 show the 2007 average daily traffic (ADT) forecasts and volume/capacity (V/C) ratios for the study area circulation system based on no-project and proposed project land uses. The with-project volumes are based on the partial project buildout trip generation estimates presented in Chapter 2.0. The no-project volumes assume no other land uses except those existing uses such as agricultural on the project site.

According to the performance criteria outlined in Chapter 1.0 and the volumes and V/C ratios shown here, the project potentially impacts four roadway locations as summarized below.

	2007 No-Project		2007 With-Project	
Roadway Segment	**ADT V/C**	**ADT LOS**	**ADT V/C**	**ADT LOS**
Jeffrey north of Alton	.87	D	.91	E
Jeffrey south of Alton	.89	D	.91	E
Sand Cyn north of I-5 NB Ramps	.89	D	.98	E
Sand Cyn south of I-5 SB Ramps	1.41	F	1.47	F

The City of Irvine's Link Capacity Analysis guidelines require that these locations be further examined using peak hour data. The results of the peak hour tests are summarized in the following table. As can be seen in this table, these locations do not require roadway midblock mitigation under the ADT link volume impact criteria. It should be noted that the peak hour link V/C ratios are based on the highest upstream/downstream peak hour volume data obtained from the intersections comprising that link.

Fig 4-1

fig. 4-2

Roadway Segment	Lanes	ADT	Peak Hour Capacity	Highest Peak Volume	V/C	LOS
Jeffrey north of Alton	6	49,000	4,800	2,020 (PM Northbound)	.42	A
Jeffrey south of Alton	6	49,000	4,800	2,658 (PM Northbound)	.55	A
Sand Cyn north of I-5 NB Ramps	6	53,000	4,800	2,490 (PM Southbound)	.52	A
Sand Cyn south of I-5 SB Ramps	4	47,000	3,200	1,725 (AM Southbound)	.54	A

Figure 4-3 shows the intersections studied here, and Appendix C lists the peak hour intersection capacity utilization (ICU) values for each location without and with the project. For actual turn movement volumes and lane configurations assumed at each intersection see Appendix C. As can be seen in the following table, three locations are adversely impacted by the project.

Intersection	Peak Hour	2007 No-Project		2007 With-Project	
		ICU	LOS	ICU	LOS
127. Jamboree Rd. at El Camino Real	PM	.94	E	.96	E
133. Jamboree Rd. at Edinger Av.	AM	1.03	F	1.05	F
485. Sand Cyn Av. at Road "B"	PM	1.19	F	1.21	F

Mitigation for these intersections are presented in a later section of this chapter.

Freeway/Tollway Mainline and Ramp Analysis

According to the freeway/tollway mainline analysis (see Figure 4-2 for V/C ratios) and performance criteria outlined in Chapter 1.0, there are no freeway/tollway mainline segments impacted by the project.

This section presents information for potential impacts at on- and off-ramps within the study area. The freeway ramp analysis presented here differs from the previous peak hour analysis which included ramp intersections with arterial streets. The analysis here involves the peak hour V/C of the ramp itself as a means to assess any project impact whereas the previous analysis assessed project impact using the ICU value of the entire ramp intersection with the arterial street. Analysis of the freeway ramps reveals two locations (see Appendix D for the detailed ramp analysis and Figure 4-4 for ramps analyzed) are impacted by the project: 1) I-5 southbound off-ramp to Culver Drive in both the

fig. 4-3

fig. 4-4

AM and PM peak hour (V/C = 1.07 and 1.80, respectively) and 2) I-405 southbound off-ramp to Irvine Center Drive in the AM peak hour (V/C = 1.04).

While potential impacts to the freeway/tollway mainline segments and ramps have been evaluated, this analysis assumes that implementation of freeway and ramp improvements, except for ramp intersections with arterial streets, will be the responsibility of the existing regional transportation agencies. A number of programs are in place in Orange County to improve and upgrade the regional transportation system. These include the Transportation Corridor Agencies (TCA) Corridor program, the State Transportation Improvement Program (STIP), Caltrans Traffic Operations Strategies (TOPS), and the Orange County Transportation Authority (OCTA) Measure M program.

The TCA has adopted a Major Thoroughfare and Bridge Fee Program in which new development is required to pay a Corridor Fee at issuance of building permits. The purpose of the fee program is to assure that new development pays its fair share cost towards construction of the ultimate Corridor improvements. The Corridor Fee revenue can be used to construct additional improvements to the existing transportation corridor system. Based on current fee rates, the Protocol development would contribute approximately $75,000,000 in new Corridor fees. In addition, project traffic would increase the amount of toll revenue that the TCA obtains from operation of the Corridors. It has been assumed that the impacts identified at the SR-133/Trabuco Road can be funded through this program.

The STIP is a four-year expenditure plan that defines how state transportation funds will be allocated. The source of these funds is primarily from state and federal gas taxes. The STIP funds are used for different projects ranging from road maintenance to new freeway construction. Each County is guaranteed a minimum amount of STIP funds.

TOPS is a program recently implemented by Caltrans to maximize utilization of the existing freeway and tollway system through performance-based investment strategies. The Caltrans' April 2000 TOPS report defines three different phases or levels of strategy within the TOPS program. Level 1 includes implementation of "intelligent infrastructure" improvements such as system-wide adaptive ramp metering, advanced traveler information systems and real-time performance measurement systems. Level 1 also includes the implementation of physical operational improvements such as the construction of freeway auxiliary lanes (merge lanes provided before and after on-ramps), the modification of ramp/city street access and the addition of short passing lanes and truck climbing lanes.

Orange County has supplemented their transportation programs by implementing a county sales tax for transportation improvements through the Measure M program. Funds from this program are available for improvements to regional interchanges and arterial highways. The ramps on the I-5 and I-405 identified as impacted would be eligible for improvement funding through the Measure M program.

It has been assumed in the traffic analysis that the cumulative impact of project traffic along with other regional growth at the identified impacted ramp locations will be mitigated through a combination of the above discussed programs. For example, Caltrans is currently preparing a Project Study Report for the widening of the I-5 southbound off-ramp at Culver Drive to two lanes. If implemented, the improvement will address the project deficiency at this location.

2007 MITIGATION MEASURES

The recommended mitigation measures and resulting ICUs proposed for the three deficient intersections are summarized in Table 4-1. It should be noted that the mitigation measures identified here would be studied further by each Master Tentative Map (or equivalent) traffic analysis. The timing and need for these improvements would be based on an updated traffic study to maintain satisfactory levels of service. The mitigation measures presented here are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts.

It has been assumed in the traffic analysis that the cumulative impact of project traffic along with other regional growth at the identified impacted ramp locations will be mitigated through a combination of programs implemented by existing regional transportation agencies. Caltrans is the lead agency for planning and implementing improvements to the freeway system and the toll roads.

Table 4-1

SUMMARY OF MITIGATION LANES FOR IMPACTED INTERSECTIONS
& MITIGATION RESULTS (2007)

LOCATION		SB L	SB T	SB R	WB L	WB T	WB R	NB L	NB T	NB R	EB L	EB T	EB R
127. Jamboree at El Camino Real	Base	1	4	d	2	2	0	2	4	1	1	1	2
	Mit.	ATMS (City of Tustin)			(mit. not needed at 25B or BO)								
133. Jamboree at Edinger	Base	2	0	1	2	3	1	2	0	f	2	3	1
	Mit.	ATMS (City of Tustin)			(mit. not needed at 25C,25B or BO)								
485. Sand Cyn at Road "B"	Base	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d	2		d	2					1

Abbreviations (in alphabetical order):

25B	2025 Buildout Toll Conditions
ATMS	Advanced Transportation Management System - The use of ATMS as a mitigation measure is discretionary and subject to subsequent review and approval by the Director of Public Works. The ATMS program involves a variety of actions such as camera surveillance and centralized system control, and is part of traffic signal system improvements planned for implementation over time.
Base	2007 conditions without mitigation
BO	Post-2040 Buildout Toll-Free Conditions
d	de facto right-turn f free right-turn L,T,R left, through, right
Mit.	Mitigation
SB,WB,NB,EB	southbound, westbound, northbound, eastbound

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
127. Jamboree Rd at El Camino Real	.65	.94	.66	.96	.01	.02	-	c	.61	.91	-	mp
133. Jamboree Rd at Edinger Av	1.03	.64	1.05	.65	.02	.01	c	-	1.00	.60	ma	-
485. Sand Cyn Av at Road "B"	.81	1.19	.82	1.21	.01	.02	-	c	.56	.84	-	ma

p - Project causes deficiency
c - Project contributes to deficiency
ma - Mitigated to an adequate level of service
mp - Project portion of impact mitigated, LOS remains less than adequate

Level of service ranges: A=.00 - .60 B=.61 - .70 C=.71 - .80 D=.81 - .90 E=.91 - 1.00 F=Above 1.00

Caltrans monitors growth and land use changes throughout its service districts and in association with local planning agencies, is responsible for developing improvement plans as required to address the future needs of the State. Typically improvements to the freeways, toll roads, and on- and off-ramps are made to address both operational and capacity concerns. Capacity enhancements to these regional facilities can be achieved through a number of measures, which Caltrans studies and evaluates before programming them for implementation. Potential capacity enhancements could include, demand management through regulation and metering of traffic utilizing the freeway interchanges and ramps, selective time responsive ramp metering activation or termination, alternative lane deployment such as converting general purpose lanes to High Occupancy Lanes (HOV) or allowing the use of HOV lanes for general purpose traffic, implementation of auxiliary lanes in selected segments or within certain corridors, selective ramp and freeway shoulder use management, traffic advisory and intelligent transportation system measures, additional ramp entry and exit lanes, and facility widening are some of the measures typically utilized by Caltrans.

Caltrans evaluates and prioritizes these improvements on the basis of system needs, benefits, and their impacts in the region. In cooperation with local agencies, Caltrans funds and constructs the most feasible improvements in an expeditious manner to address traffic demands on the freeways and tollways. Through this process Caltrans can address the type and timing of improvements to accommodate the future expected growth and demand in the region.

2007 CONCLUSIONS

With implementation of the required mitigation measures by the project, the planned local arterial highway circulation system analyzed for 2007 has adequate capacity to accommodate the proposed project land uses or those locations on the circulation system adversely impacted by the project have been mitigated to maintain the same levels of service under no-project conditions. The mitigation measures presented in this traffic study are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts.

Chapter 5.0
2025 ANALYSIS

This chapter describes traffic conditions for buildout of the project and surrounding land uses in a 2025 time frame with toll conditions on the SR-133 (north of I-5), SR-241 and SR-261. Traffic volumes and capacity evaluation results for two separate 2025 circulation system conditions under project buildout conditions are presented and with and without project conditions for the two circulation system assumptions are summarized to identify project mitigation requirements. The two 2025 model networks developed are as follows: 1) a circulation system which assumes only those improvements which exist or are committed for construction or would be constructed as part of previously entitled development by this time frame (referred to as "constrained"); and 2) buildout of the circulation system in accordance with the City of Irvine's General Plan and County of Orange Master Plan of Arterial Highways (MPAH) (referred to as "2025 buildout").

2025 (CONSTRAINED TOLL NETWORK) TRAFFIC IMPACTS

Figures 5-1 and 5-2 show the 2025 average daily traffic (ADT) forecasts and volume/capacity (V/C) ratios for the study area circulation system based on no-project and proposed project land uses under the constrained network. The with-project volumes are based on the project trip generation estimates presented in Chapter 2.0. The no-project volumes assume no other land uses except those existing uses such as agricultural on the project site.

According to the performance criteria outlined in Chapter 1.0 and the volumes and V/C ratios shown here, the project potentially impacts 39 roadway link locations as summarized in Table 5-1. The City of Irvine's Link Capacity Analysis guidelines require that these locations be further examined using peak hour data. The results of the peak hour tests are summarized in Table 5-2. As can be seen in this table, there are no link locations requiring roadway midblock mitigation under the ADT link volume impact criteria. It should be noted that the peak hour link V/C ratios are based on the highest upstream/downstream peak hour volume data obtained from the intersections comprising that link.

Fig. 5-1

fig. 5-2

Table 5-1

ADT ROADWAY LINK DEFICIENCY ANALYSIS
(2025 Constrained Toll Network)

Roadway Segment	No-Project V/C	No-Project LOS	With-Project V/C	With-Project LOS
Alton w/o Jeffrey	1.16	F	1.22	F
Alton s/o Commercentre	1.28	F	1.30	F
Bake n/o Commercentre	1.09	F	1.12	F
Bake n/o Trabuco	1.36	F	1.39	F
Bake n/o Toledo	.94	E	.96	E
Barranca w/o Jeffrey	1.03	F	1.09	F
Culver s/o I-5 SB Ramps	.96	E	1.00	E
El Camino Real e/o Jamboree	.94	E	.97	E
Irvine e/o Yale	.75	C	1.03	F
Irvine w/o Jeffrey	.83	D	1.05	F
Irvine w/o Research	.78	C	.94	E
Irvine e/o Research	.78	C	.91	E
Irvine e/o Alton	.94	E	1.04	F
Jamboree n/o I-5 NB Ramps	.93	E	.95	E
Jeffrey n/o I-5 NB Ramps	.81	D	1.06	F
Jeffrey s/o Walnut	.85	D	1.00	E
Jeffrey n/o Barranca	.87	D	1.00	E
Jeffrey n/o Alton	.93	E	1.02	F
Jeffrey s/o Alton	1.00	E	1.07	F
Millennium n/o Barranca	1.06	F	1.13	F
Millennium s/o Alton	.89	D	.94	E
Portola w/o Culver	.85	D	.94	E
Portola e/o Sand Canyon	.47	A	.97	E
Portola w/o Research	.47	A	1.00	E
Portola e/o Millennium	.38	A	.97	E
Rancho w/o Bake	.88	D	.91	E
Rockfield e/o Bake	.97	E	1.00	E
Sand Canyon n/o Irvine	.34	A	1.13	F
Sand Canyon s/o Trabuco	.70	B	1.20	F
Sand Canyon s/o Roosevelt	.80	C	1.13	F
Sand Canyon n/o I-5 NB Ramps	.98	E	1.30	F
Sand Canyon s/o I-5 SB Ramps	1.06	F	1.20	F
Trabuco e/o Jeffrey	.81	D	.91	E
Trabuco e/o Rd "A"	.78	C	.91	E
Trabuco w/o Sand Canyon	.81	D	.91	E
Trabuco e/o Sand Canyon	.81	D	.91	E
Trabuco w/o Research	1.28	F	1.33	F
Trabuco e/o Research	1.02	F	1.06	F
Walnut w/o Culver	.88	D	.91	E

Table 5-2

PEAK HOUR LINK CAPACITY ANALYSIS
(2025 Constrained Toll Network)

Roadway Segment	Lanes	ADT	Peak Hour Capacity	Highest Peak Volume	V/C	LOS
Alton w/o Jeffrey	4	39,000	3,200	2,350 (PM Westbound)	.73	C
Alton s/o Commercentre	6	70,000	4,800	3,220 (AM Northbound)	.67	B
Bake n/o Commercentre	4	42,000	3,200	2,130 (AM Southbound)	.67	B
Bake n/o Trabuco	4	52,000	3,200	2,342 (PM Northbound)	.73	C
Bake n/o Toledo	6	52,000	4,800	2,350 (AM Southbound)	.49	A
Barranca w/o Jeffrey	4	35,000	3,200	1,964 (AM Eastbound)	.61	B
Culver s/o I-5 SB Ramps	6	54,000	4,800	2,904 (PM Northbound)	.61	B
El Camino Real e/o Jamboree	4	31,000	3,200	2,237 (PM Eastbound)	.70	B
Irvine e/o Yale	5	41,000	3,200	2,369 (AM Eastbound)	.74	C
Irvine w/o Jeffrey	5	42,000	3,200	2,369 (AM Eastbound)	.74	C
Irvine w/o Research	6	51,000	4,800	4,039 (AM Eastbound)	.84	D
Irvine e/o Research	6	49,000	4,800	2,970 (AM Eastbound)	.62	B
Irvine e/o Alton	6	56,000	4,800	3,190 (AM Westbound)	.66	B
Jamboree n/o I-5 NB Ramps	8	71,000	6,400	4,180 (PM Northbound)	.65	B
Jeffrey n/o I-5 NB Ramps	7	67,000	4,800	3,190 (PM Northbound)	.66	B
Jeffrey s/o Walnut	6	54,000	4,800	2,927 (AM Southbound)	.61	B
Jeffrey n/o Barranca	6	54,000	4,800	2,517 (PM Northbound)	.52	A
Jeffrey n/o Alton	6	55,000	4,800	2,301 (PM Northbound)	.48	A
Jeffrey s/o Alton	6	58,000	4,800	3,076 (PM Northbound)	.64	B
Millennium n/o Barranca	6	61,000	4,800	2,930 (PM Southbound)	.61	B
Millennium s/o Alton	6	51,000	4,800	2,793 (PM Southbound)	.58	A
Portola w/o Culver	6	51,000	4,800	2,660 (AM Eastbound)	.55	A
Portola e/o Sand Canyon	4	31,000	3,200	1,708 (PM Eastbound)	.53	A
Portola w/o Research	4	32,000	3,200	1,708 (PM Eastbound)	.53	A
Portola e/o Millennium	4	31,000	3,200	1,880 (PM Northbound)	.59	A
Rancho w/o Bake	4	34,000	3,200	1,530 (AM Westbound)	.48	A
Rockfield e/o Bake	4	32,000	3,200	1,635 (PM Eastbound)	.51	A
Sand Canyon n/o Irvine	4	36,000	3,200	1,661 (PM Northbound)	.52	A
Sand Canyon s/o Trabuco	6	65,000	4,800	3,079 (AM Southbound)	.64	B
Sand Canyon s/o Roosevelt	6	61,000	4,800	2,560 (PM Northbound)	.53	A
Sand Canyon n/o I-5 NB Ramps	6	70,000	4,800	3,008 (PM Southbound)	.63	B
Sand Canyon s/o I-5 SB Ramps	6	65,000	4,800	2,751 (AM Southbound)	.57	A
Trabuco e/o Jeffrey	4	29,000	3,200	2,167 (AM Eastbound)	.68	B
Trabuco e/o Rd "A"	4	29,000	3,200	1,708 (AM Eastbound)	.53	A
Trabuco w/o Sand Canyon	4	29,000	3,200	1,840 (PM Westbound)	.58	A
Trabuco e/o Sand Canyon	6	49,000	4,800	2,481 (PM Eastbound)	.52	A
Trabuco w/o Research	6	72,000	4,800	4,180 (AM Eastbound)	.87	D
Trabuco e/o Research	6	57,000	4,800	3,131 (AM Eastbound)	.65	B
Walnut w/o Culver	4	29,000	3,200	1,541 (AM Eastbound)	.48	A

Figure 5-3 shows the intersections studied here, and Appendix C lists the peak hour intersection capacity utilization (ICU) values for each location without and with the project. For actual turn movement volumes and lane configurations assumed at each intersection see Appendix C. As can be seen in Table 5-3, 31 locations are adversely impacted by the project. Mitigation for the 31 deficient intersections are presented in a later section of this chapter.

