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MEMO

Date: January 17, 2005

To: Gordon Brown

From: Hsien Chen / Chris Cavers & Bill McClenney

Subject: **Remedial Investigation Tier III-C Assessment Results, IRP Site 1, Former MCAS El Toro**

INTRODUCTION

This memorandum provides results from Tier IIIC of the Remedial Investigation at IRP Site 1. The primary objective of this phase of the RI was to delineate the extent of perchlorate and to collect additional data regarding site geology and hydrogeology. Previous work efforts to collect lithological data were based on conventional exploration methods. To this end, the most recent work used surface to borehole tomographic surveys (borehole geophysics) and continuous coring methods that allow for more detailed inspection of the subsurface geology. The recent work performed at Site 1 (the subject of this technical memorandum) has led to a more refined interpretation of the subsurface geology and hydrogeology.

The initial phase of this investigation consisted of a series of borehole tomographic surveys, which were conducted to assess whether there are fracture zones or other subsurface conditions influencing groundwater flow at Site 1. The data was also to be used to optimize the placement of additional monitoring wells. The survey, which was conducted in 6 groundwater monitoring wells (01-MW101, 01-MW201, 01-MW202, 01-MW205, 01-MW209, and 01-DGMW58), consisted of suspending hydrophones in the wells at specified depth intervals. Compressional waves were induced on the surface by the use of a hammer on an aluminum plate. The hydrophones then measured the arrival times of the induced waves at different depths. The results showed relatively consistent wave velocities, suggesting the subsurface lithology is relatively homogeneous with no clear patterns or distinguishable features that would influence groundwater flow, with the exception of an area west of monitoring well 01-MW209, which indicated slightly lower velocities cross-gradient from the overall groundwater flow direction at Site 1, thus indicating possible increased weathering or permeability west of monitoring well 01-MW209. Additionally, slight differences in velocities and thus differences in lithology were noted between wells in the northern portion of the site versus the central and southern portion of the site. The results did not necessitate changes to the planned locations of additional monitoring wells.

The next phase of this investigation included the installation of 12 groundwater monitoring wells (Figure 1). These 12 wells were drilled and installed with continuous coring methods within Site 1 and along the watershed south of Site 1. These wells penetrated both feldspathic sandstone bedrock as well as locally generated alluvium, with wells screened in both. Surface to borehole geophysics was performed in selected locations.

After installation and development, the new wells and selected existing wells were sampled and analyzed for perchlorate. The results indicate that perchlorate is present in groundwater within both

the feldspathic sandstone and the alluvium at concentrations greater than the state Public Health Goal (PHG) of 6 micrograms per liter (µg/L).

PERCHLORATE SAMPLING RESULTS

Perchlorate concentrations detected in the newly-installed wells at Site 1 are consistent with previously reported concentrations. Analytical results delineate the perchlorate concentrations above the state PHG of 6 µg/L as described in greater detail below. However, reported concentrations and distribution of perchlorate in the vicinity of piezometer 01-PZ15 are higher and more widespread than anticipated. Figure 1 shows a plan view of the monitoring well locations at Site 1 and Site 2, as well as groundwater elevation contours, cross-section locations, and perchlorate concentrations and iso-concentration contours for groundwater. Figure 2 shows preliminary cross-sections A-A′ through D-D′ with ground surface elevation, lithology, monitoring well screen intervals, general groundwater contours, and perchlorate iso-concentration contours for groundwater.

The perchlorate concentration in well 01-MW221, in the northern portion of Site 1, was less than the reporting limit (RL) of 3 µg/L, indicating that the areas with perchlorate concentrations above the PHG in the northern portion of Site 1 appear to be confined to the area around piezometer 01-PZ01. Perchlorate was not detected in the newly-installed well 01-MW220, on the eastern portion of Site 1, at concentrations above the RL of 3 µg/L, which delineates the eastern edge of the main perchlorate plume. Monitoring wells 01-MW217, 01-MW218, and 01-MW219, near the western portion of the main perchlorate plume, had perchlorate concentrations of less than the RL (3 µg/L), 14.1 µg/L, and less than the RL respectively, further delineating the main perchlorate plume.

Perchlorate was not detected in monitoring well 01-MW222 above the RL (3 µg/L). This well was installed just upgradient from the main perchlorate plume, and was screened in what was interpreted as a deep water-bearing zone (at 115 to 130 feet below ground surface [bgs]). The perchlorate concentrations are consistent with results from monitoring well 01-MW204 located approximately 24 feet away and screened from 24 to 54 feet bgs, showing that groundwater at this location in both the upper and the lower depths have not been impacted with perchlorate above the RL (3 µg/L) (Figure 2, cross-section A-A′).

The initial round of sampling (September 2004) of the newly-installed monitoring wells south of Site 1 resulted in perchlorate concentrations that were higher than anticipated. To confirm these initial detections, all of the wells south of the southern Site 1 boundary and several of the wells in the southern portion of the Site 1 property which have not been sampled since 2002/2003 were re-sampled in November 2004. Table 1 (at the end of this memorandum) presents perchlorate concentrations for all wells prior to the November sampling event, as well as the November concentrations, for comparison. In general, the November concentrations are very similar to previous results.

