by November 10, 1989. Regional Board staff never received this required work plan and by a letter dated January 10, 1990, Regional Board staff informed J.C. Carter about the inadequate progress of this investigation and required the submittal of a work plan by January 26, 1990.

8. In February 1990, Delta Environmental replaced Schaefer Dixon Associates as the project consultant. On March 5, 1990, Delta submitted a work plan for further investigation. On March 6, 1990, the work plan was verbally approved (based on certain conditions) by Regional Board staff. This site investigation included the installation of four additional monitoring wells. Groundwater analyses revealed significant levels of chlorinated hydrocarbons, particularly trichloroethene (TCE) and tetrachloroethene (PCE).

9. The following table shows the maximum concentrations of the pollutants identified in groundwater underlying the J.C. Carter site as well as the drinking water standards for these constitutents:

Contaminant	Maximum Concentration ug/l (ppb)	*Drinking Water Standard (ppb)
Trichloroethene (TCE)	2,000.0	5.0
1,1,1-Trichloroethane (TCA)	38.0	200.0
Tetrachlorethene (PCE)	98.0	5.0
Trans 1,2-Dichloroethene	83.0	10.0
1,1-Dichloroethane	8.0	5.0
1,1-Dichloroethene	4.8	6.0
1,2-Dichloroethene	23.0	--
Bromoform	14.7	--
Chloroform	9.7	--
Methyl Isobutyl	18.0	--
Butanone	24.0	--
Total Recoverable Petroleum Hydrocarbons (TRPH)	3,000.0	--
Benzene	1.1	1.0
Toluene	3.5	100.0
Xylenes	1.6	1,750.0

*Either Department of Health Services (DHS) Action Level or Maximum Contaminant Level.

10. By a letter dated May 24, 1990, Regional Board staff required that a work plan for further site investigation be submitted by June 23, 1990. The letter also required the submittal of a remedial action plan for the subject site.

11. By a letter dated July 20, 1990, J.C. Carter and the project consultant informed Regional Board staff that they did not intend to conduct further site assessment. No remedial action plan for the subject site was submitted.

12. The J.C. Carter site is located in the NE1/4 of the SE1/4 of Section 21, Township 6S, and Range 10W and overlies the Irvine Pressure Ground Water Subbasin, the beneficial uses of which include:

    a. Municipal and domestic supply,
    b. Agricultural supply,
    d. Industrial service supply, and
    c. Industrial process supply.

13. J.C. Carter Company, Inc., has caused or permitted wastes to be discharged into the waters of the State such that these wastes are creating, or threatening to create, a condition of nuisance or pollution.

14. This action is being taken by a regulatory agency to enforce a water quality law. Such action is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21100 et seq.) in accordance with Section 15321, Chapter 3, Title 14, California Code of Regulations.

IT IS HEREBY ORDERED that, pursuant to Section 13304, Division 7, of the California Water Code, J.C. Carter Company, Inc., shall:

1. Abate any effects resulting from discharges of volatile organic compounds and other pollutants at the subject site and take appropriate steps to mitigate any potential effects resulting from past or present discharges.

2. By December 3, 1990, submit a detailed report describing the storage, use, and disposal of volatile organic compounds and petroleum products at the site. This report shall discuss the types and quantity of volatile organic compounds processed at the facility, identify the locations where each type of organic compound was handled, processed, stored or disposed

of, discuss the length of time that specific types of organic compounds were stored at the facility, and describe in detail the disposal methods practiced by the facility. Also, the report shall include the summarized results of any field investigations completed to date that would aid in identifying the locations of any additional pollutant source areas at the site.

3. By December 3, 1990, submit a work plan, acceptable to the Executive Officer, to conduct further site investigation which will accurately define the lateral extent of the pollution in the shallow aquifer. This work plan must include any necessary soil borings, soil-gas surveys, and monitoring well installations needed to define the pollution. The work plan must address both on-site and off-site areas and describe the locations, depths and construction details of the proposed borings and monitoring wells, and the sampling procedures, frequency and analytical methods to be employed. This work plan must also include any necessary field activities to verify and characterize any other potential on-site pollutant source areas defined as a result of the facility review required by Item 2, above. Should the proposed wells not adequately define the lateral extent of pollution, additional wells may be required. The work plan must include a time schedule for all field activities.

4. Implement the proposed work plan for additional lateral pollutant characterization submitted pursuant to Item 3, above, in accordance with the time schedule approved by the Executive Officer.

5. By January 3, 1990, develop and submit an effective soil remediation plan to address the volatile organic and petroleum product contamination of soils in the unsaturated zone beneath the site. The plan must be submitted to both the Regional Board and the Orange County Health Care Agency (OCHCA) for concurrent review. The plan must specify all components and the design details of the remediation system. The plan must also include a time schedule for the implementation of the plan, including the installation of any proposed treatment system and the start-up of the system.

6. Implement the proposed soil remediation plan submitted pursuant to Item 5, above, in accordance with the time schedule approved by the Executive Officer and in accordance with any additional requirements established by OCHCA.

7. Within 60 days of notification by the Executive Officer, submit a work plan for the installation of additional monitoring wells to detect and characterize (or verify the absence of) any pollution of the deeper aquifer(s) as a result of the discharges at the subject site. The work plan must describe the locations, depths, construction details, and sampling procedures of the proposed additional monitoring wells. The work plan must also describe appropriate drilling and well construction methods to prevent any cross-contamination of the aquifers. The work plan must include the analytical methods to be utilized, and a time schedule for all field activities and for the submittal of a report on the findings of these activities.

8. Implement the proposed work plan for vertical pollutant characterization submitted pursuant to Item 7, above in accordance with the time schedule approved by the Executive Officer.

9. Within 60 days of notification by the Executive Officer, submit a remedial action plan acceptable to the Executive Officer for a groundwater extraction and treatment system for the shallow aquifer. Such notification shall occur when the investigation, conducted pursuant to Item 4, above, indicates that the extent of contamination in the shallow aquifer has been adequately defined to allow for the initiation of remedial actions. The remedial action plan shall address the full lateral extent of volatile organic and petroleum product compounds. The remedial action plan shall include a proposal for the evaluation of the effectiveness of the system. The remedial action plan shall also include a time schedule for the installation of any necessary groundwater extraction wells, treatment system, and any appurtenant facilities necessary for the operation of the system.

10. Implement the remedial action plan for the shallow aquifer submitted pursuant to Item 9, above, in accordance with the time schedule approved by the Executive Officer. The Executive Officer may require that the scope of the groundwater extraction and treatment system be modified as needed to remediate any additional detected contamination.

11. Within 60 days of notification by the Executive Officer, submit a remedial action plan acceptable to the Executive Officer for a groundwater extraction and treatment system for the deeper aquifer(s). Such notification shall occur if the

investigation for the deeper aquifer(s) conducted pursuant to Item 8, above, indicates that pollution of the deeper aquifer(s) has occurred. The work plan shall include a proposal for the ongoing evaluation of the effectiveness of the system. The work plan shall also include a time schedule for the installation of any necessary deep groundwater extraction wells, a treatment system, and appurtenant facilities necessary for the operation of the system.

12. Implement the remedial action plan for the deeper aquifer(s) submitted pursuant to Item 11, above, in accordance with the time schedule approved by the Executive Officer. The Executive Officer may require that the deeper aquifer(s) treatment system be expanded as needed to remediate any additional detected contamination in the deeper aquifer(s).

13. Within 30 days of notification by the Executive Officer, submit a groundwater sampling and analysis plan acceptable to the Executive Officer. The plan shall identify key monitoring wells to be monitored for groundwater elevation and system performance on a monthly basis and sampled for volatile organic and petroleum hydrocarbon pollution on a quarterly basis. The monitoring network selected shall include both shallow and deep zone monitoring wells. The plan must include all field procedures and the quality assurance/quality control procedures that will be used by the sampling personnel and the laboratory. This plan must incorporate additional wells installed pursuant to Items 4 and 8, above. This plan will remain in effect for the duration of all cleanup activity.

14. Implement the proposed groundwater sampling and analysis plan submitted pursuant to Item 13, above, within 30 days of its approval by the Executive Officer.

15. Submit a report to the Board by the thirtieth (30th) day of each month describing the status of the site investigation and cleanup activities and any siginificant findings or developments that occurred during the previous month. The monthly reports shall also include all data and analytical results collected from the groundwater sampling and analysis plan (once effective) during the previous month or quarter, and an interpretation of this data.

If, in the opinion of the Executive Officer, this order is not complied with in a reasonable and timely manner, this matter will be referred to the Board for the imposition of administrative civil liability or referral to the Attorney General for imposition of judicial liability, as provided by law.

GJ Thibeault

GERARD J. THIBEAULT
Executive Officer

Date: 10/3/90

EXHIBIT G

TETRA TECH

Corrective Action Plan
Former J.C. Carter Company Facility
671 West 17th Street
Costa Mesa, California
Project No. T19437.1

June 26, 2008

Prepared By:
Tetra Tech, Inc.
17770 Cartwright Road, Suite 500
Irvine, California 92614
Phone: 949-250-6788
Fax: 949-608-5980

Prepared For:
Seventeenth Street Realty, LLC
671 West 17th Street
Costa Mesa, California 92627
Attention: Paul Keen, Esq.

TETRA TECH

17770 Cartwright Road, Suite 500
Irvine, CA 92614
Office: (949) 250-6788
Fax: (949) 608-5980

June 26, 2008

California Regional Water Quality Control Board
Santa Ana Region
3737 Main Street, Suite 500
Riverside, CA 92501

Attention: Ms. Rose Scott

SUBJECT: CORRECTIVE ACTION PLAN (CAP) TO ADDRESS THE CALIFORNIA REGIONAL WATER CONTROL BOARD – SANTA ANA REGION CLEANUP AND ABATEMENT ORDER 90-126 DATED OCTOBER 3, 1990, FOR THE:
Former J.C. Carter Company Facility
671 West 17th Street
Costa Mesa, California
Tetra Tech Project No. T19437.1

Dear Ms. Scott:

On behalf of Seventeenth Street Realty, LLC, Tetra Tech, Inc. (Tetra Tech) is pleased to provide you with the enclosed Corrective Action Plan (CAP) for the above-referenced property (the Site). The CAP has been prepared in response to the referenced Cleanup and Abatement Order 90-126.