Freeway/Tollway Mainline and Ramp Analysis

According to the freeway/tollway mainline analysis (see Figure 5-2 for V/C ratios) and performance criteria outlined in Chapter 1.0, there are no freeway/tollway mainline segments impacted by the project.

This section presents information for potential impacts at on- and off-ramps within the study area. The freeway ramp analysis presented here differs from the previous peak hour analysis which included ramp intersections with arterial streets. The analysis here involves the peak hour V/C of the ramp itself as a means to assess any project impact whereas the previous analysis assessed project impact using the ICU value of the entire ramp intersection with the arterial street. Analysis of the freeway ramps reveals that the following seven ramp locations (see Appendix D for the detailed ramp analysis and Figure 5-4 for ramps analyzed) are impacted by the project.

Ramp Location	Peak Hour	No-Project V/C	No-Project LOS	With-Project V/C	With-Project LOS
I-5 southbound on-ramp at Jeffrey Road	AM	.99	E	1.05	F
I-5 northbound on-ramp at Sand Canyon Avenue	PM	1.72	F	1.80	F
I-5 southbound off-ramp at Sand Canyon Avenue	AM	1.46	F	1.64	F
I-5 southbound off-ramp at Alton Parkway	AM	1.20	F	1.27	F
I-405 northbound direct on-ramp at Sand Canyon Avenue	PM	1.32	F	1.40	F
I-405 southbound off-ramp at Sand Canyon Avenue	AM	1.18	F	1.27	F
SR-133 northbound off-ramp at Trabuco Road	AM	1.14	F	1.30	F

While potential impacts to the freeway/tollway mainline segments and ramps have been evaluated, this analysis assumes that implementation of freeway and ramp improvements, except for ramp intersections with arterial streets, will be the responsibility of the existing regional transportation agencies. A number of programs are in place in Orange County to improve and upgrade the regionaltransportation system. These include the Transportation Corridor Agencies (TCA) Corridor fig 5-3

Table 5-3

SUMMARY OF DEFICIENT INTERSECTIONS
(2025 Constrained Toll Network)

Intersection	Peak Hour	No-Project ICU	No-Project LOS	With-Project ICU	With-Project LOS
34. Red Hill Av. at Irvine Bl.	AM	.94	E	.97	E
91. Tustin Ranch Rd. at Irvine Bl.	AM	1.14	F	1.18	F
	PM	1.09	F	1.11	F
127. Jamboree Rd. at El Camino Real	PM	.92	E	.95	E
223. Culver Dr. at I-5 SB Ramps	PM	.93	E	1.02	F
224. Culver Dr. at Walnut Av.	AM	.90	D	.93	E
	PM	.87	D	.91	E
235. Culver Dr. at University Dr.*	AM	.89	D	.92	E
	PM	.94	E	.96	E
249. Yale Av. at Irvine Bl.	AM	.90	D	.99	E
282. Jeffrey Rd. at Portola Pkwy.	AM	.76	C	.95	E
283. Jeffrey Rd. at Irvine Bl.	AM	.77	C	.99	E
284. Jeffrey Rd. at Bryan Av.	AM	.92	E	.99	E
285. Jeffrey Rd. at Trabuco Rd.	AM	.89	.D	96	E
	PM	.78	C	1.02	F
286. Jeffrey Rd. at Roosevelt	PM	.84	D	.91	E
289. Jeffrey Rd. at ICD	PM	1.00	E	1.08	F
301. Sand Cyn Av. at Irvine Bl.	AM	.67	B	.96	E
302. Sand Cyn Av. at Trabuco Rd.	AM	1.00	E	1.08	F
	PM	1.00	E	1.12	F
303. Sand Cyn Av. at I-5 NB Ramps	AM	.71	C	.92	E
	PM	.81	D	1.00	E
304. Sand Cyn Av. at Marine Way.	AM	.94	E	1.00	E
	PM	1.21	F	1.32	F
305. Sand Cyn Av. at I-5 SB Ramps	AM	1.08	F	1.26	F
	PM	.97	E	1.10	F
311. Sand Cyn Av. at I-405 NB Ramps	AM	.91	E	.95	E
317. SR-133 NB Ramps at Irvine Bl.	AM	.84	D	.91	E
362. Bake Pkwy. at Irvine Bl.	AM	1.24	F	1.27	F
364. Bake Pkwy. at Jeronimo Rd.	PM	.90	D	.91	E
366. Bake Pkwy. at Rockfield Bl.	AM	.89	D	.91	E
367. Bake Pkwy. at I-5 NB Ramps	AM	1.01	F	1.03	F
368. Bake Pkwy. at I-5 SB Ramps	PM	.92	E	.94	E
484. Sand Cyn Av. at Roosevelt	PM	.81	D	1.01	F
485. Sand Cyn Av at Road “B”	AM	.85	D	.95	E
	PM	1.14	F	1.24	F
490. Research Dr. at Trabuco Rd.	PM	.90	D	.91	E
507. Bake Pkwy. at Millennium	AM	.95	E	.99	E
	PM	.98	E	1.02	F
512. Irvine Bl. at Trabuco Rd.	AM	.87	D	.92	E
515a. Bake Pkwy. at Rancho Pkwy. N.	AM	.98	E	1.00	E

* ATMS credit of .05 reflected.

program, the State Transportation Improvement Program (STIP), Caltrans Traffic Operations Strategies (TOPS), and the Orange County Transportation Authority (OCTA) Measure M program. Each of these programs is discussed in more detail in Chapter 4.0. It has been assumed in the traffic analysis that the cumulative impact of project traffic along with other regional growth at the identified impacted ramp locations will be mitigated through a combination of these programs.

2025 (CONSTRAINED TOLL NETWORK) MITIGATION MEASURES

The recommended mitigation measures and resulting ICUs proposed for the 31 deficient intersections are summarized in Tables 5-4 and 5-5. It should be noted that the mitigation measures identified here would be studied further by each Master Tentative Map (or equivalent) traffic analysis. The timing and need for these improvements would be based on an updated traffic study to maintain satisfactory levels of service. The mitigation measures presented here are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts.

It has been assumed in the traffic analysis that the cumulative impact of project traffic along with other regional growth at the identified impacted ramp locations will be mitigated through a combination of programs implemented by existing regional transportation agencies. Caltrans is the lead agency for planning and implementing improvements to the freeway system and the toll roads. Caltrans monitors growth and land use changes throughout its service districts and in association with local planning agencies, is responsible for developing improvement plans as required to address the future needs of the State. Typically improvements to the freeways, toll roads, and on- and off-ramps are made to address both operational and capacity concerns. Capacity enhancements to these regional facilities can be achieved through a number of measures, which Caltrans studies and evaluates before programming them for implementation. Potential capacity enhancements could include, demand management through regulation and metering of traffic utilizing the freeway interchanges and ramps, selective time responsive ramp metering activation or termination, alternative lane deployment such as converting general purpose lanes to High Occupancy Lanes (HOV) or allowing the use of HOV lanes for general purpose traffic, implementation of auxiliary lanes in selected segments or within

Table 5-4
MITIGATION LANES FOR IMPACTED INTERSECTIONS
(2025 Constrained Toll Network)

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
34. Red Hill at Irvine	Base	1	2	0	1	3	0	2	1	1	1	3	0
	Mit.						d						
	Alt. Mit.	ATMS (City of Tustin)											
91. Tustin Ranch at Irvine	Base	1	3	f	2	2	1	1	3	1	2	3	1
	Mit.							2					
	Alt. Mit.	ATMS (City of Tustin)											
127. Jamboree at El Camino Real	Base	1	4	d	2	2	0	2	4	1	1	1	2
	Mit.	ATMS (City of Tustin)					(mit. not needed at 25B or BO)						
223. Culver at I-5 SB Ramps	Base	0	3	f	0	0	0	0	3	f	1.5	0	1.5
	Mit.								4				
	Alt. Mit.										3		2
224. Culver at Walnut	Base	2	3	d	2	2	d	2	3	1	2	2	0
	Mit.					3							d
	Alt. Mit.	ATMS &											d
235. Culver at University	Base	1	3	0	2	3	d	1	3	d	2	3	0
	Mit.	(mit. not needed at 25B or BO)							2	2			
249. Yale at Irvine Bl	Base	1	2	d	1	3	d	1	2	d	1	3	d
	Mit.	2											
282. Jeffrey at Portola	Base	0	1	1	2	3	0	1	1	f	1	2	1
	Mit.	(mit. not needed at 25B or BO)										3	0
283. Jeffrey at Irvine	Base	2	3	1	2	2	1	2	3	1	1	2	1
	Mit.	(mit. not needed at 25B or BO)										3	
284. Jeffrey at Bryan	Base	1	3	1	1	1	0	2	3	d	1.5	.5	d
	Mit.										1		1.5
285. Jeffrey at Trabuco	Base	1	3	d	1	2	0	2	3	1	1	2	1
	Mit.	2	4		2		d				2		
286. Jeffrey at Roosevelt	Base	2	3	d	2	1	1	1	4	d	1	1	1
	Mit.					2	d					2	d
289. Jeffrey at ICD	Base	2	3	1	2	3	1	2	3	1	2	4	f
	Mit.	3							4				
	Alt. Mit.	3	& ATMS										
301. Sand Cyn at Irvine	Base	2	3	1	2	3	1	2	3	1	2	3	1
	Mit.											4	
302. Sand Cyn at Trabuco	Base	2	3	d	2	2	0	2	3	1	2	2	1
	Mit.				3	3						3	
303. Sand Cyn at I-5 NB Ramps	Base	1	2	1	1	1	0	2	2	0	1.5	.5	1
	Mit.			f					3				
304. Sand Cyn at Marine	Base	2	2	0	1	0	1	0	2	1	0	0	0
	Mit.								3				
305. Sand Cyn at I-5 SB Ramps	Base	2	2	0	0	0	0	0	2	d	1.5	0	1.5

Table 5-4 (cont.)
MITIGATION LANES FOR IMPACTED INTERSECTIONS
(2025 Constrained Toll Network)

LOCATION		— SB —			— WB —			— NB —			— EB —		
		L	T	R	L	T	R	L	T	R	L	T	R
311. Sand Cyn at I-405 NB Ramps	Base	0	2	f	.5	0	1.5	0	2	f	0	0	0
	Mit.				1		2						
317. SR-133 NB Ramps at Irvine	Base	0	0	0	0	3	0	1	0	2	0	3	f
	Mit.							1.5		2.5			
	Alt. Mit.	ATMS (mit. not needed at BO)											
362. Bake at Irvine	Base	2	3	1	2	3	1	1	3	1	2	3	1
	Mit.	(mit. not needed at 25B or BO)						2		d			
364. Bake at Jeronimo	Base	1	3	d	1	2	0	1	3	d	2	2	1
	Mit.*				2								
	Alt. Mit.	ATMS		(mit. or alt. mit.not needed at 25B or BO)									
366. Bake at Rockfield	Base	2	4	1	2	2	f	2	4	f	1	2	f
	Mit.		5	0									1
	Alt. Mit.	ATMS (mit. not needed at BO)											
367. Bake at I-5 NB Ramps	Base	0	3	f	1.5	0	1.5	0	4	f	0	0	0
	Mit.						2.5	(mit. not needed at 25B or BO)					
368. Bake at I-5 SB Ramps	Base	0	3	f	0	0	0	0	3	f	3	0	2
	Mit.	(mit. not needed at BO)							4				
484. Sand Cyn at Roosevelt	Base	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d			d			d			d
485. Sand Cyn at Road "B"	Base	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d	2		d	2					1
490. Research at Trabuco	Base	1	1	f	1	3	1	1	1	1	2	3	1
	Mit.	(mit. not needed at 25B)										2	
507. Bake at Millennium	Base	1	4	f	2	2	0	2	4	1	2	1	f
	Mit.		5	0									
512. Irvine at Trabuco	Base	2	3	f	2	3	f	2	3	d	2	3	f
	Mit.		4		(mit. not needed at BO)								
515a. Bake at Rancho North	Base	1	2	0	2	0	2	0	2	d	0	0	0
	Mit.				2.5		1.5						

* Due to right-of-way constraints, the need for mitigation at this intersection will be re-evaluated in future studies to determine if an alternative mitigation is acceptable.

Abbreviations (in alphabetical order):

Alt. Mit. Alternative mitigation (for locations within the City of Irvine improvements are subject to approval by the City)
25B 2025 Buildout Toll Conditions
ATMS Advanced Transportation Management System - The use of ATMS as a mitigation measure is discretionary and subject to subsequent review and approval by the Director of Public Works. The ATMS program involves a variety of actions such as camera surveillance and centralized system control, and is part of traffic signal system improvements planned for implementation over time.
Base 2025 Constrained Toll Conditions without Mitigation
BO Post-2040 Buildout Toll-Free Conditions

Cyn	Canyon	d	de facto right-turn	f	free right-turn
ICD	Irvine Center Drive	LCR	Laguna Canyon Road	L,T,R	left, through, right
Mit.	Mitigation	SB,WB,NB,EB	southbound, westbound, northbound, eastbound		

Table 5-5

SUMMARY OF MITIGATION RESULTS
(2025 Constrained Toll Network)

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
34. Red Hill Av at Irvine Bl	.94	1.04	.97	1.05	.03	.01	c	-	.94	1.00	mp	-
									.92 [1]	1.00 [1]	mp	-
91. Tustin Ranch Rd at Irvine Bl	1.14	1.09	1.18	1.11	.04	.02	c	c	1.11	1.05	mp	mp
									1.13 [1]	1.06 [1]	mp	mp
127. Jamboree Rd at El Camino Real	.65	.92	.67	.95	.02	.03	-	c	.62	.90	-	ma
223. Culver Dr at I-5 SB Ramps	.74	.93	.75	1.02	.01	.09	-	c	.75	.92	-	mp
									.65 [1]	.84 [1]	-	ma
224. Culver Dr at Walnut Av	.90	.87	.93	.91	.03	.04	p	p	.83	.86	ma	ma
									.78 [1]	.86 [1]	ma	ma
235. Culver Dr at University Dr[2]	.89	.94	.92	.96	.03	.02	p	c	.81	.90	ma	ma
249. Yale Av at Irvine Bl	.90	.68	.99	.79	.09	.11	p	-	.84	.76	ma	-
282. Jeffrey Rd at Portola Pkwy	.76	1.27	.95	.73	.19	-.54	p	-	.84	.73	ma	-
283. Jeffrey Rd at Irvine Bl	.77	.75	.99	.90	.22	.15	p	-	.78	.90	ma	-
284. Jeffrey Rd at Bryan Av	.92	.44	.99	.62	.07	.18	c	-	.80	.64	ma	-
285. Jeffrey Rd at Trabuco Rd	.95	.78	.96	1.02	.01	.24	-	p	.84	.82	-	ma
286. Jeffrey Rd at Roosevelt	1.27	.84	1.26	.91	-.01	.07	-	p	1.11	.87	-	ma
									.75 [1]	.96 [1]	-	mp
289. Jeffrey Rd at ICD	.87	1.00	.87	1.08	.00	.08	-	c	.75	.96	-	mp
301. Sand Cyn Av at Irvine Bl	.67	.59	.96	.74	.29	.15	p	-	.83	.74	ma	-
302. Sand Cyn Av at Trabuco Rd	1.00	1.00	1.08	1.12	.08	.12	c	c	.89	1.00	ma	mp
303. Sand Cyn Av at I-5 NB Ramps	.71	.81	.92	1.00	.21	.19	p	p	.74	.80	ma	ma

Table 5-5 (cont.)
SUMMARY OF MITIGATION RESULTS
(2025 Constrained Toll Network)

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
304. Sand Cyn Av at Marine Way	.94	1.21	1.00	1.32	.06	.11	c	c	.92	1.06	mp	mp
305. Sand Cyn Av at I-5 SB Ramps	1.08	.97	1.26	1.10	.18	.13	c	c	1.01	.83	mp	ma
311. Sand Cyn Av at I-405 NB Ramps	.91	.55	.95	.55	.04	.00	c	-	.91	.49	mp	-
317. SR-133 NB Ramps at Irvine Bl	.84	.69	.91	.82	.07	.13	p	-	.85	.76	ma	-
									.86 [1]	.77 [1]	ma	-
362. Bake Pkwy at Irvine Bl	1.24	.81	1.27	.86	.03	.05	c	-	1.11	.86	mp	-
364. Bake Plwy at Jeronimo Rd	1.19	.90	1.14	.91	-.05	.01	-	p	1.10	.87	-	ma
366. Bake Pkwy at Rockfield Bl	.89	.94	.91	.95	.02	.01	p	-	.83	.87	ma	-
									.86 [1]	.90 [1]	ma	-
367. Bake Pkwy at I-5 NB Ramps	1.01	.63	1.03	.65	.02	.02	c	-	.88	.61	ma	-
368. Bake Pkwy at I-5 SB Ramps	.88	.92	.89	.94	.01	.02	-	c	.81	.84	-	ma
484. Sand Cyn Av at Roosevelt Av	.80	.81	.84	1.01	.04	.20	-	p	.72	.83	-	ma
485. Sand Cyn Av at Road "B"	.85	1.14	.95	1.24	.10	.10	p	c	.78	.87	ma	ma
490. Research Dr at Trabuco Rd	.79	.90	.83	.91	.04	.01	-	p	.81	.86	-	ma
507. Bake Pkwy at Millennium Bl	.95	.98	.99	1.02	.04	.04	c	c	.95	.94	mp	mp
512. Irvine Bl at Trabuco Rd	.87	.86	.92	.90	.05	.04	p	-	.83	.90	ma	-
515a. Bake Pkwy at Rancho Pkwy N	.98	1.22	1.00	1.22	.02	.00	c	-	.83	1.19	ma	-

[1] Alt. Mit. - Alternative mitigation
[2] ATMS credit of .05 reflected

p - Project causes deficiency
c - Project contributes to deficiency
ma - Mitigated to an adequate level of service
mp - Project portion of impact mitigated, LOS remains less than adequate

certain corridors, selective ramp and freeway shoulder use management, traffic advisory and intelligent transportation system measures, additional ramp entry and exit lanes, and facility widening are some of the measures typically utilized by Caltrans.

Caltrans evaluates and prioritizes these improvements on the basis of system needs, benefits, and their impacts in the region. In cooperation with local agencies, Caltrans funds and constructs the most feasible improvements in an expeditious manner to address traffic demands on the freeways and tollways. Through this process Caltrans can address the type and timing of improvements to accommodate the future expected growth and demand in the region.

2025 (CONSTRAINED TOLL NETWORK) CONCLUSIONS

With implementation of the required mitigation measures by the project, the planned local arterial highway circulation system analyzed for 2025 with constrained toll network has adequate capacity to accommodate the proposed project land uses or those locations on the circulation system adversely impacted by the project have been mitigated to maintain the same levels of service under no-project conditions. The mitigation measures presented in this traffic study are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts.

2025 (BUILDOUT TOLL NETWORK) TRAFFIC IMPACTS

Figures 5-5 and 5-6 show the 2025 ADT forecasts and V/C ratios for the study area circulation system based on no-project and proposed project land uses under the buildout network. The with-project volumes are based on the project trip generation estimates presented in Chapter 2.0. The no-project volumes assume no other land uses except those existing uses such as agricultural on the project site.

According to the performance criteria outlined in Chapter 1.0 and the volumes and V/C ratios shown here, the project potentially impacts 40 roadway locations as summarized in Table 5-6. The City

Table 5-6

ADT ROADWAY LINK DEFICIENCY ANALYSIS
(2025 Buildout Toll Network)

Roadway Segment	No-Project V/C	No-Project LOS	With-Project V/C	With-Project LOS
Alton e/o Culver	1.00	E	1.03	F
Alton w/o Jeffrey	1.13	F	1.16	F
Alton n/o Commercentre	1.03	F	1.07	F
Alton s/o Commercentre	1.11	F	1.13	F
Bake n/o Trabuco	1.33	F	1.36	F
Bake n/o Jeronimo	1.02	F	1.04	F
Barranca e/o Culver	1.06	F	1.09	F
Barranca w/o Jeffrey	1.00	F	1.06	F
Culver s/o I-5 SB Ramps	.98	E	1.02	F
Culver s/o ICD	.96	E	.98	E
El Camino Real e/o Jamboree	.94	E	.97	E
Irvine e/o Jeffrey	.65	B	.96	E
Irvine w/o Research	1.17	F	1.24	F
Irvine e/o Alton	.91	E	.96	E
Jeffrey s/o Irvine	.61	B	.93	E
Jeffrey n/o Trabuco	.67	B	.94	E
Jeffrey s/o Trabuco	.65	B	.94	E
Jeffrey n/o I-5 NB Ramps	.87	D	1.10	F
Jeffrey s/o Walnut	.91	E	1.04	F
Jeffrey n/o Barranca	.93	E	1.02	F
Jeffrey n/o Alton	.94	E	1.02	F
Jeffrey s/o Alton	.96	E	1.02	F
Millennium n/o Barranca	1.02	F	1.09	F
Portola s/o SR-241 SB Ramps	.81	D	.91	E
Portola e/o Jeffrey	.72	C	.91	E
Portola e/o Sand Canyon	.78	C	1.19	F
Portola w/o Research	.78	C	1.22	F
Portola w/o Millennium	.84	D	1.09	F
Portola e/o Millennium	.81	D	1.31	F
Research s/o Portola	.68	B	.93	E
Rockfield e/o Bake	.94	E	.97	E
Sand Canyon n/o Irvine	.59	A	1.25	F
Sand Canyon s/o Trabuco	.76	C	1.19	F
Sand Canyon n/o I-5 NB Ramps	1.04	F	1.30	F
Sand Canyon s/o I-5 SB Ramps	1.07	F	1.20	F
Sand Canyon s/o Roosevelt	.83	D	1.11	F
Trabuco e/o Jeffrey	.78	C	.91	E
Trabuco w/o Research	1.17	F	1.24	F
Trabuco e/o Research	.91	E	.96	E
Walnut w/o Culver	.88	D	.91	E

of Irvine's Link Capacity Analysis guidelines require that these locations be further examined using peak hour data. The results of the peak hour tests are summarized in Table 5-7. As can be seen in this table, there are no link locations requiring roadway midblock mitigation under the ADT link volume impact criteria. It should be noted that the peak hour link V/C ratios are based on the highest upstream/downstream peak hour volume data obtained from the intersections comprising that link.

Figure 5-7 shows the intersections studied here, and Appendix C lists the peak hour ICU values for each location without and with the project. For actual turn movement volumes and lane configurations assumed at each intersection see Appendix C. As can be seen in Table 5-8, 23 locations are adversely impacted by the project. Mitigation for these 23 intersections are presented in a later section of this chapter.

Freeway/Tollway Mainline and Ramp Analysis

According to the freeway/tollway mainline analysis (see Figure 5-6 for V/C ratios) and performance criteria outlined in Chapter 1.0, there are no freeway/tollway mainline segments impacted by the project.

This section presents information for potential impacts at on- and off-ramps within the study area. The freeway ramp analysis presented here differs from the previous peak hour analysis which included ramp intersections with arterial streets. The analysis here involves the peak hour V/C of the ramp itself as a means to assess any project impact whereas the previous analysis assessed project impact using the ICU value of the entire ramp intersection with the arterial street. Analysis of the freeway ramps reveals that the following eight ramp locations (see Appendix D for the detailed ramp analysis and Figure 5-8 for ramps analyzed) are impacted by the project.

		No-Project		With-Project	
Ramp Location	**Peak Hour**	**V/C**	**LOS**	**V/C**	**LOS**
I-5 southbound off-ramp at Culver Drive	PM	1.53	F	1.72	F
I-5 southbound on-ramp at Jeffrey Road	AM	.96	E	1.06	F
I-5 northbound on-ramp at Sand Canyon Avenue	PM	1.56	F	1.72	F
I-5 southbound off-ramp at Sand Canyon Avenue	AM	1.46	F	1.66	F
I-5 southbound off-ramp at Alton Parkway	AM	1.19	F	1.24	F
I-5 southbound off-ramp at Bake Parkway	AM	1.05	F	1.10	F
I-405 southbound off-ramp at Sand Canyon Avenue	AM	1.27	F	1.31	F
SR-133 northbound off-ramp at Trabuco Road	AM	1.07	F	1.25	F

Table 5-7

PEAK HOUR LINK CAPACITY ANALYSIS
(2025 Buildout Toll Network)

Roadway Segment	Lanes	ADT	Peak Hour Capacity	Highest Peak Volume	V/C	LOS
Alton e/o Culver	4	33,000	3,200	1,859 (PM Eastbound)	.58	A
Alton w/o Jeffrey	4	37,000	3,200	2,350 (PM Westbound)	.73	C
Alton n/o Commercentre	6	60,000	4,800	2,785 (PM Northbound)	.58	A
Alton s/o Commercentre	6	61,000	4,800	2,920 (AM Northbound)	.61	B
Bake n/o Trabuco	4	51,000	3,200	2,320 (AM Southbound)	.73	C
Bake n/o Jeronimo	6	56,000	4,800	2,632 (PM Southbound)	.55	A
Barranca e/o Culver	4	35,000	3,200	1,998 (PM Westbound)	.62	B
Barranca w/o Jeffrey	4	34,000	3,200	1,845 (AM Eastbound)	.58	A
Culver s/o I-5 SB Ramps	6	55,000	4,800	2,937 (PM Southbound)	.61	B
Culver s/o ICD	6	53,000	4,800	2,973 (PM Northbound)	.62	B
El Camino Real e/o Jamboree	4	31,000	3,200	2,020 (PM Eastbound)	.63	B
Irvine e/o Jeffrey	6	52,000	4,800	3,806 (AM Eastbound)	.79	C
Irvine w/o Research	6	51,000	4,800	3,950 (AM Eastbound)	.82	D
Irvine e/o Alton	6	55,000	4,800	3,160 (AM Westbound)	.66	B
Jeffrey s/o Irvine	6	50,000	4,800	2,412 (AM Southbound)	.50	A
Jeffrey n/o Trabuco	6	51,000	4,800	3,180 (AM Southbound)	.66	B
Jeffrey s/o Trabuco	7	59,000	4,800	3,250 (PM Northbound)	.68	B
Jeffrey n/o I-5 NB Ramps	7	69,000	4,800	3,210 (PM Northbound)	.67	B
Jeffrey s/o Walnut	6	56,000	4,800	3,011 (AM Southbound)	.63	B
Jeffrey n/o Barranca	6	55,000	4,800	2,566 (PM Northbound)	.53	A
Jeffrey n/o Alton	6	55,000	4,800	2,267 (PM Northbound)	.47	A
Jeffrey s/o Alton	6	55,000	4,800	2,965 (PM Northbound)	.62	B
Millennium n/o Barranca	6	59,000	4,800	2,848 (PM Southbound)	.59	A
Portola s/o SR-241 SB Ramps	4	29,000	3,200	2,330 (PM Eastbound)	.73	C
Portola e/o Jeffrey	4	29,000	3,200	2,430 (AM Eastbound)	.76	C
Portola e/o Sand Canyon	4	38,000	3,200	1,878 (PM Eastbound)	.59	A
Portola w/o Research	4	39,000	3,200	1,878 (PM Eastbound)	.59	A
Portola w/o Millennium	4	35,000	3,200	2,157 (PM Eastbound)	.67	B
Portola e/o Millennium	4	42,000	3,200	2,330 (PM Northbound)	.73	C
Research s/o Portola	4	26,000	3,200	1,330 (AM Northbound)	.42	A
Rockfield e/o Bake	4	31,000	3,200	1,642 (PM Eastbound)	.51	A
Sand Canyon n/o Irvine	4	40,000	3,200	1,690 (PM Northbound)	.53	A
Sand Canyon s/o Trabuco	6	64,000	4,800	2,990 (AM Southbound)	.62	B
Sand Canyon n/o I-5 NB Ram	6	70,000	4,800	3,003 (AM Northbound)	.63	B
Sand Canyon s/o I-5 SB Ram	6	65,000	4,800	2,765 (AM Southbound)	.58	A
Sand Canyon s/o Roosevelt	6	60,000	4,800	2,546 (PM Northbound)	.53	A
Trabuco e/o Jeffrey	4	29,000	3,200	2,311 (AM Eastbound)	.72	C
Trabuco w/o Research	6	67,000	4,800	4,110 (AM Eastbound)	.86	D
Trabuco e/o Research	6	52,000	4,800	2,980 (AM Eastbound)	.62	B
Walnut w/o Culver	4	29,000	3,200	1,519 (AM Eastbound)	.47	A

Table 5-8

SUMMARY OF DEFICIENT INTERSECTIONS
(2025 Buildout Toll Network)

Intersection	Peak Hour	No-Project ICU	No-Project LOS	With-Project ICU	With-Project LOS
34. Red Hill Av. at Irvine Bl.	AM	.95	E	.97	E
	PM	1.03	F	1.06	F
91. Tustin Ranch Rd. at Irvine	PM	.93	E	.95	E
125. Jamboree Rd. at Irvine Bl.	AM	.97	E	1.01	F
223. Culver Dr. at I-5 SB Ramps	PM	.90	D	1.00	E
224. Culver Dr. at Walnut Av.	AM	.91	E	.94	E
	PM	.87	D	.91	E
249. Yale Av. at Irvine Bl.	AM	.99	E	1.03	E
284. Jeffrey Rd. at Bryan Av.	AM	.94	E	1.03	F
285. Jeffrey Rd. at Trabuco Rd.	AM	.89	D	1.02	F
	PM	.87	D	1.04	F
286. Jeffrey Rd. at Roosevelt	PM	.84	D	.92	E
289. Jeffrey Rd. at ICD	PM	1.00	E	1.08	F
301. Sand Cyn. Av. at Irvine Bl.	AM	.81	D	.94	E
302. Sand Cyn. Av. at Trabuco	AM	.91	E	1.05	F
	PM	.90	D	1.00	E
303. Sand Cyn. Av. at I-5 NB Ramps	PM	.83	D	.95	E
304. Sand Cyn. Av. at Marine Wy.	PM	1.01	F	1.04	F
305. Sand Cyn. Av. at I-5 SB Ramps	AM	.94	E	1.07	F
311. Sand Cyn. Av. at I-405 NB	AM	.95	E	.97	E
321. Laguna Cyn. Rd. at Old Laguna	PM	.90	D	.94	E
406. Laguna Canyon Rd. at Lake Forest	AM	1.13	F	1.15	F
	PM	.89	D	.95	E
484. Sand Canyon Av. at Roosevelt	PM	.83	D	1.02	F
485. Sand Canyon Av. at Road "B"	AM	.88	D	.95	E
	PM	1.16	F	1.22	F
507. Bake Pkwy. at Millennium	AM	.94	E	96	E
	PM	.93	E	.96	E
515a. Bake Pkwy. at Rancho Pkwy. N.	AM	.88	D	.91	E
515b. Bake Pkwy. at Rancho Pkwy. S.	AM	.89	D	.92	E

While potential impacts to the freeway/tollway mainline segments and ramps have been evaluated, this analysis assumes that implementation of freeway and ramp improvements, except for ramp intersections with arterial streets, will be the responsibility of the existing regional transportation agencies. A number of programs are in place in Orange County to improve and upgrade the regional transportation system.

These include TCA Corridor program, the STIP, Caltrans TOPS, and the OCTA Measure M program. Each of these programs is discussed in more detail in Chapter 4.0. It has been assumed in the traffic analysis that the cumulative impact of project traffic along with other regional growth at the identified impacted ramp locations will be mitigated through a combination of these programs.

2025 (BUILDOUT TOLL NETWORK) MITIGATION MEASURES

The recommended mitigation measures and resulting ICUs proposed for the 23 deficient intersections are summarized in Tables 5-9 and 5-10. It should be noted that the mitigation measures identified here would be studied further by each Master Tentative Map (or equivalent) traffic analysis. The timing and need for these improvements would be based on an updated traffic study to maintain satisfactory levels of service. The mitigation measures presented here are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts.

It has been assumed in the traffic analysis that the cumulative impact of project traffic along with other regional growth at the identified impacted ramp locations will be mitigated through a combination of programs implemented by existing regional transportation agencies. Caltrans is the lead agency for planning and implementing improvements to the freeway system and the toll roads. Caltrans monitors growth and land use changes throughout its service districts and in association with local planning agencies, is responsible for developing improvement plans as required to address the future needs of the State. Typically improvements to the freeways, toll roads, and on- and off-ramps are made to address both operational and capacity concerns. Capacity enhancements to these regional

Table 5-9

MITIGATION LANES FOR IMPACTED INTERSECTIONS
(2025 Buildout Toll Network)

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
34. Red Hill at Irvine	Base	1	2	0	1	3	0	2	1	1	1	3	0
	Mit.						d						
	Alt. Mit.	ATMS (City of Tustin)											
91. Tustin Ranch at Irvine	Base	1	3	f	2	3	1	1	3	1	2	3	1
	Mit.							2					
	Alt. Mit.	ATMS (City of Tustin)											
125. Jamboree at Irvine	Base	2	3	f	2	3	d	2	3	1	2	3	1
	Mit.	ATMS (City of Tustin)					(mit. not needed at BO)						
223. Culver at I-5 SB Ramps	Base	0	3	f	0	0	0	0	3	f	2	0	2
	Mit.								4				
	Alt. Mit.										3		2
224. Culver at Walnut	Base	2	3	d	2	2	d	2	3	1	2	2	0
	Mit.					3							d
	Alt. Mit.	ATMS &											d
249. Yale at Irvine Bl	Base	1	2	d	1	3	d	1	2	d	1	3	d
	Mit.	2											
284. Jeffrey at Bryan	Base	1	3	1	1	1	0	2	3	d	1.5	.5	d
	Mit.										1		1.5
285. Jeffrey at Trabuco	Base	1	3	d	1	2	0	2	3	1	1	2	1
	Mit.	2	4		2		d				2		
286. Jeffrey at Roosevelt	Base	2	3	d	2	1	1	1	4	d	1	1	1
	Mit.					2	d					2	d
289. Jeffrey at ICD	Base	2	3	1	2	3	1	2	3	1	2	4	f
	Mit.	3											
301. Sand Cyn at Irvine	Base	2	3	1	2	3	1	2	3	1	2	3	1
	Mit.											4	
302. Sand Cyn at Trabuco	Base	2	3	d	2	2	0	2	3	1	2	2	1
	Mit.				3	3						3	
303. Sand Cyn at I-5 NB Ramps	Base	0	3	1	1	1	0	2	3	0	2	1	1
	Mit.			f									
304. Sand Cyn at Marine	Base	2	3	0	2	0	1	0	3	2	0	0	0
	Mit.								4				
305. Sand Cyn at I-5 SB Ramps	Base	2	3	0	0	0	0	0	3	d	1.5	0	1.5
	Mit.										2.5		
311. Sand Cyn at I-405 NB Ramps	Base	0	2	f	.5	0	1.5	0	2	f	0	0	0
	Mit.				1		2						
321. LCR at Old LCR	Base	0	3	1	0	0	0	2	3	0	3	0	f
	Mit.	(mit. not needed at BO)						3					

Continued

Table 5-9 (cont.)
MITIGATION LANES FOR IMPACTED INTERSECTIONS
(2025 Buildout Toll Network)

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
406. LCR at Lake Forest	Base	2	3	0	1	0	f	0	3	1	0	0	0
	Mit.				2		(mit. not needed at BO)						
484. Sand Cyn at Roosevelt	Base	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d			d			d			d
485. Sand Cyn at Road "B"	Base	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d	2		d	2					1
507. Bake at Millennium	Base	1	4	f	2	2	0	2	4	1	2	1	f
	Mit.					3	d					2	
515a. Bake at Rancho North	Base	1	2	0	2	0	2	0	2	d	0	0	0
	Mit.				2.5		1.5						
515b. Bake at Rancho South	Base	0	2	1	0	0	0	1	2	0	2	0	1
	Mit.			f			(mit. not needed at BO)						

Abbreviations (in alphabetical order):