Following review of the CAP by the California Regional Water Quality Control Board-Santa Ana Region (SARWQCB), we are requesting SARWQCB's approval of the CAP be transmitted to:

Seventeenth Street Realty, LLC
671 West 17th Street
Costa Mesa, CA 92627
Attention: Paul Keen, Esq.

It would be appreciated if a copy of the SARWQCB CAP approval letter is sent to the attention of the undersigned at the above address.

Additional soil sampling, and laboratory bench scale testing of the proposed remediation methodology is being conducted concurrent with SARWQCB review of the CAP.

Please contact us at your convenience if there are questions or comments.

Sincerely,

TETRA TECH, INC.

JON R. LOVEGREEN, CEG No. EG 1164
Manager, Private Practice Group

Enclosure

cc: Paul Keen, Esq., with enclosure
Pam Andes, Esq., with enclosure

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 BACKGROUND 2
2.1 Site Location and Use 2
2.2 Site History 2
2.3 Chemical Use 3
2.3.1 Chemical Storage 3
2.3.2 Waste Chemical Disposal 3
2.4 Underground Storage Tanks 3
2.5 Oil Wells 4
2.6 Regional Geology and Hydrogeology 4
2.6.1 Regional Geologic Setting 4
2.6.2 Regional Hydrogeologic Setting 5
2.6.3 Regional Groundwater Quality 6
2.7 Site Geology and Hydrogeology 6
2.7.1 Site Geology 6
2.7.2 Site Hydrogeology 6

3.0 SITE CHARACTERIZATION SUMMARY 8
3.1 Compounds of Potential Concern (COPCs) 8
3.2 Subsurface Characterization 8

4.0 CORRECTIVE ACTION OBJECTIVES 10

5.0 CORRECTIVE ACTION APPROACH 11

6.0 SCREENING CRITERIA 12
6.1 Overview 12
6.2 Soil Gas 12
6.2.1 Soil Gas Screening Levels 12
6.2.2 Soil Gas Exposure Pathway Evaluation 12
6.3 Soil 13
6.3.1 Soil Screening Levels 13
6.3.2 Recommended Remediation Guidance Screening Levels 14
6.3.3 Soil Evaluation 14
6.4 Groundwater 15
6.4.1 Groundwater Screening Levels 15
6.4.2 Groundwater Evaluation – Potential Off-Site Vapor Intrusion Conditions 16
6.4.3 Groundwater Evaluation – Potential Off-Site Surface Water Body Impacts 16

7.0 PROPOSED CORRECTIVE ACTION 17
7.1 DNAPL Source Area Remediation 17
7.1.1 Rationale 17
7.1.2 Remedial Alternatives 18
7.1.3 Implementation 19
7.1.3.1 ISCO Pilot Test 19
7.1.3.2 Full-Scale ISCO Implementation 21
7.1.4 Post-Remediation Confirmation Sampling 21

7.2 Dissolved-Phase Groundwater Remediation 22
7.2.1 Rationale 22
7.2.2 Methodology 22
7.2.3 Implementation 22
7.2.4 Documentation Sampling 22
7.3 Soil Remediation 23
7.3.1 Rationale 23
7.3.2 Methodology 23
7.3.3 Implementation 23
7.3.3.1 Soil Management Plan 23
7.3.3.2 Confirmation Soil Sampling 24
7.4 Engineering Controls 25
7.4.1 Rationale 25
7.4.2 Proposed Methodology and Implementation 25
7.5 Land-Use Restrictions 25
7.5.1 Rationale 25
7.5.2 Implementation 26

8.0 GROUNDWATER MONITORING 27

9.0 LIMITATIONS 28

10.0 REFERENCES 29

LIST OF TABLES

Table 1: Screening Criteria

LIST OF FIGURES

Figure 1: Site Location Map
Figure 2: Site Plan
Figure 3: Groundwater Elevations in July 2007
Figure 4: Inferred Area of Potential On-Site Vapor Intrusion Concerns
Figure 5: TCE Concentrations in Upper Shallow Perched Groundwater Zone
Figure 6: TCE Concentrations in Lower Shallow Perched Groundwater Zone
Figure 7: Inferred DNAPL Area

LIST OF APPENDICES

Appendix A: Site Characterization Data
Appendix B: Screening Levels

1.0 INTRODUCTION

The following Corrective Action Plan (CAP) has been prepared on behalf of Seventeenth Street Realty, LLC for the former J.C. Carter Company (JCC) facility, located at 671 West 17th Street, Costa Mesa, California (the Site). The Site location is shown on Figure 1; a Site plan is provided in Figure 2.

The California Regional Water Quality Control Board – Santa Ana Region (SARWQCB) issued Cleanup and Abatement Order 90-126 dated October 3, 1990, (CAO) for the Site. Among a number of requirements, the CAO directed that cleanup of "contaminated" soil and groundwater be initiated. This CAP has been prepared to provide the approach to remediation of groundwater and the localized area of petroleum-impacted soil found to date.

Previous work at the Site has included multiple phases of soil, soil gas, and groundwater investigation, which were previously summarized by Tetra Tech (2008c). The previous work was conducted from the late 1980s through 2007. These investigations found that groundwater at the Site has been impacted by volatile organic compounds (VOCs), primarily trichloroethene (TCE), along with cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC), which are common breakdown products of TCE and other chlorinated VOCs, such as tetrachloroethene (PCE). The VOC impacts occurred prior to Seventeenth Street Realty LLC's acquisition of the Site in 2007.

It is Tetra Tech's understanding that redevelopment of the Site for multi-family residential land use is being considered. As part of the redevelopment planning process, this CAP has been prepared to provide an approach for mitigating the impacts of VOCs to human health, environmental receptors, and water resources. Elements included in this CAP include the following:

- Section 2.0: A summary of background information pertaining to the Site.
- Section 3.0: A summary of previous Site characterization work.
- Section 4.0: Corrective action objective.
- Section 5.0: Corrective action approach.
- Section 6.0: Proposed screening criteria.
- Section 7.0: Corrective action summary, including remediation alternatives review.
- Section 8.0: A discussion of proposed groundwater monitoring activities.
- Section 9.0: Limitations and reliance language.
- Section 10.0: References cited in this report.

2.0 BACKGROUND

2.1 Site Location and Use

The Site consists of approximately 10 acres of land located at the southeast corner of the intersection of West 17th Street and Pomona Avenue in Costa Mesa, California (Figure 1). The Site consists of one parcel (Assessor Parcel Number [APN] 424-291-11). The Site lies outside of the City of Costa Mesa (City) Existing Downtown Redevelopment Project Area, which is located north of West 17th Street.

The Site is currently used by Argo-Tech Corporation (Costa Mesa) for the design and manufacturing of ground fueling and airframe products for the aerospace industry, and by Carter Cryogenics Company LLC for the manufacturing and testing of cryogenic products, primarily LNG valves and nozzles. Current uses of the Site can generally be described as follows:

- Northwestern: Parking
- Northern: Offices and parking
- Northeastern: Offices, assembly, and storage buildings and machine shops
- Central: Engineering, assembly, testing, and warehouse buildings
- Southeastern: Receiving, shipping, and maintenance buildings
- Southern: Parking and metal container storage
- Western: Cryogenics test area and parking

The locations of the above features are shown in Figure 2.

Retail and commercial businesses are located to the north and west of the Site. Commercial and light industrial businesses are located to the east and south of the Site. Known releases of hazardous materials have occurred at three nearby facilities:

- A former Texaco gas station, located east of the Site on the southwest corner of Superior Avenue and West 17th Street (approximately 250 feet east of the northeast part of the Site).
- The Newport Beach Corporate Yard, located approximately 800 feet south of the Site.
- A former Hughes Aircraft facility, also located approximately 1,200 feet south-southwest of the Site (this was a former Raytheon facility).

2.2 Site History

Prior to 1952, the Site was vacant, undeveloped land. A small, southwesterly-draining, intermittent stream channel traversed the northwestern part of the Site. Two abandoned oil wells (located in the northwestern and southwestern areas of the Site, respectively), and one plugged and abandoned dry hole (located on the adjacent property immediately east of the Site), were noted on a CADOGGR oil field map showing the Site (CADOGGR, 2003). A 1927 aerial photograph reviewed by Tetra Tech shows derricks at the locations of the two abandoned oil wells in the northwestern and southwestern areas of the Site. The northwestern derrick was not noted in a 1938 aerial photograph. The southwestern derrick was not noted in a 1953 aerial photograph, although structures that may have been related to oil production were noted at the approximate location of the southwestern oil well.

Initial development of the Site occurred in 1952, and involved construction of a limited number of buildings in the northeastern part of the Site. The remaining areas of the Site were vacant, generally unpaved land with the exception of the oil well in the southwestern part of the Site. Over time, the

facility gradually expanded to the west and south, with additional development occurring in 1959 and throughout the 1970s.

2.3 Chemical Use

A number of chemicals, including TCE, have historically been used in the manufacture and testing of products at the Site. According to information provided by longtime employees of the Site (Beard, 2000; Petrozzi, 2000), TCE was used at the Site as a degreasing agent until sometime between 1978 and 1985. Delta (1990) reported that TCE was not used at the Site since at least 1985. There is no current TCE use at the Site (Head, 2007).

According to Delta (1990), chemicals used at the Site during the 1980s include the following:

- Aviation fuels (mainly Jet A and smaller amounts of JP-4 and JP-5).
- Diesel fuel.
- 1,1,1-trichloroethane (1,1,1-TCA).
- Various petroleum-, alcohol-, and ketone-based solvents, including Stoddard solvent, Compound 140-66, Type I Fluid, Type II Fluid, isopropyl alcohol, #600 solvent, acetone, and methyl ethyl ketone.
- Various oils, including lubricating oils, motor oils, cutting oils, and hydraulic fluids.
- Water-soluble machining coolants.
- Cryogenic liquids, including liquid nitrogen, liquid propane, and liquid butane.
- Small quantities of lubricants such as penetrating oils.

Delta (1990) reported that, based on the records reviewed, TCE and PCE were not used at the Site since at least 1985. The compound 1,1,1-TCA was used at the facility in small quantities through 1986 for cleaning pump parts. That line of business was sold in 1987, and 1,1,1-TCA has reportedly not been used at the Site since that time.

2.3.1 Chemical Storage

Chemicals have been stored at the Site mainly in aboveground storage tanks (ASTs), 55-gallon drums, and in smaller containers. The ASTs are present throughout the central part of the Site. The 55-gallon drums are, and historically have been, located primarily in the area of Building #8. Smaller containers are stored primarily in storage cabinets in areas of the Site such as the machine shops. Diesel fuel was formerly stored in a 1,000-gallon underground storage tank (UST) south of Building #12. The diesel UST was abandoned in place in 1990, and diesel fuel has since been stored in an AST.

2.3.2 Waste Chemical Disposal

Historically, waste cutting oil was disposed of in a 2,000-gallon UST located south of Building #9. The UST was removed from the Site in 1986, as discussed elsewhere in this report. Subsequently, the waste cutting oils and solvents, along with other hazardous wastes, have been stored in 55-gallon drums in a hazardous waste storage area located south of Building #9.

2.4 Underground Storage Tanks

A 2,000-gallon UST located in the eastern part of the Site, south of Building #9, was used primarily to store waste cutting oil. This UST was removed in 1986 with Orange County Health Care Agency (OCHCA) oversight. A 1,000-gallon UST used to store diesel fuel for a generator was located in the

central part of the Site, south of Building #12. This UST was abandoned in place in 1990 with OCHCA oversight. It is Tetra Tech's understanding that closure of these two USTs is pending, and that the SARWQCB is not requiring additional characterization in the area of the two USTs.

2.5 Oil Wells

The Site is located within the Newport Beach oil field. Two abandoned oil wells are present in the northwestern and southwestern areas of the Site, and one appears to be located immediately to the east of the Site (CADOGGR, 2003). It is unknown whether the on-Site oil wells are abandoned in accordance with current CADOGGR guidelines, or whether there is a potential for methane gas to be present in the subsurface.

2.6 Regional Geology and Hydrogeology

2.6.1 Regional Geologic Setting

The Site is located on the Newport Mesa in the southwestern part of the Orange County Coastal Plain (Moore, 1966; California Department of Water Resources [DWR], 2003). Lower Newport Bay is located approximately one mile south of the Site. The Santa Ana River is located approximately 1-1/2 miles west of the Site and the Pacific Ocean is approximately 1-1/4 miles southwest of the Site.

Newport Mesa is a wavecut bench in Pliocene- and Miocene-age strata. Overlying this sedimentary strata in the Newport Mesa area are Quaternary-age marine terrace deposits and stream (fluvial) deposits (Schoellhamer, et al., 1954; Guptill et al., 1981).

The Orange County Coastal Plain and its underlying groundwater basin are bound by the Puente and Chino Hills on the north, the Santa Ana Mountains on the east, the San Joaquin Hills on the south, the Pacific Ocean on the southwest and a low topographic divide located at approximately the Orange County – Los Angeles County line on the northwest (DWR, 2003).

The Orange County Coastal Plain is a coastal alluvial plain that is underlain by a structural depression filled with up to approximately 20,000 feet of sediments and underlying sedimentary rock of marine and nonmarine origin. The sedimentary sequence is of Miocene to Recent age.

The Newport Mesa is reported to be underlain by Quaternary-age sedimentary deposits that overlie Capistrano and Monterey Formations. Quaternary-age (mid- to late-Pleistocene) marine terrace deposits are shown by Morton and Miller (1973) and Greenwood and Morton (1991) to be the surficial sediments on the Newport Mesa (including the Site). These deposits are described as poorly to moderately consolidated sand to silty sand with local gravel. The Capistrano and Monterey Formations are generally comprised of sandstone and shale, respectively (Jahns, 1954). The Monterey Formation is of a similar age (late Miocene) as the Puente Formation. It typically is shale that weathers to siltstone and claystone.

The Site lies within the predominately strike-slip, northwest-southeast trending Newport-Inglewood Fault Zone. The fault zone is seismically active. One trace of the fault is shown in the vicinity west of the Site. Two traces of the fault lie northerly of the Site, approximately one-third of a mile and one to two miles northeast of the Site. An additional strand of this fault zone is mapped approximately one mile southwest of the Site (Barrows, 1974; Greenwood and Morton, 1991). The northerly trace of the fault zone is reported to act as a barrier to regional southwesterly groundwater flow (as discussed additionally below).

2.6.2 Regional Hydrogeologic Setting

The Site is located within the Coastal Plain of Orange County Groundwater Basin (Orange County Basin; Basin No. 8-1; DWR, 2003). The boundaries of the Basin include the Puente and Chino Hills to the north, the Santa Ana Mountains to the east, the San Joaquin Hills to the south, the Pacific Ocean on the southwest, and a low topographic divide located approximately at the Orange County – Los Angeles County boundary on the northwest. In general, the Orange County Basin underlies the lower Santa Ana River watershed (DWR, 2003).

In general, the coarser, more permeable sediments in the Orange County Basin are located in the "forebay" part of the Basin north and east of the Site. Finer-grained, less permeable sediments are located in the seaward "pressure" part of the Basin where the Site is located. Faulting and related uplift, such as along the Newport-Inglewood Fault northward from the Site, forms a barrier to southwesterly groundwater flow within the Orange County Basin (DWR, 2003).

Recharge to the Orange County Basin occurs by percolation from the Santa Ana River (including man-made recharge basins), infiltration of precipitation, and through injection wells maintained by the Orange County Water District (OCWD). Groundwater flow in the Basin generally is toward the southwest except where altered by groundwater extraction and injection wells. The OCWD has an extensive groundwater management system in place to recharge the groundwater basin in the forebay area, provide a barrier to the intrusion of seawater into the forebay, and produce groundwater as a part of the supply of drinking and irrigation water in Orange County, California. The OCWD groundwater recharge areas and groundwater barrier are northerly and northwesterly of the Site and do not directly affect the Site groundwater conditions.

The principal water-bearing units in the Orange County Basin are found in three systems referred to as the Upper, Middle, and Lower Aquifer Systems.

The Upper Aquifer System includes Holocene (Recent) and Older alluvium and stream terrace deposits, and the upper Pleistocene-age La Habra Formation. This system has an average thickness of approximately 800 feet. In the coastal area where the Site is located, the Upper Aquifer System sediments tend to be finer-grained clays and clayey silts with possible minor recharge (DWR, 2003).

The Middle Aquifer System includes the lower Pleistocene-age Coyote Hills and San Pedro Formations. This system has an average thickness of 1,600 feet. The Middle Aquifer System is the primary source from which groundwater is extracted in the Orange County Basin.

The Lower Aquifer System includes the upper Pliocene-age Upper Fernando Group. This group is composed of sand and conglomerate with a thickness of approximately 350 to 500 feet. This aquifer is not typically a source of groundwater due to its depth.

Of the regional aquifers, only the San Pedro Formation is reported to be present at depth in the Site vicinity south of the Newport-Inglewood Fault.

Locally, shallow groundwater may be present perched on low permeability strata in the alluvium and/or terrace deposits above the regional aquifers. In an evaluation of the former Hughes Aircraft facility located approximately 500 feet southerly of the Site, Dudek & Associates, Inc. (DAI, 1997) described the groundwater flow rate (in the shallow perched groundwater zone) to be approximately 195 feet per year.

2.6.3 Regional Groundwater Quality

Water produced from aquifers in the Orange County Basin tends to have a high total dissolved solids (TDS) content that ranges from 232 milligrams per liter (mg/l) to 661 mg/l with an average TDS content of 475 mg/l (DWR, 2003). As noted above, the Newport-Inglewood Fault appears to be a barrier to groundwater movement within the Orange County Basin with higher quality water present in aquifers northerly of the fault and generally poor quality water southerly of the fault (DWR, 2003) where the Site is located.

Groundwater in the Newport Mesa was reported by James M. Montgomery Consulting Engineers, Inc. (JMM, 1987) to be highly variable and of "sodium bicarbonate character with locally high concentrations of sulfate and chloride." In particular, groundwater pumped from south of the Bolsa-Fairview Fault (of the Newport-Inglewood Fault Zone) was described as having "relatively high TDS, chloride, sodium and sulfate concentrations." Because of its poor water quality, groundwater in the Site vicinity southerly of the Newport-Inglewood Fault is not a source of potable water.

Groundwater south of the Site has been impacted with VOCs at the former Hughes Aircraft facility at 500 Superior Avenue. VOC concentrations in sampled water at that facility include TCE up to 4,500 micrograms per liter (µg/l), PCE up to 2,000 µg/l, cis-1,2-DCE up to 19,000 µg/l, and VC up to 6,100 µg/l (Hargis + Associates [HAI], 2007).

2.7 Site Geology and Hydrogeology

2.7.1 Site Geology

In general, soils beneath the Site consist primarily of sand, silty sand, and clayey sand with localized lenses of silt and clay from the ground surface to elevations of approximately 43 to 50 feet above mean sea level (msl). These soils are referred to as the coarse-gained unit. The coarse-grained unit is interpreted as alluvial and marine terrace deposits. The upper portion of the coarse-grained unit tends to have a higher percentage of fines in the northwestern area of the Site. An intermittent stream channel was noted in this area of the Site on historic topographic maps. It is possible that the fine-grained material in the upper portion of the coarse-grained unit in the northwestern area of the Site is fill placed in the former stream channel prior to or in conjunction with development of the Site. The coarse-grained unit is underlain by silt and clay, which is referred to as the fine-grained unit. The fine-grained unit extends to a depth of at least 75 feet (elevation 16 feet msl), which represents a minimum thickness of at least 25 feet. The fine-grained unit is interpreted as the Tertiary-age Monterey Formation. This formation is generally age equivalent with the Puente Formation, which is shown on some geologic maps and cross-sections of the Newport Mesa area.