Alt. Mit.	Alternative mitigation (for locations within the City of Irvine improvements are subject to approval by the City)
ATMS	Advanced Transportation Management System - The use of ATMS as a mitigation measure is discretionary and subject to subsequent review and approval by the Director of Public Works. The ATMS program involves a variety of actions such as camera surveillance and centralized system control, and is part of traffic signal system improvements planned for implementation over time.
Base	2025 Buildout Toll conditions without mitigation
BO	Post-2040 Toll-Free Conditions
Cyn	Canyon
d	de facto right-turn
f	free right-turn
ICD	Irvine Center Drive
LCR	Laguna Canyon Road
L,T,R	left, through, right
Mit.	Mitigation
SB,WB,NB,EB	southbound, westbound, northbound, eastbound

Table 5-10

SUMMARY OF MITIGATION RESULTS
(2025 Buildout Toll Network)

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
34. Red Hill Av at Irvine Bl	.95	1.03	.97	1.06	.02	.03	c	c	.94	1.01	mp	mp
									.92 [1]	1.01 [1]	mp	mp
91. Tustin Ranch Rd at Irvine Bl	.96	.93	.97	.95	.01	.02	-	c	.90	.90	-	ma
									.92 [1]	.90 [1]	-	ma
125. Jamboree Rd at Irvine Bl	.97	.85	1.01	.88	.04	.03	c	-	.96	.83	mp	-
223. Culver Dr at I-5 SB Ramps	.72	.90	.77	1.00	.05	.10	-	p	.77	.87	-	ma
									.69 [1]	.85 [1]	-	ma
224. Culver Dr at Walnut Av	.91	.87	.94	.91	.03	.04	c	p	.85	.86	ma	ma
									.80 [1]	.86 [1]	ma	ma
249. Yale Av at Irvine Bl	.99	.73	1.03	.84	.04	.11	c	-	.88	.81	ma	-
284. Jeffrey Rd at Bryan Av	.94	.45	1.03	.62	.09	.17	c	-	.85	.65	ma	-
285. Jeffrey Rd at Trabuco Rd	.89	.87	1.02	1.04	.13	.17	p	p	.88	.83	ma	ma
286. Jeffrey Rd at Roosevelt	1.25	.84	1.25	.92	.00	.08	-	p	1.09	.87	-	ma
289. Jeffrey Rd at ICD	.86	1.00	.90	1.08	.04	.08	-	c	.83	1.00	-	mp
301. Sand Cyn Av at Irvine Bl	.81	.71	.94	.84	.13	.13	p	-	.81	.84	ma	-
302. Sand Cyn Av at Trabuco Rd	.91	.90	1.05	1.00	.14	.10	c	p	.86	.90	ma	ma
303. Sand Cyn Av at I-5 NB Ramps	.55	.83	.67	.95	.12	.12	-	p	.67	.67	-	ma
304. Sand Cyn Av at Marine Wy	.59	1.01	.67	1.04	.08	.03	-	c	.55	.91	-	mp
305. Sand Cyn Av at I-5 SB Ramps	.94	.78	1.07	.86	.13	.08	c	p	.89	.79	ma	-
311. Sand Cyn Av at I-405 NB Ramps	.95	.56	.97	.56	.02	.00	c	-	.93	.50	mp	-

Table 5-10 (cont.)
SUMMARY OF MITIGATION RESULTS
(2025 Buildout Toll Network)

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
321. Laguna Cyn Rd at Old Laguna Cyn Rd	.86	.90	.88	.94	.02	.04	-	p	.86	.87	-	ma
406. Laguna Cyn Rd at Lake Forest Dr	1.13	.89	1.15	.95	.02	.06	c	p	1.13	.90	mp	ma
484. Sand Cyn Av at Roosevelt Av	.78	.83	.83	1.02	.05	.19	-	p	.71	.82	-	ma
485. Sand Cyn Av at Road “B”	.88	1.16	.95	1.22	.07	.06	p	c	.75	.86	ma	ma
507. Bake Pkwy at Millennium Bl	.94	.93	.96	.96	.02	.03	c	c	.94	.91	mp	mp
515a. Bake Pkwy at Rancho Pkwy N	.88	1.22	.91	1.21	.03	-.01	p	-	.79	1.18	ma	-
515b. Bake Pkwy at Rancho Pkwy S	.89	.82	.92	.84	.03	.02	p	-	.83	.80	ma	-

[1] Alt. Mit. - Alternative mitigation

p - Project causes deficiency
c - Project contributes to deficiency
ma - Mitigated to an adequate level of service
mp - Project portion of impact mitigated, LOS remains less than adequate

Level of service ranges: A=.00 - .60 B=.61 - .70 C=.71 - .80 D=.81 - .90 E=.91 - 1.00 F=Above 1.00

facilities can be achieved through a number of measures, which Caltrans studies and evaluates before programming them for implementation. Potential capacity enhancements could include, demand management through regulation and metering of traffic utilizing the freeway interchanges and ramps, selective time responsive ramp metering activation or termination, alternative lane deployment such as converting general purpose lanes to High Occupancy Lanes (HOV) or allowing the use of HOV lanes for general purpose traffic, implementation of auxiliary lanes in selected segments or within certain corridors, selective ramp and freeway shoulder use management, traffic advisory and intelligent transportation system measures, additional ramp entry and exit lanes, and facility widening are some of the measures typically utilized by Caltrans.

Caltrans evaluates and prioritizes these improvements on the basis of system needs, benefits, and their impacts in the region. In cooperation with local agencies, Caltrans funds and constructs the most feasible improvements in an expeditious manner to address traffic demands on the freeways and tollways. Through this process Caltrans can address the type and timing of improvements to accommodate the future expected growth and demand in the region.

2025 (BUILDOUT TOLL NETWORK) CONCLUSIONS

With implementation of the required mitigation measures by the project, the planned local arterial highway circulation system analyzed for 2025 with buildout toll network has adequate capacity to accommodate the proposed project land uses or those locations on the circulation system adversely impacted by the project have been mitigated to maintain the same levels of service under no-project conditions. The mitigation measures presented in this traffic study are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts.

In addition, the traffic forecasts presented in this study for 2025 with buildout toll conditions showed that the re-designation of Jeffrey Road between SR-241 and Portola Parkway from a six-lane major to a four-lane primary arterial and the elimination of an unnamed collector between Irvine Boulevard and Trabuco Road would not cause any unmitigated impacts.

Chapter 6.0
POST-2040 ANALYSIS

This chapter describes traffic conditions for buildout of the project and surrounding land uses in a Post-2040 time frame with toll-free conditions on the SR-133 (north of I-5), SR-241 and SR-261. Traffic volumes and capacity evaluation results for Post-2040 circulation system conditions under project buildout conditions are presented and with and without project conditions are summarized to identify project mitigation requirements. Buildout of the circulation system is assumed in accordance with the City of Irvine's General Plan and County of Orange Master Plan of Arterial Highways (MPAH).

POST-2040 TRAFFIC IMPACTS

Figures 6-1 and 6-2 show the Post-2040 average daily traffic (ADT) forecasts and volume/capacity (V/C) ratios for the study area circulation system based on no-project and proposed project land uses. The with-project volumes are based on the project trip generation estimates presented in Chapter 2.0. The no-project volumes assume no other land uses except those existing uses such as agricultural on the project site.

According to the performance criteria outlined in Chapter 1.0 and the volumes and V/C ratios shown here, the project potentially impacts 38 roadway locations as summarized in Table 6-1.

The City of Irvine's Link Capacity Analysis guidelines require that these locations be further examined using peak hour data. The results of the peak hour tests are summarized in Table 6-2. As can be seen in this table, there are no link locations requiring roadway midblock mitigation under the ADT link volume impact criteria. It should be noted that the peak hour link V/C ratios are based on the highest upstream/downstream peak hour volume data obtained from the intersections comprising that link.

Fig. 6-1

fig. 6-2

Table 6-1

ADT ROADWAY LINK DEFICIENCY ANALYSIS
(Post-2040)

Roadway Segment	No-Project ADT V/C	No-Project ADT LOS	With-Project ADT V/C	With-Project ADT LOS
Alton n/o Commercentre	.89	D	.92	E
Alton s/o Commercentre	.93	E	.96	E
Alton e/o Culver	.94	E	.97	E
Alton w/o Jeffrey	1.09	F	1.13	F
Bake n/o Toledo	.91	E	.93	E
Barranca e/o Culver	1.03	F	1.06	F
Barranca w/o Jeffrey	1.03	F	1.06	F
Culver s/o I-5 SB Ramps	.98	E	1.02	F
Culver s/o ICD	.94	E	.96	E
Culver s/o Barranca	.91	E	.93	E
El Camino Real e/o Jamboree	.88	D	.91	E
ICD e/o Jeffrey	.89	D	.91	E
Irvine w/o Research	.76	C	.94	E
Irvine e/o Alton	.89	D	.96	E
Jeffrey n/o Trabuco	.63	B	.91	E
Jeffrey s/o Trabuco	.63	B	.92	E
Jeffrey n/o I-5 NB Ramps	.87	D	1.10	F
Jeffrey s/o Walnut	.94	E	1.07	F
Jeffrey n/o Barranca	.94	E	1.06	F
Jeffrey n/o Alton	.98	E	1.06	F
Jeffrey s/o Alton	1.02	F	1.07	F
Millennium n/o Barranca	1.04	F	1.11	F
Millennium s/o Alton	.89	D	.93	E
Portola e/o Sand Canyon	.50	A	.94	E
Portola w/o Research	.50	A	1.00	E
Portola e/o Millennium	.63	B	1.09	F
Rockfield e/o Bake	.97	E	1.00	E
Sand Canyon n/o Irvine	.41	A	1.09	F
Sand Canyon s/o Trabuco	.80	C	1.26	F
Sand Canyon s/o Roosevelt	.87	D	1.19	F
Sand Canyon n/o I-5 NB Ramps	1.06	F	1.37	F
Sand Canyon s/o I-5 SB Ramps	1.24	F	1.41	F
Sand Canyon n/o ICD	.85	D	.96	E
Sand Canyon n/o Barranca	.87	D	.94	E
Sand Canyon n/o I-405 NB Ramps	.91	E	.96	E
Technology e/o Barranca	1.00	E	1.03	F
Trabuco w/o Research	1.13	F	1.19	F
Walnut w/o Culver	.88	D	.91	E

Table 6-2

PEAK HOUR LINK CAPACITY ANALYSIS
(Post-2040)

Roadway Segment	Lanes	ADT	Peak Hour Capacity	Highest Peak Volume	V/C	LOS
Alton n/o Commercentre	6	52,000	4,800	2,660 (PM Northbound)	.55	A
Alton s/o Commercentre	6	52,000	4,800	2,680 (PM Southbound)	.56	A
Alton e/o Culver	4	31,000	3,200	1,750 (PM Eastbound)	.55	A
Alton w/o Jeffrey	4	36,000	3,200	2,292 (PM Westbound)	.72	C
Bake n/o Toledo	6	50,000	4,800	2,350 (AM Southbound)	.49	A
Barranca e/o Culver	4	34,000	3,200	1,988 (PM Westbound)	.62	B
Barranca w/o Jeffrey	4	34,000	3,200	1,904 (AM Eastbound)	.60	A
Culver s/o I-5 SB Ramps	6	55,000	4,800	3,000 (AM Southbound)	.63	B
Culver s/o ICD	6	52,000	4,800	2,935 (PM Northbound)	.61	B
Culver s/o Barranca	6	50,000	4,800	2,380 (PM Northbound)	.50	A
El Camino Real e/o Jamboree	4	29,000	3,200	2,020 (PM Eastbound)	.63	B
ICD e/o Jeffrey	6	49,000	4,800	3,140 (AM Eastbound)	.65	B
Irvine w/o Research	6	51,000	4,800	3,977 (AM Eastbound)	.83	D
Irvine e/o Alton	6	52,000	4,800	3,110 (AM Westbound)	.65	B
Jeffrey n/o Trabuco	6	49,000	4,800	3,270 (AM Southbound)	.68	B
Jeffrey s/o Trabuco	7	58,000	4,800	3,382 (PM Northbound)	.70	B
Jeffrey n/o I-5 NB Ramps	7	69,000	4,800	3,360 (PM Northbound)	.70	B
Jeffrey s/o Walnut	6	58,000	4,800	3,135 (AM Southbound)	.65	B
Jeffrey n/o Barranca	6	57,000	4,800	2,680 (AM Southbound)	.56	A
Jeffrey n/o Alton	6	57,000	4,800	2,427 (PM Northbound)	.51	A
Jeffrey s/o Alton	6	58,000	4,800	3,213 (PM Northbound)	.67	B
Millennium n/o Barranca	6	60,000	4,800	2,873 (PM Southbound)	.60	A
Millennium s/o Alton	6	50,000	4,800	2,841 (PM Southbound)	.59	A
Portola e/o Sand Canyon	4	30,000	3,200	1,768 (PM Eastbound)	.55	A
Portola w/o Research	4	32,000	3,200	1,768 (PM Eastbound)	.55	A
Portola e/o Millennium	4	35,000	3,200	2,200 (PM Northbound)	.69	B
Rockfield e/o Bake	4	32,000	3,200	1,569 (PM Westbound)	.49	A
Sand Canyon n/o Irvine	4	35,000	3,200	1,721 (PM Northbound)	.54	A
Sand Canyon s/o Trabuco	6	68,000	4,800	3,114 (AM Southbound)	.65	B
Sand Canyon s/o Roosevelt	6	64,000	4,800	2,726 (PM Northbound)	.57	A
Sand Canyon n/o I-5 NB Ramps	6	74,000	4,800	3,201 (PM Northbound)	.67	B
Sand Canyon s/o I-5 SB Ramps	6	76,000	4,800	3,169 (AM Southbound)	.66	B
Sand Canyon n/o ICD	6	52,000	4,800	2,250 (AM Southbound)	.47	A
Sand Canyon n/o Barranca	6	51,000	4,800	2,279 (AM Southbound)	.47	A
Sand Canyon n/o I-405 NB Ramps	6	52,000	4,800	3,256 (AM Northbound)	.68	B
Technology e/o Barranca	4	33,000	3,200	1,881 (PM Eastbound)	.59	A
Trabuco w/o Research	6	64,000	4,800	3,836 (AM Eastbound)	.80	C
Walnut w/o Culver	4	29,000	3,200	1,479 (AM Eastbound)	.46	A

Figure 6-3 shows the intersections studied here, and Appendix C lists the peak hour intersection capacity utilization (ICU) values for each location without and with the project. For actual turn movement volumes and lane configurations assumed at each intersection see Appendix C. As can be seen in Table 6-3, 23 locations are adversely impacted by the project. Mitigation for the 23 deficient intersections are presented in a later section of this chapter.

Freeway/Tollway Mainline and Ramp Analysis

According to the freeway/tollway mainline analysis (see Figure 6-2 for V/C ratios) and performance criteria outlined in Chapter 1.0, there are no freeway/tollway mainline segments impacted by the project.

This section also presents information for potential impacts at on- and off-ramps within the study area. The freeway ramp analysis presented here differs from the previous peak hour analysis which included ramp intersections with arterial streets. The analysis here involves the peak hour V/C of the ramp itself as a means to assess any project impact whereas the previous analysis assessed project impact using the ICU value of the entire ramp intersection with the arterial street. Analysis of the freeway ramps reveals that the following seven ramp locations (see Appendix D for the detailed ramp analysis and Figure 6-4 for ramps analyzed) are impacted by the project.

		No-Project		With-Project	
Ramp Location	**Peak Hour**	**V/C**	**LOS**	**V/C**	**LOS**
I-5 southbound on-ramp at Jeffrey Road	AM	.96	E	1.03	F
I-5 northbound on-ramp at Sand Canyon Avenue	PM	1.72	F	1.98	F
I-5 southbound off-ramp at Sand Canyon Avenue	AM	1.66	F	1.84	F
I-5 southbound off-ramp at Alton Parkway	AM	1.35	F	1.40	F
I-405 northbound direct on-ramp at Sand Canyon Avenue	PM	.95	E	1.01	F
I-405 southbound off-ramp at Sand Canyon Avenue	AM	1.32	F	1.39	F
SR-133 northbound off-ramp at Trabuco Road	AM	.93	E	1.10	F

While potential impacts to the freeway/tollway mainline segments and ramps have been evaluated, this analysis assumes that implementation of freeway and ramp improvements, except for ramp intersections with arterial streets, will be the responsibility of the existing regional transportation

Fig. 6-3

Table 6-3

SUMMARY OF DEFICIENT INTERSECTIONS
(Post-2040)

Intersection	Peak Hour	No-Project ICU	No-Project LOS	With-Project ICU	With-Project LOS
34. Red Hill Av. at Irvine Bl.	AM	.93	E	.95	E
91. Tustin Ranch Rd. at Irvine	AM	.93	E	.96	E
223. Culver Dr. at I-5 SB Ramps	PM	.93	.E	.98	E
224. Culver Dr. at Walnut Av.	AM	.93	E	.96	E
	PM	.87	D	.91	E
284. Jeffrey Rd. at Bryan Av.	AM	.96	E	1.02	F
249. Yale Av. at Irvine Bl.	AM	.94	E	1.02	F
285. Jeffrey Rd. at Trabuco Rd.	AM	.90	D	1.00	E
	PM	.88	D	1.05	F
286. Jeffrey Rd. at Roosevelt	AM	1.25	F	1.27	F
	PM	.85	D	.93	E
289. Jeffrey Rd. at ICD	AM	.86	D	.91	E
	PM	1.04	F	1.11	F
301. Sand Cyn. Av. at Irvine Bl.	AM	.78	C	.95	E
302. Sand Cyn. Av. at Trabuco	AM	.95	E	1.07	F
	PM	.94	E	1.01	F
303. Sand Cyn. Av. at I-5 NB Ramps	PM	.88	D	1.07	F
304. Sand Cyn. Av. at Marine Wy.	PM	1.05	F	1.12	F
305. Sand Cyn. Av. at I-5 SB Ramps	AM	.95	E	1.10	F
	PM	.82	D	.92	E
306. Sand Cyn. Av. at Oak Cyn.	PM	.88	D	.93	E
311. Sand Cyn. Av. at I-405 NB Ramps	AM	1.00	E	1.05	F
316. SR-133 SB Ramps at Irvine	AM	.89	D	.98	E
452. Jamboree Rd. at Santiago	AM	.88	D	.91	E
484. Sand Canyon Av. at Roosevelt	PM	.84	D	1.05	F
485. Sand Canyon Av. at Road "B"	AM	.89	D	.99	E
490. Research Dr. at Trabuco Rd.	PM	.85	D	.91	E
507. Bake Pkwy. at Millennium	AM	.95	E	.97	E
	PM	.98	E	1.00	E
515a. Bake Pkwy. at Rancho Pkwy. North	PM	1.11	F	1.14	F

fig. 6-4

agencies. A number of programs are in place in Orange County to improve and upgrade the regional transportation system.