Soil conditions observed by Tetra Tech (2008b), in off-Site areas, and by DAI (1997) at the former Hughes facility located approximately 1,200 feet south-southwest and generally downgradient from the Site, are generally consistent with soil conditions at the Site.

2.7.2 Site Hydrogeology

Groundwater at the Site is present as a shallow perched zone immediately above the fine-grained unit (Monterey Formation). Depth to groundwater at the Site has generally ranged from approximately 12 to 32 feet bgs. The range in groundwater depth is primarily due to the variation in ground surface elevation across the Site. Depth to groundwater in individual groundwater monitoring wells has been relatively constant over the time period for which data is available: water level fluctuations in all of the groundwater monitoring wells have been 2.5 feet or less. Groundwater elevations show more variability

than the depth to groundwater measurements, due to changes in the reference elevation datum used for surveying the groundwater monitoring wells over time.

Groundwater elevations for the most recent groundwater monitoring event (July 2007, Tetra Tech, 2007) are shown on Figure 3. Interpreted groundwater elevation contours in Figure 3 show that the direction of groundwater flow is generally toward the south-southeast or south, at a gradient of approximately 0.007 feet per foot. The general direction of groundwater flow and the groundwater gradient for July 2007 were generally consistent with the results of previous groundwater monitoring events.

Hydrogeologic conditions observed by Tetra Tech (2008b) in off-Site areas, and by DAI (1997) at the former Hughes Aircraft facility located approximately 1,200 feet south-southwest and generally downgradient from the Site, are generally consistent with hydrogeologic conditions at the Site.

3.0 SITE CHARACTERIZATION SUMMARY

Tetra Tech (2008c) conducted a review of previous environmental investigations at the Site. Site characterization commenced in 1986 when a 2,000-gallon waste cutting oil UST was removed from the eastern part of the Site, in the area south of Building #9. Removal of the UST was conducted with oversight from the OCHCA. Site characterization was initially conducted with oversight from OCHCA. Regulatory oversight was subsequently transferred to the SARWQCB in 1988, and the SARWQCB has been the lead regulatory agency for investigation of the Site since that time.

Since removal of the former waste cutting oil UST 1986, subsurface characterization of the Site and off-Site areas has included the following:

- Logging of subsurface lithology at 64 on- and off-Site locations, including 34 cone penetrometer test (CPT) locations.
- Analysis of 105 soil samples collected from 42 on- and off-Site soil borings.
- Collection and analysis of 74 soil gas samples at 57 on-Site locations.
- Installation of 17 on- and off-Site groundwater monitoring wells (not including well MW-17a, which was installed to replace well MW-17 in 2007).
- Groundwater monitoring, which was conducted on- and off-Site on an intermittent basis from 1988 to 1991, on a quarterly or semiannual basis from 1996 to 2001, and which recommenced in 2007.
- Collection and analysis of 51 discrete-depth groundwater samples at 17 on-Site locations.
- Collection and analysis of 39 discrete-depth groundwater samples at 13 off-Site locations.

The results of the above work were summarized in Tetra Tech (2008c); tabulated analytical results are provided in Appendix A. Tetra Tech's conclusions with respect to environmental conditions at the Site and downgradient areas are summarized in the following sections.

3.1 Compounds of Potential Concern (COPCs)

Based on the available laboratory analyses of soil, soil gas, and groundwater samples collected at the Site, the primary VOC detected at the Site is TCE. Other VOCs detected at significant concentrations, including cis-1,2-DCE and VC, are common breakdown products of TCE and other chlorinated VOCs, such as PCE. These three VOCs – TCE, cis-1,2-DCE, and VC – are considered to be the compounds of potential concern (COPC) at the Site. Because TCE has been found at the most locations and at the highest concentrations at the Site, COPCs are discussed below primarily in terms of TCE to facilitate the discussion.

3.2 Subsurface Characterization

The following presents Tetra Tech's judgments regarding subsurface characterization conducted at the Site by Tetra Tech and other consultants. The subsurface data obtained to date are summarized in Tetra Tech's Summary Report (Tetra Tech, 2008c).

Soil Characterization

- The characterization of Site soils by soil (and soil gas) sampling has been adequate to locate significant sources of COPCs in Site soils. This characterization includes soil and/or soil gas sampling in potential source areas.

- No TCE concentrations indicative of a significant source in soil for the COPCs detected in groundwater have been found.

- The presence of localized areas of COPC-impacted soil cannot be ruled out. However, it is not considered practical to conduct additional soil characterization. It is expected that if any localized areas of COPCs are present, they can be remediated during Site grading operations, as discussed elsewhere in this CAP.

Soil Gas Characterization

- The lateral extent of TCE and other COPCs in soil gas has been adequately characterized.

- TCE concentrations in soil gas appear to be consistent with partitioning of TCE vapor from TCE-impacted groundwater.

- No apparent soil source of TCE has been indicated by the TCE concentrations found in soil gas.

Groundwater Characterization

- The lateral extent of TCE in groundwater has been adequately characterized, both on- and off-Site.

- Two areas of TCE-impacted groundwater are interpreted to be present at the Site, one in the eastern area and one in the western area of the Site.

- The maximum TCE concentrations detected in on-Site groundwater (71,000 µg/l), and a pattern of increasing TCE concentrations with depth within the shallow perched groundwater zone, are considered indicative of the presence of DNAPL in the western area of the Site. The inferred DNAPL is likely at the bottom of shallow perched groundwater zone in the coarse-grained unit, at a depth of approximately 50 feet bgs. The underlying fine-grained unit, with a minimum thickness of approximately 25 feet, is expected to act as a barrier to further downward migration of COPCs (including TCE).

- No indication of the presence of DNAPL has been found in the eastern area of the Site or in downgradient off-Site areas.

4.0 CORRECTIVE ACTION OBJECTIVES

The overall objectives of the proposed corrective action are to minimize on- and off-Site human health risks and adverse impacts to off-Site receptors related to COPCs consistent with CAO 90-126.

5.0 CORRECTIVE ACTION APPROACH

To address the corrective action objective cited above, the CAP includes on-Site remedial measures intended to address the CAO 90-126 directive that soil and groundwater cleanup be initiated by reducing COPC concentrations in on-Site soil and on- and off-Site groundwater, as well as on-Site engineering controls and land-use restrictions intended to reduce the likelihood of exposure to COPCs in the future. The approach includes the following:

- Remove as much of the DNAPL as practical utilizing in-situ chemical oxidation (ISCO).
- Reduce the concentration of dissolved COPCs in the shallow perched groundwater zone in the western part of the Site using ISCO.
- Provide for monitored natural attenuation (MNA) of dissolved COPCs in the eastern part of the Site and in the western part of the Site after completion of ISCO activities.
- Remediate COPC-impacted soil, if any, at the time of Site redevelopment, along with the localized area of petroleum-impacted soil in the area of the former 2,000-gallon waste cutting oil UST, using a soil management plan (SMP).
- Implement engineering controls, primarily in the form of a vapor intrusion mitigation system (VIMS) that includes a vapor barrier and passive ventilation system.
- Implement institutional controls, such as prohibiting single-family homes and use of perched shallow groundwater for drinking water.

It is expected that by removing as much of the DNAPL as practical, reducing the highest dissolved concentrations of COPCs in the western part of the Site to the degree practical, and installation of engineering controls, the corrective action objective will be met.

6.0 SCREENING CRITERIA

6.1 Overview

Published numerical screening levels intended to be protective of public health and safety and water resources in California are used as screening criteria. These numerical screening levels have been developed by a number of State agencies to be used to evaluate risks at Sites and are, therefore, necessarily conservative. They have not been developed by the State to be cleanup levels and their inclusion in this CAP is not intended to be cleanup standards. They are presented in this CAP to provide risk-based guidance to remediation activities. Screening levels are provided for each of the COPCs discussed in Section 3.1.

The screening levels considered, and the rationale for the selection of screening levels, are discussed below.

6.2 Soil Gas

6.2.1 Soil Gas Screening Levels

Soil gas screening criteria are summarized in Table 1 and Appendix B, and include the following:

- California Human Health Screening Levels (CHHSLs) soil gas screening levels for residential land use (Cal/EPA, 2005). The soil gas CHHSLs are human health-based criteria for selected VOCs, which are based on consideration of the vapor intrusion pathway only and were developed by Cal/EPA for a target risk of 10^{-6} for carcinogens, or a target hazard quotient of 1.0 for non-carcinogens.

- SFRWQCB residential land use soil gas screening levels for the evaluation of potential vapor intrusion conditions (SFRWQCB, 2008; Table E-2). These screening levels are based on consideration of the vapor intrusion pathway only, and assume a target risk of 10^{-6} for carcinogens. For non-carcinogens, screening levels were developed by the SFRWQCB based on target hazard quotients of 0.2. To maintain consistency with other screening levels, the value for cis-1,2-DCE (a non-carcinogen) was adjusted by a factor of five to correspond to a target hazard quotient of 1.0. The CHHSL documentation (Cal/EPA [2005], Appendix 2) notes that the residential land use CHHSLs and residential land use SFRWQCB screening criteria for soil gas were developed using similar methodology, and are essentially identical.

Where available, CHHSLs (which were developed for use throughout California) are used as screening levels for soil gas. The SFRWQCB soil gas screening levels (which were developed for use primarily within the San Francisco Bay Region) are used for compounds for which CHHSLs have not been developed. The SFRWQCB screening levels are presented here because no comparable screening levels have been developed by southern California regulatory agencies, to the knowledge of Tetra Tech.

6.2.2 Soil Gas Exposure Pathway Evaluation

The VIMS is proposed to address vapor intrusion considerations on-Site. The VIMS is expected to result in there being no complete exposure pathway at the Site related to soil gas. In addition, it is expected that DNAPL source area remediation and subsequent groundwater remediation will further reduce COPC concentrations in soil gas. Additional discussion of the VIMs is presented in Section 7.4.