These include the Transportation Corridor Agencies (TCA) Corridor program, the State Transportation Improvement Program (STIP), Caltrans Traffic Operations Strategies (TOPS), and the Orange County Transportation Authority (OCTA) Measure M program. Each of these programs is discussed in more detail in Chapter 4.0. It has been assumed in the traffic analysis that the cumulative impact of project traffic along with other regional growth at the identified impacted ramp locations will be mitigated through a combination of these programs.

POST-2040 MITIGATION MEASURES

The recommended mitigation measures and resulting ICUs proposed for the 23 deficient intersections are summarized in Tables 6-4 and 6-5. It should be noted that the mitigation measures identified here would be studied further by each Master Tentative Map (or equivalent) traffic analysis. The timing and need for these improvements would be based on an updated traffic study to maintain satisfactory levels of service. The mitigation measures presented here are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts.

It has been assumed in the traffic analysis that the cumulative impact of project traffic along with other regional growth at the identified impacted ramp locations will be mitigated through a combination of programs implemented by existing regional transportation agencies. Caltrans is the lead agency for planning and implementing improvements to the freeway system and the toll roads. Caltrans monitors growth and land use changes throughout its service districts and in association with local planning agencies, is responsible for developing improvement plans as required to address the future needs of the State. Typically improvements to the freeways, toll roads, and on- and off-ramps are made to address both operational and capacity concerns. Capacity enhancements to these regional facilities can be achieved through a number of measures, which Caltrans studies and evaluates before

Table 6-4

MITIGATION LANES FOR IMPACTED INTERSECTIONS
(Post-2040)

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
34. Red Hill at Irvine	Base	1	2	0	1	3	0	2	1	1	1	3	0
	Mit.						d						
	Alt. Mit.	ATMS (City of Tustin)											
91. Tustin Ranch at Irvine	Base	1	3	f	2	3	1	1	3	1	2	3	1
	Mit.							2					
	Alt. Mit.	ATMS (City of Tustin)											
223. Culver at I-5 SB Ramps	Base	0	3	f	0	0	0	0	3	f	2	0	2
	Mit.								4				
	Alt. Mit.										3		2
224. Culver at Walnut	Base	2	3	d	2	2	d	2	3	1	2	2	0
	Mit.					3							d
	Alt. Mit.	ATMS &											d
249. Yale at Irvine Bl	Base	1	2	d	1	3	d	1	2	d	1	3	d
	Mit.	2											
284. Jeffrey at Bryan	Base	1	3	1	1	1	0	2	3	d	1.5	.5	d
	Mit.										1		1.5
285. Jeffrey at Trabuco	Base	1	3	d	1	2	0	2	3	1	1	2	1
	Mit.	2	4		2		d				2		
286. Jeffrey at Roosevelt	Base	2	3	d	2	1	1	1	4	d	1	1	1
	Mit.					2	d					2	d
289. Jeffrey at ICD	Base	2	3	1	2	3	1	2	3	1	2	4	f
	Mit.	3											
301. Sand Cyn at Irvine	Base	2	3	1	2	3	1	2	3	1	2	3	1
	Mit.											4	
302. Sand Cyn at Trabuco	Base	2	3	d	2	2	0	2	3	1	2	2	1
	Mit.				3	3						3	
303. Sand Cyn at I-5 NB Ramps	Base	1	2	1	1	1	0	2	2	0	1.5	.5	1
	Mit.			f									
304. Sand Cyn at Marine	Base	2	2	0	1	0	1	0	2	1	0	0	0
	Mit.								4				
305. Sand Cyn at I-5 SB Ramps	Base	2	2	0	0	0	0	0	2	d	1.5	0	1.5
	Mit.										2.5		
306. Sand Cyn at Oak Cyn.	Base	1	3	d	2	1	1	1	3	1	2	1	d
	Mit.	2				.5	1.5						
311. Sand Cyn at I-405 NB Ramps	Base	0	2	f	.5	0	1.5	0	2	f	0	0	0
	Mit.				1		2						
316. SR-133 SB Ramps at Irvine	Base	1.5	0	1.5	1	3	0	0	0	0	0	3	d
	Mit.											4	

Continued

Table 6-4 (cont.)
MITIGATION LANES FOR IMPACTED INTERSECTIONS
(Post-2040)

LOCATION		SB L	SB T	SB R	WB L	WB T	WB R	NB L	NB T	NB R	EB L	EB T	EB R
452. Jamboree at Santiago Cyn	Base	2	3	d	2	3	d	2	2	1	2	2.5	1.5
	Mit.		4										
484. Sand Cyn at Roosevelt	Base	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d			d			d			d
485. Sand Cyn at Road “B”	Base	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d	2		d	2					1
490. Research at Trabuco	Base	1	1	f	1	3	1	1	1	1	2	3	1
	Mit.							2					
507. Bake at Millennium	Base	1	4	f	2	2	0	2	4	1	2	1	f
	Mit.					3	d					2	
515a. Bake at Rancho North	Base	1	2	0	2	0	2	0	2	d	0	0	0
	Mit.				2.5		1.5						

Abbreviations (in alphabetical order):

Alt. Mit.	Alternative mitigation (for locations within the City of Irvine improvements are subject to approval by the City)
ATMS	Advanced Transportation Management System - The use of ATMS as a mitigation measure is discretionary and subject to subsequent review and approval by the Director of Public Works. The ATMS program involves a variety of actions such as camera surveillance and centralized system control, and is part of traffic signal system improvements planned for implementation over time.
Base	Post-2040 Buildout Toll-Free Conditions without Mitigation
Cyn	Canyon
d	de facto right-turn
f	free right-turn
ICD	Irvine Center Drive
L,T,R	left, through, right
Mit.	Mitigation
SB,WB,NB,EB	southbound, westbound, northbound, eastbound

Table 6-5

SUMMARY OF MITIGATION RESULTS
(Post-2040)

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
34. Red Hill Av at Irvine Bl	.93	1.01	.95	1.02	.02	.01	c	-	.93	.98	mp	-
									.90 [1]	.97 [1]	ma	-
91. Tustin Ranch Rd at Irvine Bl	.93	.88	.96	.89	.03	.01	c	-	.90	.86	ma	-
									.91 [1]	.84 [1]	mp	-
223. Culver Dr at I-5 SB Ramps	.74	.93	.76	.98	.02	.05	-	c	.76	.86	-	ma
									.70 [1]	.84 [1]	-	ma
224. Culver Dr at Walnut Av	.93	.87	.96	.91	.03	.04	c	p	.87	.86	ma	ma
									.82 [1]	.86 [1]	ma	ma
249. Yale Av at Irvine Bl	.94	.73	1.02	.83	.08	.10	c	-	.87	.79	ma	-
284. Jeffrey Rd at Bryan Av	.96	.46	1.02	.65	.06	.19	c	-	.85	.68	ma	-
285. Jeffrey Rd at Trabuco Rd	.90	.88	1.00	1.05	.10	.17	p	p	.86	.86	ma	ma
286. Jeffrey Rd at Roosevelt	1.25	.85	1.27	.93	.02	.08	c	p	1.11	.88	mp	ma
289. Jeffrey Rd at ICD	.86	1.04	.91	1.11	.05	.07	p	c	.84	1.03	ma	mp
301. Sand Cyn Av at Irvine Bl	.78	.69	.95	.83	.17	.14	p	-	.82	.83	ma	-
302. Sand Cyn Av at Trabuco Rd	.95	.94	1.07	1.01	.12	.07	c	c	.88	.91	ma	mp
303. Sand Cyn Av at I-5 NB Ramps	.55	.88	.65	1.07	.10	.19	-	p	.65	.72	-	ma
304. Sand Cyn Av at Marine Way	.59	1.05	.69	1.12	.10	.07	-	c	.60	.97	-	mp
305. Sand Cyn Av at I-5 SB Ramps	.95	.82	1.10	.92	.15	.10	c	p	.93	.86	mp	ma

(Continued)

Table 6-5 (cont.)
SUMMARY OF MITIGATION RESULTS
(Post-2040)

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM	W/MITIGATION AM	W/MITIGATION PM	RESULT AM	RESULT PM
306. Sand Cyn Av at Oak Cyn	.82	.88	.89	.93	.07	.05	-	p	.64	.75	-	ma
311. Sand Cyn Av at I-405 NB Ramps	1.00	.59	1.05	.61	.05	.02	c	-	1.00	.53	mp	-
316. SR-133 SB Ramps at Irvine Bl	.89	.56	.98	.68	.09	.12	p	-	.82	.63	ma	-
452. Jamboree Rd at Santiago Cyn Rd	.88	.89	.91	.90	.03	.01	p	-	.85	.90	ma	-
484. Sand Cyn Av at Roosevelt Av	.78	.84	.84	1.05	.06	.21	-	p	.73	.87	-	ma
485. Sand Cyn Av at Road “B”	.89	1.14	.99	1.23	.10	.09	p	c	.78	.87	ma	ma
490. Research Dr at Trabuco Rd	.72	.85	.73	.91	.01	.06	-	p	.71	.83	-	ma
507. Bake Pkwy at Millennium Bl	.95	.98	.97	1.00	.02	.02	c	c	.95	.96	mp	mp
515a. Bake Pkwy at Rancho Pkwy North	.89	1.11	.90	1.14	.01	.03	-	c	.74	1.11	-	mp

[1] Alt. Mit. - Alternative mitigation

p - Project causes deficiency
c - Project contributes to deficiency
ma - Mitigated to an adequate level of service
mp - Project portion of impact mitigated, LOS remains less than adequate

Level of service ranges: A=.00 - .60 B=.61 - .70 C=.71 - .80 D=.81 - .90 E=.91 - 1.00 F=Above 1.00

programming them for implementation. Potential capacity enhancements could include, demand management through regulation and metering of traffic utilizing the freeway interchanges and ramps, selective time responsive ramp metering activation or termination, alternative lane deployment such as converting general purpose lanes to High Occupancy Lanes (HOV) or allowing the use of HOV lanes for general purpose traffic, implementation of auxiliary lanes in selected segments or within certain corridors, selective ramp and freeway shoulder use management, traffic advisory and intelligent transportation system measures, additional ramp entry and exit lanes, and facility widening are some of the measures typically utilized by Caltrans.

Caltrans evaluates and prioritizes these improvements on the basis of system needs, benefits, and their impacts in the region. In cooperation with local agencies, Caltrans funds and constructs the most feasible improvements in an expeditious manner to address traffic demands on the freeways and tollways. Through this process Caltrans can address the type and timing of improvements to accommodate the future expected growth and demand in the region.

POST-2040 CONCLUSIONS

With implementation of the required mitigation measures by the project, the planned local arterial highway circulation system analyzed for Post-2040 has adequate capacity to accommodate the proposed project land uses or those locations on the circulation system adversely impacted by the project have been mitigated to maintain the same levels of service under no-project conditions. The mitigation measures presented in this traffic study are subject to further refinement based on updated traffic forecasts that include any applicable land use and circulation revisions. Therefore, subsequent traffic studies will determine whether these mitigation measures and/or additional improvements, if any, are necessary based on the updated traffic forecasts.

In addition, the traffic forecasts presented in this study for Post-2040 toll-free conditions showed that the re-designation of Jeffrey Road between SR-241 and Portola Parkway from a six-lane major to a four-lane primary arterial and the elimination of an unnamed collector between Irvine Boulevard and Trabuco Road would not cause any unmitigated impacts.

Chapter 7.0
SPECIAL ISSUES

This chapter summarizes the special issues that were evaluated as part of this project traffic study.

1. "NOT APPROVED PROBABLE FUTURE" PROJECTS

This scenario presents a sensitivity run under 2025 buildout toll network conditions assuming the buildout of the Northern Sphere Area project and the inclusion of "not approved probable future" project developments. These "not approved probable future" projects have either filed applications, are expected to be included in a March 2002 ballot measure or have been announced by The Irvine Company with the intent to modify existing approved plans. This sensitivity scenario is compared to the baseline 2025 buildout toll with-project forecasts, which were presented in Chapter 5.0. These "not approved probable future" projects include Lower Peters Canyon Intensity Transfer (Irvine Planning Area 4), Irvine Spectrum Housing (Planning Areas 17, 31, 33 and 34) and the recently approved Woodbridge General Plan Amendment (Irvine Planning Area 15). The City of Irvine's proposed Great Park Plan for the former Marine Corps Air Station (MCAS) El Toro is included. The City of Irvine's proposed Master Plan of Arterial Highways (MPAH) Amendment to delete Culver Drive between Portola Parkway and SR-241 is also included. Lastly, development reductions have been assumed in the East Orange area reflecting The Irvine Company's intention to expand permanent open space within this area. Detailed land use data for these "Not Approved Probable Future" Projects is included in Appendix A.

Figures 7-1 and 7-2 show the average daily traffic (ADT) forecasts and volume/capacity (V/C) ratios for the study area circulation system for this sensitivity run. The corresponding intersection capacity utilization (ICU) values are contained in Appendix C, and include a comparison with the baseline with-project traffic forecasts under 2025 buildout toll network conditions as first presented in Chapter 5.0.

The purpose of this sensitivity run is to show the potential change in travel patterns attributed to the implementation of the "not approved probable future" projects. Compared with the baseline with-project (2025 buildout toll network conditions), decreases in volume by 1,000 to 3,000 ADT occur on Sand Canyon Avenue between Trabuco Road and Irvine Center Drive with increases in volume by 3,000 to 5,000 ADT north of Trabuco Road to Portola Parkway. Volumes on Jeffrey Road north of Trabuco Road are higher than the baseline by 2,000 to 3,000 ADT with decreases south of Trabuco Road by 1,000 to 2,000 ADT. Volumes are noticeably lower northwest of the Great Park Plan area near the SR-133 on Irvine Boulevard and Trabuco Road and higher south and southeast of the area on Alton Parkway west of I-5 and on Irvine Boulevard north of Alton Parkway which is probably due to the absence of an east-west connection through the former MCAS El Toro site. Near the Culver Drive extension deletion area, Jeffrey Road, Jamboree Road and SR-261 north of Portola Parkway increase by 3,000 to 4,000 ADT and Culver Drive decreases by 10,000 ADT south of Portola Parkway

In general, the ICUs are lower than the baseline (see summary in Appendix C). However, significant change (defined when level of service changes from acceptable to unacceptable) does occur at Jamboree Road at Portola Parkway (PM ICU changes from .89 to .93), Alton Parkway at Irvine Boulevard (AM ICU changes from .67 to .92), Bake Parkway at Rockfield Boulevard (AM and PM ICUs change from .89 and .90, respectively, to 1.04 and 1.04), and Research Drive at Trabuco Road (AM ICU changes from .79 to .94). Two intersections (Bake Parkway at Rancho Parkway South and Sand Canyon Avenue at I-5 northbound ramps) previously identified in the baseline with-project (2025 buildout toll) as operating as unacceptable is forecast to operate at acceptable levels under this scenario.

2. EL TORO AVIATION PLAN

This scenario presents the traffic conditions assuming the County's voter approved current plan for a commercial airport (28.8 MAP alternative) was implemented within the former MCAS El Toro site. Figure 7-3 presents the 2025 ADT forecasts and V/C ratios for this scenario. The corresponding ICUs are contained in Appendix C. Except for the El Toro Aviation Plan, this sensitivity run has the same land use and circulation system assumptions as included in the 2025 buildout toll scenario presented in Chapter 5. Compared with the baseline with-project (2025 buildout toll) Sand Canyon

Avenue volumes north of I-5 increase by 3,000 to 14,000 ADT. Volumes south of I-5 on Sand Canyon Avenue decrease by 2,000 to 6,000 ADT. Jeffrey Road volumes north of I-5 increase by 1,000 to 6,000 ADT. Alton Parkway and Bake Parkway immediately north of I-5 would decrease by 7,000 ADT and 15,000 ADT, respectively.

3. OAK CANYON CROSSING

This scenario presents a circulation alternative under 2025 buildout toll network conditions assuming the buildout of the Northern Sphere Area project and the inclusion of an extension of Oak Canyon from its existing terminus west of Sand Canyon Avenue to Trabuco Road (baseline 2025 buildout toll with-project forecasts were previously presented in Chapter 5.0). Figures 7-4 and 7-5 show the ADT forecasts and V/C ratios for the study area circulation system for this sensitivity run. The corresponding intersection capacity utilization (ICU) values are contained in Appendix C, and include a comparison with the baseline with-project traffic forecasts under 2025 buildout toll network conditions as first presented in Chapter 5.0.

The purpose of this sensitivity run is to show the potential change in travel patterns attributed to the implementation of the Oak Canyon connection between Sand Canyon Avenue and Trabuco Road. In addition to a low projected use of the facility with 7,000 ADT, the effects of the crossing without an I-5 connection have been largely localized. Compared with the baseline with-project (2025 buildout toll network conditions), maximum decreases of 3,000 ADT occur on Sand Canyon Avenue north and south of I-5 and 2,000 ADT on Jeffrey Road north of I-5 with minimal increases of 1,000 ADT on Roosevelt Avenue and Trabuco Road east of Jeffrey Road.

In general, the ICUs are slightly lower or unaffected compared to the baseline. However, in the immediate vicinity of the proposed connection, increased ICU values occur at Jeffrey Road and Trabuco Road (PM ICU changes from 1.04 to 1.08), Jeffrey Road and Roosevelt (AM ICU changes from 1.25 to 1.32), and Sand Canyon Avenue and Trabuco Road (PM ICU changes from 1.00 to 1.02). The conditions at Sand Canyon Avenue and Road "B" access intersection to Planning Area 40/Irvine Spectrum 8 is somewhat alleviated with the connection (PM ICU changes from 1.22 to 1.12).

The possibility of reducing the project impacts along Jeffrey Road and Sand Canyon Avenue by extending the Oak Canyon connection to Portola Parkway was analyzed. The portion of the Oak Canyon extension between Irvine Boulevard and Trabuco Road is consistent with the current City of Irvine MPAH assumption. A sensitivity run extending Oak Canyon to Portola Parkway showed that the projected volumes along Jeffrey Road and Sand Canyon Avenue with the project were not significantly modified by this extension (see comparative ADT results in Figures 7-4 and 7-5 and comparative ICU results in Table 7-1).

4. HICKS CANYON ROAD/YALE AVENUE ANALYSIS

The Irvine Unified School District (IUSD) previously acquired a site for a middle school with assumed total enrollment of 1,000 students in Planning Area 5B (PA5B). It is assumed that this school will serve the existing Northwood community to the west and PA5B and PA9. The proposed zoning for PA5B includes the easterly extension of existing Hicks Canyon Road should the middle school remain in PA5B. The proposed zoning also states that the extension of this road will not occur if the middle school is relocated outside of PA5B. The impacts of relocating the middle school to two alternative sites in Planning Area 9 (PA9) are discussed in Section 11 of this chapter.

The IUSD has indicated that it is supportive of relocating the middle school to PA9. However, the required State approval of this relocation has not yet been obtained. Thus, in the event that the middle school remains at its current location in PA5B, this section analyzes four alternative access concepts for the school and PA5B and how such access would impact Hicks Canyon Road and Yale Avenue within the existing Northwood community under 2025 buildout toll conditions as per the Scope of Work (see Appendix F). Figure 7-6 illustrates these four alternative access alternatives and the middle school traffic generation distribution for each. The four alternatives are described as follows:

1) No vehicle access to the school or school drop-off on Hicks Canyon Road. Therefore all trips would be entering and exiting to and from Jeffrey Road. In addition, there would be no access to Hicks Canyon Road by PA5B.

2) All vehicle or pedestrian access to the school would only be on Hicks Canyon Road. No vehicle access to the school or school drop-off would be possible on the east side of the school. Therefore all trips would be entering and exiting from an extension of the existing Hicks Canyon Road.

Table 7-1

2025 BUILDOUT ICU SUMMARY
(Oak Canyon Crossing and Extension to Portola Parkway)

INTERSECTION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	ALT. 1 AM	ALT. 1 PM	ALT. 2 AM	ALT. 2 PM
282. Jeffrey Rd. at Portola Pk.	.66	.56	.78	.63	.76	.64	.80	.64
283. Jeffrey Rd. at Irvine Bl.	.78	.74	.83	.90	.84	.90	.82	.88
284. Jeffrey Rd. at Bryan Av.	.94	.45	1.03*	.62	1.04	.64	1.02	.61
285. Jeffrey Rd. at Trabuco Rd.	.87	.87	1.02*	1.04*	1.01	1.08	.98	1.05
286. Jeffrey Rd. at Roosevelt	1.25	.89	1.25	1.01*	1.32	.91	1.34	.92
287. Jeffrey Rd. at I-5 NB Ramps	.62	.72	.71	.82	.69	.79	.70	.80
288. Jeffrey Rd. at Walnut Av.	.79	.71	.85	.79	.82	.77	.85	.78
300. Sand Cyn. Av. at Portola	.53	.57	.64	.61	.64	.59	.64	.58
301. Sand Cyn. Av. at Irvine Bl.	.81	.71	.94*	.84	.95	.84	.95	.85
302. Sand Cyn. Av. at Trabuco	.91	.90	1.05*	1.00*	1.02	1.02	1.00	.95
303. Sand Cyn. Av. at I-5 NB Ramps	.55	.83	.67	.95*	.65	.95	.66	.92
304. Sand Cyn. Av. at Marine Wy.	.59	1.01	.67	1.04*	.64	1.01	.64	1.01
305. Sand Cyn. Av. at I-5 SB Ramps	.94	.78	1.07*	.86	1.04	.85	1.06	.85
306. Sand Cyn. Av. at Oak Cyn.	.79	.76	.81	.79	.86	.79	.87	.79
482. Road "A" at Trabuco Rd.	.53	.49	.60	.53	.55	.56	.66	.59
483. Road "C" at Trabuco Rd.	.57	.43	.68	.55	.63	.54	.62	.50
484. Sand Canyon Av. at Roosevelt	.78	.83	.83	1.02*	.78	1.00	.79	.95
485. Sand Canyon Av. at Road "B"	.88	1.16	.95*	1.22*	.89	1.12	.88	1.13
519. Collector St. at Irvine Bl.	.70	.57	.80	.95*	.79	.88	.86	.88
520. Collector St. at Trabuco	.54	.31	.77	.38	.72	.39	.69	.35

ALT. 1 - Oak Canyon I-5 crossing to Trabuco Road with-project
ALT. 2 - Oak Canyon extension to Portola Parkway with-project

* Exceeds City of Irvine's performance criteria

3) Vehicle and pedestrian access to the school would be possible via Hicks Canyon Road on the west side and a PA5B internal roadway system on the east side. However, there would be no connection to allow through traffic on Hicks Canyon Road between Yale Avenue and Jeffrey Road.

4) Vehicle and pedestrian access would be possible from either side of the school. In addition, a connection is assumed that would allow through traffic on Hicks Canyon Road between Yale Avenue and Jeffrey Road.

Based on the capacity constraints at the intersection of Yale Avenue and Irvine Boulevard and roadway characteristics of the proposed extension of Hicks Canyon Road to Jeffrey Road, it has been assumed for Alternative 4 that approximately 40 percent of the traffic oriented to and from the southeast of PA5 and PA5B would utilize the extension of Hicks Canyon Road. It should be noted that no bypass traffic is assumed utilizing Orange Arrow to access the school in Alternatives 2 through 4.

Figure 7-7 shows the existing conditions for this area which form the basis for the future forecasts along Yale Avenue. Figures 7-8 through 7-12 illustrate the projected 2025 buildout toll ADT forecasts associated with the baseline conditions (no middle school or PA5B uses) and each alternative which assumes with-project conditions. It should be noted that the with-project forecasts presented in this section differ from the 2025 buildout toll with-project forecasts in Chapter 5.0. The forecasts presented in Chapter 5.0 assume that the entire project in Planning Area 5B (including the proposed middle school and residential community) will have access to Yale Avenue and Jeffrey Road via a Hicks Canyon Road connection with no possibility of through traffic. Table 7-2 summarizes the corresponding ICU values. Figure 7-13 shows the lane configurations assumed in these ICU calculations. Using the City's performance guidelines discussed in Chapter 1.0, the intersection of Yale Avenue and Irvine Boulevard is adversely impacted in Alternatives 1, 2 and 3. This finding is consistent with the 2025 buildout toll with-project forecasts. The proposed mitigation for this intersection was also introduced in Chapter 5.0 and involves the addition of a second northbound left-turn lane resulting in level of service "D" for both the AM and PM peak hour.

It should be noted that although Hicks Canyon Road east of Jeffrey Road is analyzed here for impacts by the middle school. However, the school would still be obligated to provide an analysis to satisfy the California Environment Quality Act (CEQA) requirements. Site issues (i.e., access and off-site impacts) will be further studied in this document.

(Text continued on page 7-21)

Table 7-2

ICU SUMMARY
(2025 Buildout Toll Conditions)

	Count		Baseline		Alt. 1		Alt. 2		Alt. 3		Alt. 4	
INTERSECTION	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1. Yale Av & Portola Pkwy	.41	.18	.64	.48	.73	.55	.75	.55	.72	.55	.72	.55
2. Yale Av & Arborwood	.37	.19	.40	.19	.42	.19	.43	.20	.40	.19	.43	.20
3. Yale Av & Meadowood	.25	.23	.28	.25	.28	.25	.32	.26	.29	.25	.38	.28
4. Yale Av & Hicks Cyn	.31	.24	.31	.25	.31	.25	.39	.27	.33	.26	.37	.30
5. Yale Av & Orange Arrow	.31	.19	.35	.22	.36	.22	.37	.22	.35	.22	.29	.20
6. Yale Av & Park Place	.49	.30	.53	.30	.54	.30	.55	.31	.53	.30	.43	.27
7. Yale Av & Irvine Bl	.59	.55	.99*	.74	1.03*	.80	1.05*	.80	1.02*	.80	.85	.80

* Exceeds level of service “D”

NOTES:

See Figure 7-6 for alternatives.

Baseline does not include a middle school or other land uses in Planning Area 5B (No-Project).
Baseline and Alts. 1, 2 and 3 reflect conditions in which there is no connection of Hicks Canyon Road to Jeffrey Road.
Alt. 4 include Hicks Canyon Road connection to Jeffrey Road.

Hicks Canyon Road East of Yale Avenue Analysis

Table 7-3 shows comparative traffic volumes on Hicks Canyon Road east of Yale Avenue for the four middle school access alternatives. The first (Alternative 1) is labeled the “base case” since no school traffic would use Hicks Canyon Road to access the school. Under Alternative 2, in which all school access is via Hicks Canyon Road, the ADT increases by 1,000 (from 2,400 in the base case to 3,400). The corresponding AM peak hour increase is 300 (from 210 to 510). For Alternative 3, in which school access is shared between Yale Avenue and Jeffrey Road, the base case ADT would increase from 2,400 to 2,700 (an increase of 300) and the AM peak hour would increase from 210 to 310 (an of increase of 100). In Alternative 4, which connects Hicks Canyon Road between Yale Avenue and Jeffrey Road, school traffic would be the same as in Alternative 3, but a component of through traffic would also be added. The ADT would increase from 2,400 in the base case to 5,700. The corresponding AM peak hour increase would be from 210 to 440.

Presently, the segment of Hicks Canyon Road east of Yale Avenue is a cul-de-sac simply because it has yet to be constructed to join Jeffrey Road and is a 48-foot wide unstriped street with parking allowed and no driveways or residences fronting on the street which indicates that operationally the roadway is a collector. Hicks Canyon Road on the west side of Yale Avenue is also 48 feet wide and striped with two travel lanes, two bike lanes and a center two-way left-turn lane which is posted for a 40 miles per hour (mph) speed limit, all of which are indicative of a street operating as a collector. Hicks Canyon Road east of Yale Avenue, which is comparable in design to Hicks Canyon Road west of Yale Avenue as a collector, should be similarly striped with speed limit similarly posted.

Hicks Canyon Road east of Yale Avenue possesses some curvature in alignment with a few residential street intersections situated along its length. The design as it exists today met previous sight distance standards in 1977 when the roadway system in this area was built. Since then, the City of Irvine has changed the sight distance standards. According to the actual as-built street improvement plan as represented in Figure 7-14, the street design for sight distance complies with the current City of Irvine standards assuming that bike lanes are striped and red curb areas are designated which would allow the relocation of the limit lines. At a minimum, on-street parking will be eliminated wherever red curb areas are designated. Additional traffic due to the middle school and/or new housing in Alternatives 2 through 4 will not affect sight distance but increase the duration of wait time for side streets at each

Table 7-3

TRAFFIC VOLUME COMPARISON
(Hicks Canyon Road)

	ADT	AM PEAK HOUR
Base (Alt. 1)	2,400	210
-No School Traffic		
School Alt. 2	1,000	300
School + Base	3,400	510
(School %)	29%	59%
School Alt. 3	300	100
School + Base	2,700	310
(School %)	11%	32%
Non-School	3,000	130
School Alt. 4	300	100
School + Base + Non-School	5,700	440
(School %)	5%	23%

intersection. However, level of service along this segment of Hicks Canyon Road as discussed below would still be adequate.

The City of Irvine standard capacity for a two-lane collector roadway is 13,000 ADT. Examination of the alternatives indicates that simply constructing the school alone with 3,400 ADT or in combination with through traffic (resulting in 5,700 ADT) would not cause the capacity of Hicks Canyon Road to be exceeded (projected to be operating at level of service "A").

The City's peak hour link capacity analysis uses a basic peak hour capacity in one direction of 1,600 vehicles per hour (vph). All of the alternatives have peak hour volumes that would not exceed either the link capacity or intersection capacity on Hicks Canyon Road. The percentage difference (i.e., with and without the school) varies substantially, with Alternative 2 being the highest, and the increase being most notable in the AM peak hour. Because of the peaking characteristics of a school, this is the only time that school traffic would have some level of impact in terms of driveway access. However, even the highest volume (510 in two directions) is well below the maximum flow of 1,600 vph in one direction for continuous flow and would lead to the conclusion that adequate gaps would be available for driveway access.

Signal Warrants

Signal warrants are also performed for the intersections along Yale Avenue analyzed here with the exception of Orange Arrow which is already proposed for signal installation and Portola Parkway and Irvine Boulevard which are already signalized. Traffic signal warrants based on peak hour volumes as adopted by the Federal Highway Administration and Caltrans were used here to determine the need for signalization. In applying this warrant, the volumes of both the major and minor street must meet or exceed those shown on the curves in Figures 7-15 and 7-16 under rural and urban conditions, respectively.

Determining the major street signal warrant volume involves calculating the number of vehicles approaching the intersection on both major street legs. The minor street peak hour signal warrant volume is the number of peak hour vehicles approaching the intersection on only the highest volume leg.

Rural or urban classifications are determined by the speed on the major street. Warrants are based on rural when the speed on the major street is 40 mph or higher. For urban areas, the speed on the major street is 35 mph or lower. Speeds on Yale Avenue are expected to be higher than 35 mph therefore the signal warrants for intersections along Yale Avenue are based on rural.

A signal warrant analysis was carried out for the Yale Avenue intersections using the forecast approach volumes previously shown in Figures 7-8 through 7-12. The signal warrant volumes are summarized in Table 7-4. Based on the application of the warrant, traffic signals need to be installed at all intersections along Yale Avenue under baseline (no-project) conditions with the exception of Yale Avenue and Meadowood which meets signal warrants only when access to Hicks Canyon Road east of Yale Avenue is provided. Typically, signals are not installed until actual volumes meet or exceed the warrants.

5. PERFORMANCE CRITERIA

Figure 7-17 shows the intersections of which the performance criteria would be changed to allow a threshold of 1.00 (level of service (LOS) “E”) as acceptable. Currently, the City of Irvine recognizes LOS “E” as acceptable for locations within the Irvine Business Complex (IBC)/PA36 and Irvine Center/PA33, and the Bake Parkway/I-5 northbound ramps and Congestion Management Program (CMP) intersections. If LOS “E” was adopted for the additional intersection locations in Figure 7-17, the resulting 2007, 2025 (constrained and buildout toll networks) and Post-2040 locations needing mitigation would be less. Table 7-5 is a summary of previously identified impacted locations (using LOS “D” as the criteria) taken from each of the impact analysis chapters of this report (Chapters 4.0 through 6.0) which is marked to show the locations deleted if the LOS “E” criteria was adopted. By implementing the level of service “E” (or ICU = 1.00) as acceptable, six locations in the 2025 constrained toll network scenario, four in the 2025 buildout toll network scenario and five in Post-2040 will no longer need project mitigation. In addition, mitigation for intersection #484. Sand Canyon Avenue at Roosevelt Avenue under 2025 (constrained toll and buildout toll) and Post-2040 conditions would be reduced (see Table 7-6 for an amended summary of mitigation measures with revised performance criteria). LOS “E” conditions were described in Chapter 1.0.

Table 7-4

PEAK HOUR SIGNAL WARRANT SUMMARY
(Hicks Canyon Road/Yale Avenue Analysis)

		Baseline		ALT. 1		ALT. 2		ALT. 3		ALT. 4	
INTERSECTION	DIRECTION	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Yale & Arborwood											
Major Approach	Northbound	220	70	220	70	220	70	220	70	220	70
	Southbound	330	180	350	190	380	190	330	180	380	190
	Total	550	250	570	260	600	260	550	250	600	260
Minor Approach	Westbound	350	140	360	140	390	160	350	140	350	140
Satisfies Warrant (Rural)?		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Yale & Meadowood											
Major Approach	Northbound	320	240	320	240	370	270	340	250	340	310
	Total	320	240	320	240	370	270	340	250	340	310
Minor Approach	Westbound	300	190	300	190	360	190	310	190	430	190
Satisfies Warrant (Rural)?		No	No	No	No	Yes	No	Yes	No	Yes	No
Yale & Hicks Canyon											
Major Approach	Northbound	300	380	310	380	390	390	320	380	380	400
	Southbound	390	180	390	180	470	190	420	180	450	180
	Total	690	560	700	560	860	580	740	560	830	580
Minor Approach	Westbound	160	100	160	100	280	150	200	120	150	200
Satisfies Warrant (Rural)?		Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes
Yale & Park Place											
Major Approach	Northbound	480	870	500	870	550	880	480	870	470	710
	Southbound	760	300	770	300	820	320	760	300	520	340
	Total	1,240	1,170	1,270	1,170	1,370	1,200	1,240	1,170	990	1,050
Minor Approach	Eastbound	280	130	290	130	290	130	290	130	290	130
Satisfies Warrant (Rural)?		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 7-5

REVISED SUMMARY OF IMPACTED INTERSECTIONS
(LOS "E" Performance Criteria)