6.3 Soil

6.3.1 Soil Screening Levels

Impacted soil has been encountered only in the area of the former waste cutting oil UST in the eastern part of the Site. In this area, a localized area with a limited amount of petroleum-impacted soil appears to be present.

In addition to the localized petroleum-impacted soil in the former waste cutting oil UST area, soil screening levels are considered in the event that COPC-impacted soil is encountered during redevelopment at the Site. The following have been considered in evaluating soil screening levels:

- Potential future resident exposure by direct contact with shallow soils;
- Potential construction worker exposure by direct contact with shallow soils during overexcavation of the Site as a part of grading operations during Site redevelopment; and
- The potential for petroleum hydrocarbons and/or COPCs in deeper soils (i.e., below the depth of excavation for Site development) to leach to groundwater.

Soil screening criteria for COPCs, petroleum (as total petroleum hydrocarbons - mid-range distillates [TPH]), and benzene considered for the Site are summarized in Table 1 and Appendix B, and are briefly discussed below.

- SFRWQCB Residential Land Use Soil Screening Levels (Direct Exposure): These screening levels were developed for evaluation of direct exposure concerns (SFRWQCB, 2008; Table K-1). These SFRWQCB screening levels were developed for the protection of human health of residents (adults and children). They account for exposure to COPCs and/or TPH through direct contact (i.e., direct ingestion, dermal absorption, and inhalation of volatiles and fugitive dust). The SFRWQCB screening levels were developed using California cancer slope factors, reference doses, and skin absorption factors, and assume a target risk of 10^{-6} for carcinogens. For non-carcinogens, screening levels were developed by the SFRWQCB for target hazard quotients of 0.2 and 1.0. To maintain consistency with other screening levels, the values for a hazard quotient of 1.0 are presented in Table 1.

- USEPA Region 9 Preliminary Remediation Goals (PRGs) (Direct Exposure): PRGs were developed for residential land use (USEPA, 2004). The PRGs are criteria for the protection of human health which also account for exposure through direct contact with COPCs. The PRGs assume a target risk of 10^{-6} for carcinogens and a target hazard quotient of 1.0 for non-carcinogens. In some cases, the PRGs include "California-modified" screening levels, which were developed using California-specific parameters. Where available, California-modified PRGs are presented in Table 1.

- SFRWQCB Construction/Trench Worker Screening Levels (Direct Exposure): These screening levels were developed for evaluation of direct exposure concerns (SFRWQCB, 2008; Table K-3). These SFRWQCB screening levels were developed for the protection of human health for construction/trench workers. These criteria account for exposure to construction/trench workers through direct contact with COPCs and/or TPH. These screening levels assume a target risk of 10^{-6} for carcinogens. For non-carcinogens, screening levels were developed by the SFRWQCB

based on target hazard quotients of 0.2 and 1.0. To maintain consistency with other screening levels, the values for a target hazard quotient of 1.0 are presented in Table 1.

- SFRWQCB Soil Screening Levels for Potential Leaching to Groundwater: These screening levels were developed by the SFRWQCB (SFRWQCB, 2008; Table G) using a fate-and-transport algorithm developed by the State of Oregon and modified by the Massachusetts Department of Environmental Protection. The screening levels recommended for the CAP are those developed by the SFRWQCB for a non-drinking water resource. The assumed groundwater endpoint concentrations used by the SFRWQCB for developing the non-drinking water resource screening levels were potential residential vapor intrusion conditions and gross contamination ceiling levels odor considerations, whichever was lower.

6.3.2 Recommended Remediation Guidance Screening Levels

Shallow Soils – COPCs, TPH, and Benzene

Shallow soils are defined as soils at depths of less than three feet below the depth that will be overexcavated as part of Site redevelopment, which are expected to correspond to soils within approximately five feet of current grade. The SFRWQCB residential land use soil screening levels are proposed as the shallow soil remediation guidance screening levels for COPCs, TPH, and benzene encountered in shallow soils.

The SFRWQCB residential land use soil screening levels were selected because they are based on California-specific parameters, and are somewhat more conservative than the corresponding residential land use PRGs (Table 1). The SFRWQCB residential land use soil screening levels are also more conservative than the SFRWQCB construction/trench worker screening levels, which are based on exposure assumptions appropriate for construction/trench workers, rather than residents. Mitigation of COPCs, TPH, benzene, and other VOCs (if encountered) to SFRWQCB residential land use soil screening levels is, therefore, considered to be suitably conservative with respect to construction worker exposure.

Deeper Soils – COPCs, TPH, and Benzene

Deeper soils are defined as soils at depths greater than three feet below the depth that will be overexcavated as part of Site redevelopment, which are expected to correspond to soils at depths greater than approximately five feet below current grade. It is not expected that impacted soil will be encountered below the shallow soil depth described above. However, in the event impacted soil is found in deeper soils, SFRWQCB soil screening levels based on leaching considerations (where groundwater is not a drinking water resource) are proposed as remediation guidance soil screening levels.

The SFRWQCB screening levels for leaching considerations are considered to be appropriate for deeper soils because once impacted shallow soils are removed and engineered fill is placed at the Site, future residents in the planned multi-tenant residential development are not expected to come into direct contact with Site soils. There will be, as a result, an incomplete exposure pathway for direct exposure. The proposed screening levels for leaching concerns are based on the assumption that groundwater is not a source of drinking water, which is appropriate for the Site (as discussed in Section 6.4).

6.3.3 Soil Evaluation

The only soil-related area of concern (AOC) known to be present is the localized area, presently inaccessible, at the former waste cutting oil UST. One soil sample (the 10-foot sample from boring B-1, located adjacent to the former waste cutting oil UST) had reported total recoverable petroleum hydrocarbon (TRPH) and benzene concentrations of 3,764 mg/kg and 31,000 µg/kg, respectively.

Underlying soil samples had non-detectable TRPH concentrations. In addition, four soil borings (B-2 to B-5) were drilled within approximately 6 to 19 feet of boring B-1. Soil samples collected from these borings all had lower TRPH concentrations and, where analyzed, non-detectable benzene concentrations. Assuming that the reported benzene concentration in sampled soil from boring B-1 is correct, it appears likely that the extent of TRPH- and benzene-impacted soil in this area is localized. Note: The analysis for TRPH typically is now used as a screening analytical method and can be used as a general indicator of the concentrations of petroleum-related hydrocarbons. However, it is not considered appropriate for making decisions regarding whether the soil is impacted to the extent that remediation is warranted. As discussed in Section 7.3, analysis for TPH with carbon speciation is expected to be used for decisions regarding whether remediation is warranted and for confirmation soil sampling.

In the vadose (unsaturated) zone, the highest TCE concentration in analyzed soil samples was 120 µg/kg, well below the proposed soil screening criterion for TCE. Concentrations of the remaining COPCs in all of the analyzed soil samples were also below their respective soil screening criteria.

In the saturated zone below the water table, analyzed soil samples had TCE concentrations up to 19,000 µg/kg (in the 33-foot bgs soil sample from boring MW-15) and 1,100 µg/kg (in the 44-foot bgs soil sample from boring MW-14). Both these of soil samples were collected below the water table in areas of groundwater highly impacted with TCE. Other soil samples collected from the unsaturated zone above the impacted soil samples at both locations had non-detectable TCE concentrations. It is likely that the high concentrations of TCE detected in the 33-foot bgs sample from boring MW-15 and the 44-foot sample from boring MW-14 reflect conditions in groundwater rather than soil.

Based on the above considerations, other than the localized area, presently inaccessible, around the former waste cutting oil UST, there are no known soil-related AOCs at the Site. The reported concentrations of COPCs in soil across the Site are all below the soil screening levels cited above. It is considered unlikely, in the judgment of Tetra Tech, that a large volume of soil with COPC concentrations exceeding the soil screening levels is present at the Site. However, to address the petroleum-impacted soil in the area of the former waste cutting oil UST and address the possibility that localized areas of soil with elevated COPC concentrations may be present at the Site, future grading and potential soil remediation activities, if any, will be conducted in accordance with a SMP, as described in Section 7.3.

6.4 Groundwater

6.4.1 Groundwater Screening Levels

Although the Site is located in an area where municipal supply is designated as a beneficial use of groundwater (SARWQCB, 1995), the shallow perched groundwater and any water-bearing zones that may be present at greater depth at the Site are not used as sources of drinking water. There are no water supply wells in the area of the Site, and the nearest water supply wells are located approximately three miles upgradient to the north or northeast of the Site. In addition, the Site is located to the west of several faults which constitute the Newport-Inglewood Fault Zone, a barrier to groundwater flow, and the aquifers which are used for water supply elsewhere in the Orange County Groundwater Basin are not present beneath the Site. For these reasons, groundwater screening levels for the protection of drinking water resources are not considered to be applicable to the Site.

Applicable screening levels are considered to be those used to evaluate potential vapor intrusion conditions due to volatilization of COPCs from groundwater and those used to evaluate potential surface water impacts. Because on-Site vapor intrusion conditions are addressed through the use of residential land use soil gas screening levels and the installation of the VIMS resulting in an incomplete vapor pathway following Site development (Section 6.2), only potential impacts to downgradient land uses,

which are commercial/industrial, are considered here. Groundwater screening levels considered applicable to the Site and downgradient areas are summarized in Table 1 and Appendix B, and include the following:

- SFRWQCB commercial/industrial land use groundwater screening levels for evaluation of potential vapor intrusion concerns (SFRWQCB, 2008; Table E-1). The SFRWQCB groundwater screening levels are based on the Johnson and Ettinger spreadsheet model for evaluating vapor intrusion concerns. The model conservatively assumes high-permeability vadose zone soil types and that groundwater is present at a depth of approximately 10 feet. The screening levels were developed using California-specific parameters, and assume a target risk of 10^{-6} for carcinogens and a target hazard quotient of 0.2 for non-carcinogens. The criterion for cis-1,2-DCE in Table 1 has been adjusted upward by a factor of five to correspond to a target hazard quotient of 1.0, to maintain consistency with other screening levels.

- Numerical water quality standards for enclosed bays and estuaries of California implemented under the California Toxics Rule (CTR) (USEPA, 2000: 40 CFR 131.38). The CTR water quality standards are numerical standards for discharges to enclosed bays and estuaries of California which are based on human health effects from consumption of aquatic organisms. These criteria apply to actual discharges to Lower Newport Bay, which is located approximately one mile south of the Site.

6.4.2 Groundwater Evaluation – Potential Off-Site Vapor Intrusion Conditions

TCE concentrations in the upper portion of the shallow perched groundwater zone (Tetra Tech, 2008a; Tetra Tech, 2008b) are shown in Figure 5. These data are used for comparison with the SFRWQCB groundwater screening levels because volatilization of VOCs from groundwater is expected to occur only from groundwater located at or near the water table. Figure 5 shows that TCE concentrations in the upper portion of the perched shallow groundwater zone are well below the SFRWQCB groundwater screening level of 1,800 µg/l indicating that off-Site potential vapor intrusion conditions due to TCE are not of concern at this time. Review of data for other COPCs in groundwater (Appendix A) indicates that the VC concentration detected in groundwater location CPT104 (27 µg/l) slightly exceeds the SFRWQCB groundwater screening level of 13 µg/l.

6.4.3 Groundwater Evaluation – Potential Off-Site Surface Water Body Impacts

TCE concentrations in the lower portion of the shallow perched groundwater zone (Tetra Tech, 2008a; Tetra Tech, 2008b) are shown in Figure 6. These data are used for comparison with the CTR criteria because TCE concentrations in groundwater are generally highest in the lower portion of the shallow perched groundwater zone. Figure 5 shows that TCE concentrations in the lower portion of the perched shallow groundwater zone in the downgradient area of the TCE-impacted groundwater are below the CTR criterion of 81 µg/l for TCE. The downgradient part of the area of TCE-impacted groundwater is approximately 4,000 feet from Upper Newport Bay at closest approach (and also lies generally upgradient of the VOC-impacted groundwater at the former Hughes Aircraft facility). None of the other COPCs concentrations in off-Site sampled water exceed their respective CTRs. For these reasons, the likelihood of impacts to surface water in Lower Newport Bay related to on-Site COPCs is considered to be remote, in the judgment of Tetra Tech, and this guidance screening level is not considered further.

7.0 PROPOSED CORRECTIVE ACTION

The proposed corrective action consists of implementing a combination of remediation, engineering controls, and land-use restrictions to minimize on- and off-Site human health risks and adverse impacts to off-Site receptors related to COPC concentrations that exceed one or more of the screening levels. The proposed corrective action is designed to address the following:

- On-Site Potential Vapor Intrusion Conditions: On-Site vapor intrusion is primarily addressed by incorporating appropriate engineering controls into the design of future structures at the Site (Section 7.4), and by establishing restrictions against future activities which have the potential to damage the engineering controls unless there is appropriate notification (Section 7.5). On-Site vapor intrusion concerns are also addressed by ISCO in the DNAPL source zone, which is intended to reduce the total mass of VOCs in groundwater in the western area of the Site (Section 7.1), and by MNA of the dissolved-phase VOCs remaining in groundwater after ISCO is completed (Section 7.2).

- Potential On-Site Direct Exposure to COPCs in Soil and Groundwater: Potential direct exposure to petroleum- and COPC-impacted soil and/or groundwater is addressed by excavation and off-Site disposal of shallow COPC- and TPH-impacted soil (Section 7.3), by restrictions on future excavation activities to depths greater than those overexcavated during the course of Site redevelopment without appropriate notifications and soil handling procedures, and by restrictions on future use of groundwater beneath the Site (Section 7.5)

- Off-Site Potential Vapor Intrusion Conditions: Potential off-Site vapor intrusion at off-Site properties is addressed by ISCO remediation of the inferred DNAPL source zone (Section 7.1), followed by MNA of the remaining dissolved-phase VOCs in groundwater (Section 7.2). These measures are expected to further reduce the only COPC currently exceeding its screening level guidance concentration (VC at one location as discussed in Section 6.4) to a concentration considered unlikely to result in off-Site vapor intrusion impacts.

- Potential Water Quality Impacts to Lower Newport Bay: As discussed in Section 6.4.3, none of the COPCs have been found in sampled water at concentrations that exceed their respective guidance screening level concentrations related to off-Site surface water bodies such as Lower Newport Bay. However, the CAP includes expanding the existing groundwater monitoring well network to include downgradient "sentry" wells that will allow monitoring of COPCs during the ISCO remediation and MNA. (Section 8.0).

7.1 DNAPL Source Area Remediation

7.1.1 Rationale

The inferred presence of DNAPL in the western area of the Site represents an ongoing source of dissolved-phase VOCs to groundwater. The purpose of conducting remediation in the DNAPL zone is to reduce the mass of VOCs in the subsurface to the extent feasible, so that other strategies described above and in the following sections can be used to address dissolved-phase VOCs in groundwater.

The approximate area of the Site where DNAPL source area remediation is proposed is shown in Figure 7. The area shown in Figure 7 is an inferred outer limit of the DNAPL source area, based on the presence of greater than 10,000 µg/l of TCE in groundwater samples collected from the lower portion of the shallow perched groundwater zone (Tetra Tech, 2008a). It is possible that the area where DNAPL is

actually present in the subsurface is smaller and may have a different configuration than shown in Figure 7.

7.1.2 Remedial Alternatives

Alternatives considered for DNAPL source area remediation include the following:

- Excavation: Excavation involves physically removing impacted soil and either on-Site treatment or off-Site disposal of the excavated soil. At the Site, remediation of the DNAPL source area would involve excavation to a depth of up to approximately 50 feet, which may require shoring, dewatering of the shallow perched groundwater zone to allow soils to be excavated, treatment and disposal of the extracted groundwater, as well as either on-Site treatment or off-Site disposal of the source area soil. This technology is not considered to be cost-effective for the Site, unless redevelopment of the Site includes deep overexcavation in this area for construction of a subgrade parking structure.
  Pros: Relatively quick.
  Cons: Expensive; impractical during current Site use; not cost-effective unless there is significant overexcavation during Site redevelopment; increased truck traffic would likely be a concern to the City of Costa Mesa.

- Dual-phase extraction: Dual-phase extraction is an in-situ technology consisting of a combination of groundwater extraction and treatment and soil vapor extraction. At the Site, groundwater levels would need to be drawn down by as much as 20 feet to expose the DNAPL area, which is located at the bottom of the shallow perched groundwater zone, to vapor extraction. This would likely involve treatment and disposal of relatively large amounts of impacted groundwater over an extended period of time. This technology is not considered to be cost-effective for the Site, unless Site redevelopment includes dewatering of this area, such as for a deep subgrade parking structure excavation.
  Pros: Limited surficial disruption; technically feasible; medium duration, not as fast as excavation; no significant truck traffic.
  Cons: Requires treatment and disposal of large volumes of groundwater - groundwater discharge to the storm drain or sanitary sewer system requires either a National Pollution Discharge Elimination System or Orange County Sanitation District permit; medium to high cost (less expensive than excavation, generally more expensive than in-situ treatment methods).

- In-situ bioremediation: In-situ bioremediation involves enhancing the activity of naturally-occurring TCE-degrading microorganisms, or introducing cultured TCE-degrading microorganisms, into the subsurface. This technology is considered to be relatively inexpensive compared with excavation and dual-phase extraction. However, it is not known whether bioremediation would be effective for treatment of high TCE concentrations expected in the DNAPL source area. In addition, reductive dechlorination of TCE by microorganisms proceeds through a series of intermediate compounds, which include cis-1,2-DCE and VC. In some cases, VC degradation is recalcitrant compared with degradation of TCE and cis-1,2-DCE, which can result in VC concentrations increasing in groundwater. Due primarily to the expected overall ineffectiveness of in-situ bioremediation and the possibility of producing more toxic intermediate compounds, this technology is not considered to be feasible for the Site.
  Pros: Limited surficial disruption; treats groundwater in-place without removal/disposal; relatively inexpensive; medium duration – not as fast as excavation; no significant truck traffic would be expected.
  Cons: Not likely to be technically feasible due to high TCE concentrations; can produce increased concentrations of deleterious breakdown products.

- In-situ chemical oxidation (ISCO): ISCO involves the introduction of strong oxidizing agents into the subsurface which react with TCE and other chlorinated hydrocarbons to produce carbon dioxide, water, and chloride ion. The oxidants commonly used for ISCO include permanganate (usually potassium or sodium permanganate), sodium persulfate, Fenton's reagent (a mixture of hydrogen peroxide and ferrous iron), and ozone. In general, these oxidants are hazardous materials and require special handling and secondary containment during use, and need to be stored in a secure area. In addition, strong oxidants may have adverse reactions with soils, such as oxidation of trivalent chromium to hexavalent chromium, although byproducts such as hexavalent chromium usually return to the reduced valence state after the oxidants have dissipated. ISCO has been shown to be effective for remediation of high TCE concentrations and typically does not produce more toxic intermediate compounds, such as VC. It is, therefore, considered to be applicable to the Site. In addition, costs are considered likely to be lower than excavation or dual-phase extraction and generally comparable to in-situ bioremediation. For these reasons, ISCO is considered to be the preferred remedial technology for DNAPL source area remediation at the Site.
  Pros: Limited surficial disruption; technically feasible; treats groundwater in-place without removal/disposal; ultimately produces non-hazardous breakdown products; medium cost and duration – not as expensive or fast as excavation, but generally lower cost than dual phase extraction; no significant truck traffic would be expected.
  Cons: Treatment chemicals are hazardous materials that require careful handling and mixing; can result in temporary generation of increased concentrations of deleterious reaction products; may not be cost-effective in soils with high oxygen demand; can result in reduced permeability of soils and solubilization of metals.