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM
2007								
127. Jamboree Rd & El Camino Real	.65	.94	.66	.96	.01	.02	-	c
133. Jamboree Rd at Edinger Av	1.03	.64	1.05	.65	.02	.01	c	-
485. Sand Cyn Av at Road "B"	.81	1.19	.82	1.21	.01	.02	-	c
2025 CONSTRAINED								
34. Red Hill Av at Irvine Bl	.94	1.04	.97	1.05	.03	.01	c	-
91. Tustin Ranch Rd at Irvine Bl	1.14	1.09	1.18	1.11	.04	.02	c	c
127. Jamboree Rd at El Camino Real	.65	.92	.67	.95	.02	.03	-	c
222. Culver Dr at Trabuco Rd	.66	1.03	.69	1.09	.03	.06	-	c
223. Culver Dr at I-5 SB Ramps	.74	.93	.75	1.02	.01	.09	-	c
224. Culver Dr at Walnut Av	.90	.87	.93	.91	.03	.04	p	p
235. Culver Dr at University Dr	.94	.99	.97	1.01	.03	.02	c	c
249. Yale Av at Irvine Bl	.90	.68	.99	.79	.09	.11	p	-
283. Jeffrey Rd at Irvine Bl	.77	.75	.99	.90	.22	.15	p	p
284. Jeffrey Rd at Bryan Av	.92	.44	.99	.62	.07	.18	c	-
285. Jeffrey Rd at Trabuco Rd	.89	.78	.96	1.02	.07	.24	p	p
286. Jeffrey Rd at Roosevelt	1.27	.86	1.26	1.00	-.01	.14	-	p
288. Jeffrey Rd at Walnut Av	.93	.84	1.01	.97	.08	.13	c	p
289. Jeffrey Rd at ICD	.87	1.00	.87	1.08	.00	.08	-	c
~~301. Sand Cyn Av at Irvine Bl~~	~~.67~~	~~.59~~	~~.96~~	~~.74~~	~~.29~~	~~.15~~	~~p~~	
302. Sand Cyn Av at Trabuco Rd	1.00	1.00	1.08	1.12	.08	.12	c	c
~~303. Sand Cyn Av at I-5 NB Ramps~~	~~.51~~	~~.81~~	~~.67~~	~~1.00~~	~~.16~~	~~.19~~	~~-~~	~~p~~
304. Sand Cyn Av at Marine Wy	.57	.98	.66	1.06	.09	.08	-	c
305. Sand Cyn Av at I-5 SB Ramps	.91	.76	1.08	.86	.17	.10	c	-
311. Sand Cyn Av at I-405 NB Ramps	.91	.55	.95	.55	.04	.00	c	-
~~317. SR-133 NB Ramps at Irvine Bl~~	~~.84~~	~~.69~~	~~.91~~	~~.82~~	~~.07~~	~~.13~~	~~p~~	~~-~~
362. Bake Pkwy at Irvine Bl	1.24	.81	1.27	.86	.03	.05	c	-
364. Bake Plwy at Jeronimo Rd	1.19	.90	1.14	.91	-.05	.01	-	p
~~366. Bake Pkwy at Rockfield Bl~~	~~.89~~	~~.94~~	~~.91~~	~~.95~~	~~.02~~	~~.01~~	~~p~~	~~-~~
367. Bake Pkwy at I-5 NB Ramps	1.01	.63	1.03	.65	.02	.02	c	-
~~368. Bake Pkwy at I-5 SB Ramps~~	~~.88~~	~~.92~~	~~.89~~	~~.94~~	~~.01~~	~~.02~~	~~-~~	~~c~~
484. Sand Cyn Av at Roosevelt Av	.80	.81	.84	1.01	.04	.20	-	p
485. Sand Cyn Av at Road "B"	.85	1.14	.95	1.24	.10	.10	p	c
~~490. Research Dr at Trabuco Rd~~	~~.79~~	~~.90~~	~~.83~~	~~.91~~	~~.04~~	~~.01~~	~~-~~	~~p~~
507. Bake Pkwy at Millennium Bl	.95	.98	.99	1.02	.04	.04	c	c
512. Irvine Bl at Trabuco Rd	.87	.86	.92	.90	.05	.04	p	-
515a. Bake Pkwy at Rancho Pkwy N	.98	1.22	1.00	1.22	.02	.00	c	-
2025 BUILDOUT								
34. Red Hill Av at Irvine Bl	.95	1.03	.97	1.06	.02	.03	c	c
91. Tustin Ranch Rd at Irvine Bl	.96	.93	.97	.95	.01	.02	-	c
125. Jamboree Rd at Irvine Bl	.97	.85	1.01	.88	.04	.03	c	-
223. Culver Dr at I-5 SB Ramps	.72	.90	.77	1.00	.05	.10	-	p
224. Culver Dr at Walnut Av	.91	.87	.94	.91	.03	.04	c	p

(Continued)

Table 7-5 (cont.)
REVISED SUMMARY OF IMPACTED INTERSECTIONS
(LOS "E" Performance Criteria)

LOCATION	NO-PROJECT AM	NO-PROJECT PM	WITH-PROJECT AM	WITH-PROJECT PM	DIFFERENCE AM	DIFFERENCE PM	IMPACT AM	IMPACT PM
2025 BUILDOUT (cont.)								
249. Yale Av at Irvine Bl	.99	.73	1.03	.84	.04	.11	c	-
284. Jeffrey Rd at Bryan Av	.94	.45	1.03	.62	.09	.17	c	-
285. Jeffrey Rd at Trabuco Rd	.87	.87	1.02	1.04	.15	.17	p	p
286. Jeffrey Rd at Roosevelt	1.25	.89	1.25	1.01	.00	.12	-	p
289. Jeffrey Rd at ICD	.86	1.00	.90	1.08	.04	.08	-	c
~~301. Sand Cyn Av at Irvine Bl~~	~~.81~~	~~.71~~	~~.94~~	~~.84~~	~~.13~~	~~.13~~	~~p~~	~~-~~
302. Sand Cyn Av at Trabuco Rd	.91	.90	1.05	1.00	.14	.10	c	p
~~303. Sand Cyn Av at I-5 NB Ramps~~	~~.55~~	~~.83~~	~~.67~~	~~.95~~	~~.12~~	~~.12~~	~~-~~	~~p~~
304. Sand Cyn Av at Marine Wy	.59	1.01	.67	1.04	.08	.03	-	c
305. Sand Cyn Av at I-5 SB Ramps	.94	.78	1.07	.86	.13	.08	c	p
311. Sand Cyn Av at I-405 NB Ramps	.95	.56	.97	.56	.02	.00	c	-
321. Laguna Cyn Rd at Old Laguna Cyn Rd	.86	.90	.88	.94	.02	.04	-	p
406. Laguna Cyn Rd at Lake Forest Dr	1.13	.89	1.15	.95	.02	.06	c	p
484. Sand Cyn Av at Roosevelt Av	.78	.83	.83	1.02	.05	.19	-	p
485. Sand Cyn Av at Road "B"	.88	1.16	.95	1.22	.07	.06	p	c
~~507. Bake Pkwy at Millennium Bl~~	~~.94~~	~~.93~~	~~.96~~	~~.96~~	~~.02~~	~~.03~~	~~c~~	~~c~~
515a. Bake Pkwy at Rancho Pkwy N	.88	1.22	.91	1.21	.03	-.01	p	-
515b. Bake Pkwy at Rancho Pkwy S	.89	.82	.92	.84	.03	.02	p	-
POST-2040								
34. Red Hill Av at Irvine Bl	.93	1.01	.95	1.02	.02	.01	c	-
91. Tustin Ranch Rd at Irvine Bl	.93	.88	.96	.89	.03	.01	c	-
223. Culver Dr at I-5 SB Ramps	.74	.93	.76	.98	.02	.05	-	c
224. Culver Dr at Walnut Av	.93	.87	.96	.91	.03	.04	c	p
249. Yale Av at Irvine Bl	.94	.73	1.02	.83	.08	.10	c	-
284. Jeffrey Rd at Bryan Av	.96	.46	1.02	.65	.06	.19	c	-
285. Jeffrey Rd at Trabuco Rd	.90	.88	1.00	1.05	.10	.17	p	p
286. Jeffrey Rd at Roosevelt	1.25	.90	1.27	1.02	.02	.12	c	p
289. Jeffrey Rd at ICD	.86	1.04	.91	1.11	.05	.07	p	c
~~301. Sand Cyn Av at Irvine Bl~~	~~.78~~	~~.69~~	~~.95~~	~~.83~~	~~.17~~	~~.14~~	~~p~~	~~-~~
302. Sand Cyn Av at Trabuco Rd	.95	.94	1.07	1.01	.12	.07	c	c
303. Sand Cyn Av at I-5 NB Ramps	.55	.88	.65	1.07	.10	.19	-	p
304. Sand Cyn Av at Marine Wy	.59	1.05	.69	1.12	.10	.07	-	c
305. Sand Cyn Av at I-5 SB Ramps	.95	.82	1.10	.92	.15	.10	c	p
~~306. Sand Cyn Av at Oak Cyn~~	~~.82~~	~~.88~~	~~.89~~	~~.93~~	~~.07~~	~~.05~~	~~-~~	~~p~~
311. Sand Cyn Av at I-405 NB Ramps	1.00	.59	1.05	.61	.05	.02	c	-
~~316. SR-133 SB Ramps at Irvine Bl~~	~~.89~~	~~.56~~	~~.98~~	~~.68~~	~~.09~~	~~.12~~	~~p~~	~~-~~
452. Jamboree Rd at Santiago Cyn Rd	.88	.89	.91	.90	.03	.01	p	-
484. Sand Cyn Av at Roosevelt Av	.78	.84	.84	1.05	.06	.21	-	p
485. Sand Cyn Av at Road "B"	.89	1.14	.99	1.23	.10	.09	p	c
~~490. Research Dr at Trabuco Rd~~	~~.72~~	~~.85~~	~~.78~~	~~.91~~	~~.06~~	~~.06~~	~~-~~	~~p~~
~~507. Bake Pkwy at Millennium Bl~~	~~.95~~	~~.98~~	~~.97~~	~~1.00~~	~~.02~~	~~.02~~	~~c~~	~~c~~
515a. Bake Pkwy at Rancho Pkwy N	.89	1.11	.90	1.14	.01	.03	-	c
519. Collector St at Irvine Bl	.65	.55	.77	.91	.12	.36	-	p

Note: Locations no longer needing mitigation because of change in level of service from "D" to "E" are shown with a strikeout.
p - project causes deficiency c - project contributes to deficiency
Level of service ranges: A=.00 - .60 B=.61 - .70 C=.71 - .80 D=.81 - .90 E=.91 - 1.00 F=Above 1.00

Table 7-6

REVISED MITIGATION LANES FOR IMPACTED INTERSECTIONS
(LOS “E” Performance Criteria)

LOCATION		— SB —			— WB —			— NB —			— EB —		
		L	T	R	L	T	R	L	T	R	L	T	R
34. Red Hill at Irvine	25C,25B,BO	1	2	0	1	3	0	2	1	1	1	3	0
	Mit.						d						
	Alt. Mit.	ATMS (City of Tustin)											
91. Tustin Ranch at Irvine	25C	1	3	f	2	2	1	1	3	1	2	3	1
	25B,BO					3							
	Mit.							2					
	Alt. Mit.	ATMS (City of Tustin)											
125. Jamboree at Irvine	25B	2	3	f	2	3	d	2	3	1	2	3	1
	Mit.	ATMS (City of Tustin)					(mit. not needed at BO)						
127. Jamboree at El Camino Real	07,25C	1	4	d	2	2	0	2	4	1	1	1	2
	Mit.	ATMS (City of Tustin)					(mit. not needed at 25B or BO)						
133. Jamboree at Edinger	07	2	0	1	2	3	1	2	0	f	2	3	1
	Mit.	ATMS (City of Tustin)					(mit. not needed at 25C,25B or BO)						
223. Culver at I-5 SB Ramps	25C	0	3	f	0	0	0	0	3	f	1.5	0	1.5
	25B,BO										2		2
	Mit.								4				
	Alt. Mit.										3		2
224. Culver at Walnut	25C,25B,BO	2	3	d	2	2	d	2	3	1	2	2	0
	Mit.					3							d
	Alt. Mit.	ATMS &											d
235. Culver at University	25C	1	3	0	2	3	d	1	3	d	2	3	0
	Mit.	(mit. not needed at 25B or BO)							2	2			
249. Yale at Irvine Bl	25C,25B,BO	1	2	d	1	3	d	1	2	d	1	3	d
	Mit.	2											
282. Jeffrey at Portola	25C	0	1	1	2	3	0	1	1	f	1	2	1
	Mit.	(mit. not needed at 25B or BO)										3	0
283. Jeffrey at Irvine	25C	2	3	1	2	2	1	2	3	1	1	2	1
	Mit.	(mit. not needed at 25B or BO)										3	
284. Jeffrey at Bryan	25C,25B,BO	1	3	1	1	1	0	2	3	d	1.5	.5	d
	Mit.										1		1.5
285. Jeffrey at Trabuco	25C,25B,BO	1	3	d	1	2	0	2	3	1	1	2	1
	Mit.	2	4		2		d				2		
286. Jeffrey at Roosevelt	25C,25B,BO	2	3	d	2	1	1	1	4	d	1	1	1
	Mit.					2	d					2	d
289. Jeffrey at ICD	25C,25B,BO	2	3	1	2	3	1	2	3	1	2	4	f
	25C Mit.	3							4				
	25C Alt. Mit.	3	& ATMS										
	25B,BO Mit.	3											

Continued

Table 7-6 (cont.)
REVISED MITIGATION LANES FOR IMPACTED INTERSECTIONS
(LOS “E” Performance Criteria)

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
~~301. Sand Cyn at Irvine~~	~~25C,25B,BO~~	~~2~~	~~3~~	~~1~~	~~2~~	~~3~~	~~1~~	~~2~~	~~3~~	~~1~~	~~2~~	~~3~~	~~1~~
	~~Mit.~~											~~4~~	
302. Sand Cyn at Trabuco	25C,25B,BO	2	3	d	2	2	0	2	3	1	2	2	1
	Mit.				3	3						3	
303. Sand Cyn at I-5 NB Ramps	~~25C~~	~~1~~	~~2~~	~~1~~	~~1~~	~~1~~	~~0~~	~~2~~	~~2~~	~~0~~	~~1.5~~	~~.5~~	~~1~~
	~~25C Mit.~~			~~f~~					~~3~~				
	~~25B,~~BO	0	3						3		2	1	
	~~25B,BO~~ Mit.			f									
304. Sand Cyn at Marine	25C	2	2	0	1	0	1	0	2	1	0	0	0
	25C Mit.								3				
	25B,BO		3		2				3	2			
	25B,BO Mit.								4				
305. Sand Cyn at I-5 SB Ramps	25C	2	2	0	0	0	0	0	2	d	1.5	0	1.5
	25C Mit.								3		2.5		
	25B,BO		3						3				
	25B,BO Mit.										2.5		
~~306. Sand Cyn at Oak Cyn.~~	~~BO~~	~~1~~	~~3~~	~~d~~	~~2~~	~~1~~	~~1~~	~~1~~	~~3~~	~~1~~	~~2~~	~~1~~	~~d~~
	~~Mit.~~	~~2~~				~~.5~~	~~1.5~~						
311. Sand Cyn at I-405 NB Ramps	25C,25B,BO	0	2	f	.5	0	1.5	0	2	f	0	0	0
	Mit.				1		2						
316. SR-133 SB Ramps at Irvine	BO	1.5	0	1.5	1	3	0	0	0	0	0	3	d
	Mit.											4	
~~317. SR-133 NB Ramps at Irvine~~	~~25C~~	~~0~~	~~0~~	~~0~~	~~0~~	~~3~~	~~0~~	~~1~~	~~0~~	~~2~~	~~0~~	~~3~~	~~f~~
	~~Mit.~~							~~1.5~~		~~2.5~~			
	~~Alt. Mit.~~	~~ATMS (mit. not needed at BO)~~											
321. LCR at Old LCR	25B	0	3	1	0	0	0	2	3	0	3	0	f
	Mit.							3					
362. Bake at Irvine	25C	2	3	1	2	3	1	1	3	1	2	3	1
	Mit.							2		d			
364. Bake at Jeronimo	25C	1	3	d	1	2	0	1	3	d	2	2	1
	Mit.*				2								
	Alt. Mit.	ATMS (mit. or alt. mit. not needed at 25B or BO)											
~~366. Bake at Rockfield~~	~~25C~~	~~2~~	~~4~~	~~1~~	~~2~~	~~2~~	~~f~~	~~2~~	~~4~~	~~f~~	~~1~~	~~2~~	~~f~~
	~~Mit.~~		~~5~~	~~0~~									~~1~~
	~~Alt. Mit.~~	~~ATMS (mit. not needed at BO)~~											
367. Bake at I-5 NB Rmps	25C	0	3	f	1.5	0	1.5	0	4	f	0	0	0
	Mit.						2.5						
~~368. Bake at I-5 SB Rmps~~	~~25C~~	~~0~~	~~3~~	~~f~~	~~0~~	~~0~~	~~0~~	~~0~~	~~3~~	~~f~~	~~3~~	~~0~~	~~2~~
	~~Mit.~~	~~(mit. not needed at BO)~~							~~4~~				
406. LCR at Lake Forest	25B	2	3	0	1	0	f	0	3	1	0	0	0
	Mit.				2								

(Continued)

Table 7-6 (cont.)
REVISED MITIGATION LANES FOR IMPACTED INTERSECTIONS
(LOS “E” Performance Criteria)

LOCATION		SB L	SB T	SB R	WB L	WB T	WB R	NB L	NB T	NB R	EB L	EB T	EB R
452. Jamboree at Santiago Cyn	BO	2	3	d	2	3	d	2	2	1	2	2.5	1.5
	Mit.		4										
484. Sand Cyn at Roosevelt	25C,25B,BO	1	3	0	1	1	0	1	3	0	1	1	0
	25C,25B Mit.			~~d~~			~~d~~			d			~~d~~
	BO Mit.						d						
485. Sand Cyn at Road “B”	07,25C,25B,BO	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.			d	2		d	2					1
~~490. Research at Trabuco~~	~~25C,BO~~	~~1~~	~~1~~	~~f~~	~~1~~	~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~3~~	~~1~~
	~~Mit.~~	~~(mit. not needed at 25B)~~						~~2~~					
507. Bake at Millennium	25C~~,25B,BO~~	1	4	f	2	2	0	2	4	1	2	1	f
	25C Mit.		5	0									
	~~25B,BO Mit.~~					~~3~~	~~d~~					~~2~~	
512. Irvine at Trabuco	25C	2	3	f	2	3	f	2	3	d	2	3	f
	Mit.		4		(mit. not needed at BO)								
515a. Bake at Rancho North	25C,25B,BO	1	2	0	2	0	2	0	2	d	0	0	0
	Mit.				2.5		1.5						
515b. Bake at Rancho South	25B	0	2	1	0	0	0	1	2	0	2	0	1
	Mit.			f	(mit not needed at BO)								

* Due to right-of-way constraints, the need for mitigation at this intersection will be re-evaluated in future studies to determine if an alternative mitigation is acceptable.

Note: This table is an amended mitigation measure summary showing locations no longer needing mitigation or needing less mitigation because of change in level of service from “D” to “E” (indicated with a strikeout).

Abbreviations (in alphabetical order):

07	2007 Conditions
25B	2025 Buildout Toll Conditions
25C	2025 Constrained Toll Conditions
Alt. Mit.	Alternative mitigation (for locations within the City of Irvine improvements are subject to approval by the City)
ATMS	Advanced Transportation Management System - The use of ATMS as a mitigation measure is discretionary and subject to subsequent review and approval by the Director of Public Works. The ATMS program involves a variety of actions such as camera surveillance and centralized system control, and is part of traffic signal system improvements planned for implementation over time.
BO	Post-2040 Buildout Toll-Free Conditions
Cyn	Canyon
d	de facto right-turn
f	free right-turn
ICD	Irvine Center Drive
LCR	Laguna Canyon Road
L,T,R	left, through, right
Mit.	Mitigation
SB,WB,NB,EB	southbound, westbound, northbound, eastbound

6. IRVINE SPECTRUM TRIP REDUCTION

This scenario presents a sensitivity run comparing the buildout of the project during Post-2040 and toll-free conditions on the corridors in which peak hour trip reductions are reflected for the successful trip reduction program (Spectrumotion) implemented by The Irvine Company. Data was collected for Planning Area 13/Irvine Spectrum 4 and Planning Area 32/Irvine Spectrum 3 and compared with the adopted ITAM peak hour trip rates. Based on this trip monitoring data, the reduction is applied to the model forecasting by decreasing AM and PM inbound and outbound trips to and from Planning Area 13/Irvine Spectrum 4 and Planning Area 32/Irvine Spectrum 3 by 41 and two percent, respectively. Figures 7-18 and 7-19 show the ADT forecasts and V/C ratios for the study area circulation system for this sensitivity run. The corresponding ICUs are contained in Appendix C.