7.1.3 Implementation

Conceptually, ISCO is expected to be conducted by introducing an aqueous oxidant solution into the possible DNAPL source area by gravity feeding the solution via injection wells. It is expected that the injection wells will consist of conventionally constructed two-inch diameter PVC groundwater monitoring wells, screened across the lower portion of the shallow perched groundwater zone. Injection is expected to be conducted as a batch (as opposed to continuous) process, with a fixed volume of oxidant being introduced into the subsurface at each injection well by gravity feeding directly from a portable mixing AST. It is expected that multiple rounds of injection will be conducted at the Site, with remediation-related groundwater monitoring conducted between injection events to assess the progress of remediation.

7.1.3.1 ISCO Pilot Test

Bench-Scale Treatability Testing

Prior to full-scale implementation of ISCO, an ISCO Pilot Test Work Plan is expected to be prepared for review and approval by the SARWQCB. Prior to preparing the work plan, five soil borings are expected to be advanced in the areas shown in Figure 7. The purpose of the soil borings is to collect soil samples for the purpose of conducting bench-scale treatability testing, and for the installation of additional two-inch diameter wells for the purpose of conducting the ISCO pilot test. No oxidant injections will be conducted prior to approval of the ISCO Pilot Test Work Plan by the SARWQCB.

Pilot Test Work Plan

The ISCO Pilot Test Work Plan is expected to include the following:

- The results of bench-scale treatability testing of at least two selected oxidants, which is expected to be conducted using soil and groundwater samples collected at the Site. The treatability test results are expected to be used to evaluate soil oxidant demand (i.e., the amount of oxidant that is lost by reaction with native, unimpacted soil), the optimal dosage rate for each oxidant, and whether any adverse reactions could be expected to occur during oxidant injection. The treatability test results are expected to be used for final oxidant selection and to obtain engineering parameters for the pilot-scale test, including optimum oxidant concentrations, rate of delivery to the subsurface, and any design adjustments needed to minimize undesirable reactions in the field.

- A plan for conducting the oxidant injections, including, but not necessarily limited to, the number and location of the injection wells, the number and location of wells to be used for pilot test monitoring, the oxidant to be used and its characteristics, and the expected oxidant quantities and injection rates.

- Methods that will be used to control the area of injection and the potential for migration of oxidant to undesired areas, such as underground utilities.

- A sampling and analytical plan for monitoring VOC concentration reductions and potential migration of oxidant in groundwater for a period of three months following oxidant injection. Figure 7 shows the locations of the proposed pilot test wells, as well as existing groundwater monitoring wells located in the proposed pilot test area.

- A Site-specific Health & Safety Plan for the pilot test, which is expected to include supplemental information regarding chemical safety and handling, including secured work and oxidant storage areas, and a plan for spill containment during the oxidant injection.

- Information required by the Los Angeles Regional Water Quality Control Board in "Revised General Waste Discharge Requirements for Groundwater Remediation at Petroleum Hydrocarbon Fuel, Volatile Organic Compound, and/or Hexavalent Chromium Impacted Sites" (Board Order No. R4-2007-0019, dated March 1, 2007). This information was informally requested by the SARWQCB in a meeting held on July 10, 2007.

It is Tetra Tech's understanding that the SARWQCB has concerns regarding potential releases of oxidant to the public storm drain system, which discharges to Upper Newport Bay. Prior to implementing the ISCO pilot test, utility plans showing the locations and depths of known public and on-Site utilities (including storm drain lines) will be requested from the Site owner, the City of Costa Mesa, and applicable Orange County agencies. Drawings that are provided are expected to be reviewed to assess whether utilities (including storm drains) are present in the area proposed for injection of the ISCO solution. In addition, a private utility locating service is expected to be used to locate on-Site private storm drain lines. This information is expected to be used to modify, as appropriate, the injection locations, rates, and/or volumes of the ISCO solution.

Pilot Test and Pilot Test Status Report

Following SARWQCB's approval of the ISCO Pilot Test Work Plan, a pilot test consisting of a single gravity feed injection is expected to take place with groundwater monitoring that includes monitoring for three months following injection.

Following the conclusion of the three-month monitoring period, an ISCO Pilot Test Status Report is expected to be prepared for SARWQCB review and approval. The status report is expected to include the following:

- Discussion of the oxidant injection methodology, the field monitoring program, and the results and conclusions of the ISCO pilot test-related groundwater sampling and analysis.
- Recommendations regarding the effectiveness of the ISCO remediation methodology. If ISCO is effective, recommendations for full-scale implementation are expected to be provided, including, but not necessarily limited to, additional oxidant injections and/or expansion of the injection well network to cover the entire DNAPL area.
- Tables and figures summarizing the pilot test-related groundwater sampling and analysis results.
- Copies of the original laboratory reports.

7.1.3.2 *Full-Scale ISCO Implementation*

Assuming that the pilot test results confirm the effectiveness of ISCO to the Site, the ISCO injection well network is expected to be expanded to a full-scale system encompassing the entire inferred DNAPL area. It is expected that an amendment to the ISCO Pilot Test Work Plan will be submitted to the SARWQCB for review and approval prior to starting oxidant injection in wells located outside of the initial pilot test area. The amendment is expected to provide an outline of the proposed remediation system expansion, including:

- Additional injection well and remediation monitoring well locations.
- Revisions to the sampling and analytical plan for monitoring VOC concentration reductions and potential migration of oxidant in the subsurface during remediation.
- A proposed schedule for conducting additional oxidant injections.

7.1.4 Post-Remediation Confirmation Sampling

At the conclusion of remediation, a Confirmation Sampling Work Plan is expected to be prepared for SARWQCB review and approval. The Confirmation Sampling Work Plan is expected to include information on the type, number, and locations of the proposed confirmation samples, sampling methodology, and analytical methods.

Post-remediation confirmation sampling is expected to consist of collecting soil and/or discrete depth groundwater samples at the bottom of the shallow water-bearing zone, and analyzing the groundwater samples for VOCs in general accordance with USEPA Method No. 8260B. Confirmation soil sampling is expected to be conducted using either a hollow stem auger or direct-push drill rig. Discrete-depth confirmation groundwater sampling is expected to be conducted using a HydroPunch (or equivalent) groundwater sampling tool advanced by a CPT or other direct-push type rig.

7.2 Dissolved-Phase Groundwater Remediation

7.2.1 Rationale

The proposed ISCO program is designed to reduce the mass of VOCs in the relatively small area of inferred DNAPL (described above), as this appears to be the primary source of elevated VOC concentrations in groundwater. This section describes additional remedial measures designed to further reduce dissolved-phase VOC concentrations in groundwater to the point where vapor intrusion is not a significant concern at downgradient commercial/industrial properties.

7.2.2 Methodology

Dissolved-phase groundwater impacts remaining after completion of the ISCO program described above are expected to be addressed through MNA. The available data for COPCs in groundwater indicate that cis-1,2-DCE and VC, both of which are common degradation products of TCE and other chlorinated solvents, such as PCE, are also present within the area of TCE-impacted groundwater. This observation suggests that naturally-occurring TCE degradation is occurring in the subsurface, and that MNA is a viable strategy for reducing dissolved phase VOC concentrations in shallow perched groundwater.

7.2.3 Implementation

MNA is expected be implemented as part of the ongoing groundwater monitoring program for the Site. In addition to analyzing groundwater samples for VOCs, analysis for other biodegradation-related parameters (such as carbonate, bicarbonate, chloride, dissolved oxygen, nitrate, dissolved manganese, dissolved iron, and sulfate) are expected to be incorporated in the monitoring program for sampled water collected from selected wells. Additional discussion of the groundwater monitoring program is provided in Section 7.0.

It should be noted that ISCO could locally inhibit biological activity within the shallow water-bearing zone due to direct contact between microbes and oxidant, or due to the creation of highly oxidizing conditions in the subsurface. Studies of microbial activity before and after implementation of ISCO (summarized in Interstate Technology & Regulatory Council [ITRC], 2005 and Huling and Pivetz, 2006) have found that biodegradation rates rebound relatively quickly following treatment with a variety of oxidants. In the event that biodegradation rates are significantly impacted by ISCO, bioenhancements (such as ethenogens) may be implemented to restore the reducing conditions and microbial populations necessary for MNA.

7.2.4 Documentation Sampling

MNA documentation sampling is expected be conducted as part of the groundwater monitoring program for the Site, discussed in Section 8.0. A request for final closure of the Site is expected to be made when the extent of the VOC-impacted groundwater is documented to be stable, dissolved-phase VOC concentrations are documented to be decreasing as a result of ongoing non-bioenhanced biodegradation, and VOC concentrations in off-Site groundwater have been reduced to below the SFRWQCB groundwater screening levels for vapor intrusion concerns (SFRWQCB, 2008) summarized in Table 1.

7.3 Soil Remediation

7.3.1 Rationale

In addition to the known limited area of petroleum-impacted soil in the area of the former waste cutting oil UST, soil remediation is expected to be used to address any presently unknown COPC-impacted soil that might be encountered during Site redevelopment. Soil remediation is intended to address impacted soil encountered during overexcavation of the Site as a part of Site redevelopment. Remedial measures designed to address potential on-Site vapor intrusion are discussed below in Section 7.4.

7.3.2 Methodology

Any impacted soil encountered during overexcavation of the Site as a part of Site redevelopment that exceeds screening levels is expected to be remediated by excavation and off-Site disposal. It should be noted that soil and soil gas characterization work conducted to date at the Site has not found areas of shallow soil with significant VOC concentrations, and has only found a localized area of soil impacted with petroleum hydrocarbons, in the area of the former waste cutting oil UST (Figure 2). The localized petroleum-impacted area is currently inaccessible, in a paved area, and elevated petroleum hydrocarbon concentrations have not been found in groundwater. As a result, no exposure pathway currently exists for direct contact with soil and no impact to groundwater is expected. Since soil remediation of the localized area of petroleum-impacted soil is not feasible at the present time and there is no exposure pathway, remediation of this soil is expected to be conducted in conjunction with grading of the Site and related overexcavation for building foundations, utilities, and pavement.

7.3.3 Implementation

It is expected that soil remediation, if any, will take place in areas of the Site where impacted soil is encountered in shallow soils during overexcavation, grading, and foundation preparation that exceeds residential land soil screening levels (discussed in Section 6.3). Remediation is expected to include excavation and off-Site disposal of petroleum- or COPC-impacted soil.

In the event that impacted soil is found in deeper soils (i.e., at depths greater three feet below the depth that will be overexcavated as part of Site redevelopment), soil screening levels for leaching considerations (where groundwater is not a drinking water resource) will be used for remediation guidance. Remediation is expected to include excavation and off-Site disposal of petroleum- or COPC-impacted soil. However, in the event that overexcavation becomes infeasible, alternative remedial measures may be considered.

Soil remediation is expected to be conducted in accordance with a SMP, including confirmation soil sampling, as discussed further below.

7.3.3.1 Soil Management Plan

The SMP is expected to provide formal protocols and procedures for inspection of the Site by trained personnel during mass grading, excavation of potential impacted soil, post-excavation confirmation sampling, management and disposal of impacted soil, and Site-wide confirmation soil sampling. The SMP is expected to be incorporated by reference into the grading specifications for the Site. Specific items that are expected to be included in the SMP include the following:

- A Site-specific Health & Safety Plan to be implemented during Site grading activities.

- Notification to the grading contractor and other personnel present at the Site during grading of the potential presence of impacted soil.

- Procedures for inspection of the Site by trained environmental personnel during grading.

- Protocols for redirecting grading operations and conducting soil sampling in the event that potentially-impacted soil (i.e., soil observed to be stained, odorous, or with elevated organic vapor meter readings) is encountered during grading.

- A plan for excavation confirmation soil sampling, and sample analysis in areas where potentially-impacted soil is encountered (see additional discussion below [Section 7.3.3.2]).

- A plan for routine confirmation soil sampling and analysis of the bottom of the mass grading excavations to document that soil left in place is acceptable for the intended land use.

- Protocols and procedures for the management of impacted soil stockpiles and for sampling and analysis of the stockpiles for the purpose of soil characterization and disposal.

- Information pertaining to community and worker health and safety concerns during implementation of the SMP.

A copy of the SMP is expected to be submitted to the SARWQCB for review and approval prior to implementation. The SMP is expected to include provisions for confirmation soil sampling in remedial excavations and Site-wide grid soil sampling outside of the footprint of the planned buildings. Additional information on the planned confirmation soil sampling is presented below.

7.3.3.2 Confirmation Soil Sampling

It is expected that confirmation soil sampling will be conducted following removal of the localized petroleum-impacted soil in the area of the former waste cutting oil UST, as a part of the SMP. In the event that other, presently unknown, impacted soil is encountered, confirmation soil sampling discussed below will also be performed as a part of the SMP.

In areas where impacted soil is encountered and excavated during grading, excavation sidewall and bottom confirmation soil sampling is expected to be conducted to document that the soil screening levels cited in Section 6.3 have been achieved to the maximum depth excavated. The number and locations of soil samples to be collected from each excavation is expected to be based on excavation size, in accordance with a sampling plan to be provided in the SMP and submitted to the SARWQCB for approval. It is expected that the confirmation soil samples in impacted soil excavations will be analyzed for VOCs and/or TPH with carbon chain speciation (TPHcc) in general accordance with USEPA Method Nos. 8260B and 8015m, respectively. If the laboratory results for the soil samples indicate that soil which does not meet the guidance screening levels remains in place, additional excavation and soil sampling is expected to be conducted until analytical results indicate that the remediation guidance screening levels have been achieved. However, in the event that overexcavation becomes infeasible, discussions are expected to be held with the SARWQCB to decide the appropriate approach for handling this soil (including whether the remediation guidance screening level(s) can be modified).

7.4 Engineering Controls

7.4.1 Rationale

It is anticipated that it may not be feasible to remediate soil, groundwater, and soil gas at the Site to the extent that soil gas guidance screening levels for potential vapor intrusion conditions (which are very low) can be achieved at the Site. In addition, the Site is located within the Newport Beach Oil Field, and there is a potential for methane gas to be present in the subsurface. To address potential vapor intrusion conditions related to COPCs and methane gas, engineering controls are proposed for all future occupied structures at the Site.

7.4.2 Proposed Methodology and Implementation

Based on the extent of soil gas presently impacted by COPCs (Figure 4), it is expected that a VIMS (including sub-slab passive ventilation system and vapor barrier) will be used as an engineering control beneath all occupied structures at the Site, with the exception of areas where development plans call for passively- or mechanically-ventilated parking structures to be constructed beneath occupied buildings. Where parking structures are to be constructed beneath occupied buildings, the parking structure itself will be considered to represent an adequate engineering control.

Passive ventilation systems typically consist of either a gravel blanket with perforated vapor collection piping or shallow trenches with perforated piping and gravel backfill, which is connected to one or more vent risers. Vapor barriers typically consist of an impervious material, such as high-density polyethylene (HDPE), linear low density polyethylene (LLDPE), or a cold-sprayed emulsion (Liquid Boot®), which is placed above the ventilation system and below the building foundation slab. Vapor barriers are sealed in areas where the barrier material is overlapped, at building footings, and at slab penetrations. A protective covering consisting of sand or geotextile is typically placed over the vapor barrier to provide protection during building foundation installation. Appropriate VIMS notification signage is stenciled on or otherwise attached to the vent risers and other appropriate locations.

The VIMS is expected to be designed and certified by a California-licensed Professional Engineer (P.E.) familiar with vapor intrusion engineering controls. The vapor barrier design is expected to conform to manufacturer's guidelines and industry standards for the construction of vapor barriers, including methods used for sealing the vapor barrier at overlaps, building footings and slab penetrations. Prior to installation, the vapor barrier design is expected to be submitted to the City as part of the building plan approval process, and to the SARWQCB for review and approval. The design drawings are expected to specify that installation of the vapor barrier will be monitored and inspected by a California P.E. familiar with vapor intrusion engineering controls. Items to be monitored during construction are expected to include barrier terminations, sealing of the barrier at overlaps and penetrations, and that the vapor barrier was installed in accordance with the City- and SARWQCB-approved drawings. Following construction, the P.E. is expected to provide a letter certifying that the vapor barrier was constructed in accordance with the City- and SARWQCB-approved design drawings.

7.5 Land-Use Restrictions

7.5.1 Rationale

Land-use restrictions (also referred to as deed restrictions) are expected to: provide appropriate notice to owners, tenants, and others using the property regarding COPCs; prevent inadvertent damage to the on-Site engineering controls described above; and reduce the likelihood that future residents will inadvertently come into contact with impacted soil and/or groundwater.

7.5.2 Implementation

Land-use restrictions are expected to be recorded for the Site at the County of Orange (County) Clerk-Recorder's office prior to occupancy. Land-use restrictions which are expected to be implemented at the Site include the following:

- Appropriate notification to future owners, tenants, and others using the property that COPCs may be present in soil gas, soil, and groundwater beneath the Site.
- Restrictions on future single-family residential land use.
- Restrictions on soil excavation below a depth of three feet below the depth overexcavated for grading purposes, without prior notification to the property owner and the SARWQCB, and implementation of SARWQCB-approved appropriate monitoring for COPCs, health and safety procedures, and mitigation measures, including the repair of vapor barriers and sub-slab ventilation systems and/or handling of impacted soil – if encountered.
- Restrictions on activities such as piping repairs which have the potential to disturb the VIMS, without notification to the property owner and the SARWQCB. This restriction is expected to include a requirement that any SARWQCB-approved work include all necessary repairs to the VIMS, with inspection and certification of the repairs by a California P.E.
- Restrictions on future use of groundwater beneath the Site.

Proposed language for the land-use restrictions is expected to be provided to the SARWQCB for review and comment at least three months prior to occupancy of the Site. After approval, the land-use restrictions are expected to be recorded by the County Clerk-Recorder's office.

8.0 GROUNDWATER MONITORING

Groundwater monitoring was conducted on a quarterly basis for the first three quarters of 2007. Ongoing groundwater monitoring is expected to be conducted on a semi-annual basis until two years after the completion of ISCO. Future activities pertaining to the groundwater monitoring program are expected to include the following:

- Preparation of a work plan for proposed changes to the groundwater monitoring program for the Site. The work plan is expected to be submitted to the SARWQCB for review and approval prior to implementing the proposed changes.

- Evaluation of the existing groundwater monitoring well network, including groundwater monitoring well design and placement, to assess whether any of the existing groundwater monitoring wells can be eliminated from the monitoring program and abandoned in accordance with State standards. For example, COPC concentrations in groundwater in the eastern area of the Site are all below guidance screening levels. The groundwater monitoring wells in this area could, therefore, be removed from the groundwater monitoring program and abandoned in accordance with State standards.

- Installation of additional on-Site groundwater monitoring wells at locations which are better suited for evaluating the effectivity of remediation of dissolved-phase COPCs in groundwater and natural attenuation of dissolved-phase COPCs.

- Installation of off-Site groundwater monitoring wells.

- Periodic analysis of groundwater samples for additional biodegradation-related parameters.

It should be noted that future redevelopment of the Site may involve a temporary cessation of groundwater monitoring activities during construction, and relocation of some or all of the groundwater monitoring wells to areas that are expected to be accessible when development is completed. Potential issues pertaining to well relocation are expected to be discussed with the SARWQCB when redevelopment plans become available.

9.0 LIMITATIONS

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with customary principles and practices in the fields of environmental science and engineering. This warranty is in lieu of all other warranties either expressed or implied. Tetra Tech is not responsible for the independent conclusions, opinions, or recommendations made by others based on the information presented in this report.

It must be recognized that environmental investigations are inherently limited in the sense that conclusions are drawn and recommendations developed from information obtained from limited research and Site investigation. All Site subsurface conditions were not field investigated as part of this study. Additionally, the passage of time may result in a change in the environmental characteristics at this Site and surrounding properties. This report does not warrant against future operations or conditions, nor does this warrant operations or conditions present of a type or at a location not investigated.

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