Two locations (#306. Sand Canyon Avenue at Oak Canyon and #490. Research Drive at Trabuco Road) change from operating at unacceptable to acceptable levels with the Irvine Spectrum trip reduction (AM and PM peak hour ICUs = .84 and .88 for Sand Canyon Avenue at Oak Canyon and PM peak hour = .87 for Research Drive at Trabuco Road). Furthermore, if LOS “E” was adopted for the additional locations, two less intersections, #301. Sand Canyon Avenue at Irvine Boulevard and #316. SR-133 southbound ramps at Irvine Boulevard, for Post-2040 with Irvine Spectrum trip reduction would be needing mitigation (see Table 7-7 for an amended summary of Post-2040 mitigation measures with Irvine Spectrum trip reduction and also with revised performance criteria).

7. CIRCULATION PHASING REPORT INTERSECTIONS

There are several locations included in this analysis that are identified as impacted Circulation Phasing Report intersections by a July 12, 1999, action of the Transportation and Infrastructure Commission. Table 7-8 presents the corresponding 2007 ICU results for these locations. It should be noted that the ICUs listed here may be different from the Circulation Phasing report because of the updated modeling assumptions reflected throughout this current traffic study. The updated model includes more recent land use and network assumptions that would affect the trip generation and trip distribution in the analysis area. Also, key roadway links and intersection locations in the study area

Table 7-7

MITIGATION LANES FOR POTENTIALLY IMPACTED POST-2040 INTERSECTIONS
(Irvine Spectrum Trip Reduction)

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
34. Red Hill at Irvine	Base	1	2	0	1	3	0	2	1	1	1	3	0
	Mit.						d						
	Alt. Mit.	ATMS (City of Tustin)											
91. Tustin Ranch at Irvine	Base	1	3	f	2	3	1	1	3	1	2	3	1
	Mit.							2					
	Alt. Mit.	ATMS (City of Tustin)											
223. Culver at I-5 SB Ramps	Base	0	3	f	0	0	0	0	3	f	2	0	2
	Mit.								4				
	Alt. Mit.										3		2
224. Culver at Walnut	Base	2	3	d	2	2	d	2	3	1	2	2	0
	Mit.					3							d
	Alt. Mit.	ATMS &											d
249. Yale at Irvine Bl	Base	1	2	d	1	3	d	1	2	d	1	3	d
	Mit.	2											
284. Jeffrey at Bryan	Base	1	3	1	1	1	0	2	3	d	1.5	.5	d
	Mit.										1		1.5
285. Jeffrey at Trabuco	Base	1	3	d	1	2	0	2	3	1	1	2	1
	Mit.	2	4		2		d				2		
286. Jeffrey at Roosevelt	Base	2	3	d	2	1	1	1	4	d	1	1	1
	Mit.					2	d					2	d
289. Jeffrey at ICD	Base	2	3	1	2	3	1	2	3	1	2	4	f
	Mit.	3											
301. Sand Cyn at Irvine*	Base	2	3	1	2	3	1	2	3	1	2	3	1
	Mit.											4	
302. Sand Cyn at Trabuco	Base	2	3	d	2	2	0	2	3	1	2	2	1
	Mit.				3	3						3	
303. Sand Cyn at I-5 NB Ramps	Base	0	3	1	1	1	0	2	3	0	2	1	1
	Mit.			f									
304. Sand Cyn at Marine	Base	2	3	0	2	0	1	0	3	2	0	0	0
	Mit.								4				
305. Sand Cyn at I-5 SB Ramps	Base	2	3	0	0	0	0	0	3	d	1.5	0	1.5
	Mit.										2.5		
~~306. Sand Cyn at Oak Cyn.~~	~~Base~~	~~1~~	~~3~~	~~d~~	~~2~~	~~1~~	~~1~~	~~1~~	~~3~~	~~1~~	~~2~~	~~1~~	~~d~~
	~~Mit.~~	~~2~~				~~.5~~	~~1.5~~						
311. Sand Cyn at I-405 NB Ramps	Base	0	2	f	.5	0	1.5	0	2	f	0	0	0
	Mit.				1		2						

Continued

Table 7-7 (cont.)
MITIGATION LANES FOR POTENTIALLY IMPACTED POST-2040 INTERSECTIONS
(Irvine Spectrum Trip Reduction)

		— SB —			— WB —			— NB —			— EB —		
LOCATION		L	T	R	L	T	R	L	T	R	L	T	R
316. SR-133 SB Ramps at Irvine*	Base	1.5	0	1.5	1	3	0	0	0	0	0	3	d
	Mit.											4	
452. Jamboree at Santiago Cyn	Base	2	3	d	2	3	d	2	2	1	2	2.5	1.5
	Mit.		4										
484. Sand Cyn at Roosevelt	Base	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.						d			d			
485. Sand Cyn at Road "B"	Base	1	3	0	1	1	0	1	3	0	1	1	0
	Mit.							2					
~~490. Research at Trabuco~~	~~Base~~	~~1~~	~~1~~	~~f~~	~~1~~	~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~3~~	~~1~~
	~~Mit.~~							~~2~~					
507. Bake at Millennium	Base	1	4	f	2	2	0	2	4	1	2	1	f
	Mit.					3	d					2	
515a. Bake at Rancho North	Base	1	2	0	2	0	2	0	2	d	0	0	0
	Mit.				2.5		1.5						

* Intersection not needing mitigation with revised performance criteria and Irvine Spectrum trip reduction.

Note: This table is an amended Post-2040 mitigation measure summary showing locations no longer needing mitigation because of the trip reduction in Planning Area 13/Irvine Spectrum 4 and Planning Area 32/Irvine Spectrum 3 (indicated with a strikeout). Revisions to the mitigation due to change in level of service from "D" to "E" in addition to the trip reduction is indicated by an asterisk.

Abbreviations (in alphabetical order):

Alt. Mit.	Alternative mitigation (for locations within the City of Irvine improvements are subject to approval by the City)
ATMS	Advanced Transportation Management System - The use of ATMS as a mitigation measure is discretionary and subject to subsequent review and approval by the Director of Public Works. The ATMS program involves a variety of actions such as camera surveillance and centralized system control, and is part of traffic signal system improvements planned for implementation over time.
Base	Post-2040 Buildout Toll-Free Conditions without Mitigation
Cyn	Canyon
d	de facto right-turn
f	free right-turn
ICD	Irvine Center Drive
L,T,R	left, through, right
Mit.	Mitigation
SB,WB,NB,EB	southbound, westbound, northbound, eastbound

Table 7-8

CIRCULATION PHASING INTERSECTION IMPROVEMENT LOCATIONS BY PRIORITY LEVEL
(Within Study Area)

	NO-PROJECT				WITH-PROJECT			
	AM PEAK HOUR		PM PEAK HOUR		AM PEAK HOUR		PM PEAK HOUR	
INTERSECTION	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS
HIGH PRIORITY LOCATIONS								
Bake & Trabuco	1.05	F	.83	D	1.03	F	.83	D
Jeffrey & ICD	.69	B	.82	D	.69	B	.85	D
Jamboree & Barranca	.85	D	1.00	E	.84	D	1.00	E
Culver & Alton	.79	C	.92	E	.80	C	.92	E
West Yale Loop & Alton	.47	A	.64	B	.48	A	.65	B
ICD & I-405 SB Ramps	.88	D	.72	C	.88	D	.71	C
ICD & Lake Forest	.63	B	.70	B	.63	B	.70	B
Jeffrey & I-405 NB Ramps	.58	A	.73	C	.57	A	.74	C
Sand Canyon & Marine Way	.47	A	.48	A	.47	A	.50	A
Barranca & ICD	.67	B	.62	B	.67	B	.61	B
MEDIUM PRIORITY LOCATIONS								
Sand Canyon & Irvine Bl.	.61	B	.52	A	.68	B	.51	A
Sand Canyon & ICD	.49	A	.50	A	.49	A	.50	A
Jeffrey & Alton[1]	.79	C	.62	B	.80	C	.64	B
Sand Canyon & Alton	.67	B	.52	A	.67	B	.52	A
University & I-405 SB Ramps	.59	A	.63	B	.59	A	.64	B
Bake & ICD	.44	A	.43	A	.45	A	.43	A
I-5 SB Ramps & Bake	1.07	F	1.00	E	1.06	F	1.00	E
LOW PRIORITY LOCATIONS								
Alton & Toledo	.53	A	.57	A	.53	A	.57	A
ICD & Scientific Way	.52	A	.64	B	.51	A	.64	B
Ada & Alton	.51	A	.71	C	.49	A	.71	C

[1] Reflects Woodbridge Mixed Use Site project ATMS credit

were validated with new counts taken in late 2000, early 2001. As can be seen in Table 7-8, the project does not adversely impact any of the subject intersections.

8. CONGESTION MANAGEMENT PROGRAM (CMP) CHECKLIST

The Congestion Management Program (CMP) legislation requires that the CMP Agency monitor the implementation of the Orange County CMP, including CMP land use coordination component requirements. The goal of CMP is to ensure that certain key intersections within the been developed to monitor impacts on CMP Highway System (CMPHS) intersections can be found in Appendix E.

One location within the study area which is a part of the CMP Highway System is adversely impacted by the project for 2007 conditions. This location is Jamboree Road at Edinger Avenue. Mitigation was identified in Chapter 4.0 of this traffic study and involves implementing Advanced Transportation Management System (ATMS) measures for this intersection.

9. PEDESTRIAN AND BICYCLE CIRCULATION

The project area is planned to provide a system of private and public sidewalks and pathways to accommodate the recreational and transportation needs of the residents. These facilities will provide access to recreational facilities, schools, public amenities, commercial centers, bus stops, and provide for an alternative mode of transportation for the area residents. These facilities will be designed in conjunction with the subdivision maps for each portion of the Northern Sphere Area.

The project will implement the Jeffrey Open Space Spine trail, which consists of a Class I off-street trail for pedestrian and bicycle use. This facility will be implemented within the limits of the project from Trabuco Road to north of Portola Parkway, and may also include linkages and/or gap closures to other portions of the Jeffrey Open Space Spine. The appropriateness and/or need for the project to provide linkages and/or gap closures shall be further investigated with subsequent subdivision applications. The development of the Jeffrey Open Space Spine will be consistent with the Jeffrey Open Space Spine Master Plan being developed by the City.

Bicycle lanes will be provided along all public arterials in accordance with the City's standards and the General Plan. These facilities in addition to a system of internal pathways within each project area will serve the needs of recreational and experienced cyclists. The planned trails also provide an alternative mode of transportation for those who wish to ride their bicycle to work, shopping, school, and other destinations.

In conjunction with the submittal of future subdivision maps and street improvement plans for the project area the applicant shall contact Orange County Transportation Authority's bus planning department to identify the existing and planned bus routes and bus stop locations. The street improvement plans will include the implementation of these facilities. Also, public sidewalks and pedestrian paths from adjacent development will be planned to provide convenient access to these facilities.

The street improvement plans and the planning and design of abutting development will be coordinated through the subdivision map process to ensure that conflicts between pedestrian, bicycle and vehicular traffic are minimized. Appropriate traffic control measures in accordance with City standards will be implemented in the design of the street improvements to ensure the optimum level of safety.

Through the implementation of the on-street and off-street trails, and a system of public and private sidewalks within the project area, as stated above, the goals of the City's General Plan (Objectives B-3 and B-4)) for providing alternative modes of transportation and recreational amenities will be met by the proposed development

10. PROJECT ACCESS AND CIRCULATION ANALYSIS

Project access and internal circulation are critical elements of a project development. Access from a major new development area to the existing abutting arterials is typically planned at two levels. The first level is through the implementation of missing segments of the City of Irvine's master plan of arterial highways, as appropriate, and new arterials through the project area. An example of this type of access is the extension of Bryan Avenue to portions of the project area. This traffic study has addressed the design features, potential impacts and appropriate mitigation measures, where needed, of these facilities

The second level is a more localized and land use specific system, which will be implemented in the future phases of the project. These elements of a project are developed in the subsequent stages of project planning and design which follow the current Zoning action. The next step in the project implementation is the subdivision process. Project access and internal circulation along with a more detailed and refined land use plan are established at this stage of development. In conjunction with the subdivision map process, a subsequent traffic study will be conducted to address the operational characteristics of the project such as internal circulation, access, and traffic control measures.

Additionally, at this stage of project development, site grading and design features are more refined which enable the proper alignment selection, roadway design, infrastructure planning and design for the circulation system. Roadway design will be completed in accordance with City of Irvine standards and will be subject to subsequent review and approval process by appropriate agencies.

Through these stages of project planning and design the goals and objectives of the City of Irvine's General Plan (Objectives B-1 and B-2) will be implemented with the best available information. The City of Irvine will also be able to conduct its review and oversight role in the design of these facilities more efficiently and with the most relevant information through the utilization of map level traffic studies.

11. MIDDLE SCHOOL RELOCATION

This section presents information on the possible relocation of the proposed middle school in PA5B to Planning Area 9A (Alternative 1) or Planning Area 9B (Alternative 2). Furthermore, 200 dwelling units would be transferred into PA5B from the site (Planning Area 9A or 9B) where the school is relocated. Figure 7-20 illustrates the study area that was identified for this special analysis. As discussed in Section 4 of this chapter, it is assumed that Hicks Canyon Road would not be extended into Planning Area 5B with these two scenarios. The ICU results are summarized in Table 7-9. As can be seen from this table, intersection #283. Jeffrey Road at Irvine Boulevard operates from an acceptable

Table 7-9

ICU SUMMARY - Middle School Relocation Alternatives (With-Project)

INTERSECTION	BASELINE AM	BASELINE PM	RELOCATION ALT. 1 AM	RELOCATION ALT. 1 PM	RELOCATION ALT. 2 AM	RELOCATION ALT. 2 PM
218 Culver Dr. at Portola Pkwy.	.75	.47	.75	.47	.74	.46
220 Culver Dr. at Irvine Bl.	.76	.77	.76	.76	.77	.76
221 Culver Dr. at Bryan Av.	.75	.66	.75	.66	.76	.67
222 Culver Dr. at Trabuco Rd.	.72	.88	.73	.87	.73	.88
223 Culver Dr. at I-5 SB Ramps	.77	1.00*	.75	1.00*	.74	1.00*
224 Culver Dr. at Walnut Av.	.94*	.91*	.95*	.91*	.95*	.91*
249 Yale Av. at Irvine Bl.	1.03*	.84	1.02*	.82	1.03*	.81
252 Yale Av. at Bryan Av.	.36	.51	.36	.50	.36	.50
255 Yale Av. at Trabuco Rd.	.68	.56	.65	.57	.65	.56
259 Yale Av. at Walnut Av.	.54	.77	.54	.78	.54	.77
282 Jeffrey Rd. at Portola Pkwy.	.78	.63	.77	.64	.77	.65
283 Jeffrey Rd. at Irvine Bl.	.83	.90	.84	.92*	.85	.92*
284 Jeffrey Rd. at Bryan Av.	1.03*	.62	1.03*	.64	1.02*	.62
285 Jeffrey Rd. at Trabuco Rd.	1.02*	1.04*	.99*	1.06*	.99*	1.05*
286 Jeffrey Rd. at Roosevelt	1.25*	.92*	1.25*	.91*	1.26*	.92*
287 Jeffrey Rd. at I-5 NB Ramps	.71	.82	.70	.82	.71	.82
288 Jeffrey Rd. at Walnut Av.	.85	.79	.85	.79	.85	.79
300 Sand Cyn. Av. at Portola Pkwy.	.64	.61	.63	.59	.64	.61
301 Sand Cyn. Av. at Irvine Bl.	.94*	.84	.95*	.84	.95*	.83
302 Sand Cyn. Av. at Trabuco Rd.	1.05*	1.00*	1.03*	1.01*	1.03*	1.00*
303 Sand Cyn. Av. at I-5 NB Ramps	.67	.95*	.67	.97*	.67	.97*
304 Sand Cyn. Av. at Marine Wy.	.67	1.04*	.66	1.04*	.67	1.05*
305 Sand Cyn. Av. at I-5 SB Ramps	1.07*	.86	1.07*	.86	1.07*	.86
316 SR-133 SB Ramps at Irvine Bl.	.83	.61	.85	.60	.83	.59
317 SR-133 NB Ramps at Irvine Bl.	.89	.87	.90	.87	.90	.86
402 I-5 NB Ramps at Trabuco Rd.	.79	.78	.76	.80	.76	.78
482 Road "A" at Trabuco Rd.	.60	.53	.57	.56	.57	.53
483 Road "C" at Trabuco Rd.	.68	.55	.65	.56	.65	.55
484 Sand Canyon Av. at Roosevelt	.83	1.02*	.84	1.02*	.83	1.01*
485 Sand Canyon Av. at Road "B"	.95*	1.22*	.96*	1.21*	.96*	1.22*
486 SR-133 SB Ramps at Trabuco Rd.	.61	.50	.59	.51	.59	.49
487 SR-133 NB Ramps at Trabuco Rd.	.85	.77	.85	.77	.85	.77
488 Research Dr. at Portola Pkwy.	.79	.87	.79	.87	.79	.87
489 Research Dr. at Irvine Bl.	.75	.88	.76	.86	.76	.87
490 Research Dr. at Trabuco Rd.	.79	.88	.78	.89	.78	.87
491 Research Dr. at Marine Wy.	.45	.47	.45	.47	.45	.46
519 Collector St. at Irvine Bl.	.80	.89	.80	.88	.78	.88
520 Collector St. at Trabuco Rd.	.77	.38	.74	.39	.73	.38

* Exceeds LOS “D”

Baseline - Refers to 2025 Buildout Toll Conditions With-Project

ALT. 1 - Middle school is relocated to Planning Area 9A.
ALT. 2 - Middle school is relocated to Planning Area 9B.

level of service to an unacceptable level of service in the PM peak hour thereby needing mitigation. This would be the only change to the mitigation measures summary presented in Chapter 5.0 for 2025 buildout toll conditions. The potential mitigation measure for this location could be to add a fourth northbound through lane resulting in a PM ICU of .85 for both Alternatives 1 and 2.