Monitoring wells 01-MW213, 01-MW214, and 01-MW215 had perchlorate concentrations of 105 µg/L, 124 µg/L, and 114 µg/L, respectively in November 2004. These detections were found primarily in the recent alluvium deposited over the feldspathic sandstone. The recent alluvium is expected to exibit higher transmissivity than the underlying sandstone bedrock (see Figure 2, cross-

section D-D'). This is also reinforced by the fact that perchlorate was not detected at or above the RL (3 µg/L) in monitoring wells 01-MW212 and 01-MW216, which are farther from the wash than the other wells in the area. Additionally, the perchlorate concentration in monitoring well 01-MW211, located further south along the wash, was 32.6 µg/L. Based on these results, additional evaluation of the areas between Site 1 and Site 2 is necessary to further evaluate the distribution of perchlorate and whether it is associated with the release at Site 1

ALLUVIUM/BEDROCK CONDITIONS

Analysis of existing Site 1 geologic and hydrogeologic data suggests that as its own watershed, this small area consists of in-place weathering feldspathic sandstone with degrees of weathering appearing to be greater towards the center of the valley. Although in the central valley portion of Site 1 no continuous core data is available south of monitoring well 01-MW222, alluvium is apparent at the surface, and it would seem a reasonable assumption that a gradually thickening wedge of alluvium probably begins south of 01-MW-222 and extends to the vicinity of the fault mapped by Morton (1999) in the southern portion of Site 1 (see Figure 1). No data are known related to the age of movement of this interpreted fault crossing the southern end of Site 1, therefore it is not presently known if this wedge of alluvium changes thickness where it crosses the fault or if the alluvium simply gradually thickens as it merges with a larger watershed to the east. This larger watershed eventually empties into the western tributary of Borrego Canyon Wash at Site 2.

Previous Site 1 exploratory efforts were primarily focused towards obtaining perchlorate distribution information. As such, due to the drilling techniques and soil sampling (logged based on drill cuttings and/or 5-foot interval sampling) it was less likely to differentiate between alluvium and weathered bedrock due to friable nature of the sandstone.

Data on alluvium thickness is available at several locations between Sites 1 and 2. Monitoring well 01-MW215 is interpreted to have no alluvium. Approximately 350 feet south-southwest (SSW) of monitoring well 01-MW215, monitoring well 01-MW214 exhibited alluvium to a depth of at least 28 feet bgs before recovery losses prevented core acquisition until 43 feet bgs. At 43 feet, slightly weathered feldspathic sandstone was evident (Figure 2, cross-section D-D'). At monitoring well 01-MW212, approximately 350 feet west-southwest (WSW) of monitoring well 01-MW215, 11 feet of alluvium was identified above what was interpreted to be the siltstone member of the Niguel Formation. Approximately 500 feet southwest (SW) of monitoring well 01-MW215, monitoring well 01-MW213 appears to be alluvium from the surface to total depth (43 feet bgs) as is monitoring well 01-MW216 (surface to 50 feet bgs), which is located approximately 350 feet south of 01-MW-215 and is the furthest monitoring well into the wash in this cluster of wells.

Bedrock encountered in the continuously-cored boreholes south of the inferred Site 1 southern boundary fault is also a feldspathic sandstone and is presumed to be the Pliocene age Niguel Formation. The Niguel is noted to have locally-derived blocks of siltstone, which are believed to have been encountered in the borehole for monitoring well 01-MW-212.

Further south, and across another inferred fault, monitoring well 01-MW211 encountered alluvium to 40 feet bgs, where siltstone was encountered to total depth of 70 feet bgs. Again, it is not

presently known if this is the siltstone facies of either the Capistrano or Niguel formations. The next area where thickness of alluvium has been studied is Site 2, where thicknesses seem to vary from approximately 30 to 60 feet north of the basin boundary lineament. South of this lineament, alluvium was found to be 80 feet thick in monitoring wells 02NEW26 and 02NEW27 at Site 2.

Alluvium thickness therefore is interpreted to begin in the southern half of Site 1, increases in thickness to approximately 40 feet where measured between Sites 1 and 2, varies in thickness from 30 to 60 feet in Site 2, and increases in thickness basinward across the basin-bounding lineament.

BEDROCK GEOLOGY/HYDROGEOLOGY

As continuous cores were removed from each borehole, they were immediately logged by the attending geologist, and such properties as reactivity to hydrochloric acid (HCl), degree of moisture saturation, as well as color and grain size features were noted in the logs. Initial examination of the logs indicated that there were other properties which might better aid the interpretive efforts, therefore the entire core from each borehole was further examined within a week of collection for characteristics such as alluvium versus bedrock, degree of weathering of the bedrock, and the presence or absence of moisture and degree of saturation.

The results of the detailed core examination indicated that the entire Site 1 area appears to be underlain by feldspathic sandstone, presumably the Oso member of the Pliocene-Miocene age Capistrano Formation, which is mapped as occurring in the majority of the Site 1 area. The sandstone is massive in nature, with little observable evidence of bedding, fracturing or faulting. Differences as to color/hue, grain size, and secondary minerals (such as biotite and quartz) exist within the sandstone, but these characteristics do not appear to provide a consistent means of stratigraphic interpretation or correlation (Figure 2). Similar distinctions exist between the Capistrano Formation and the Niguel Formation, and in general, these two units appear to have a similar provenance and depositional environment.

During drilling and the detailed examination of the bedrock cores, several factors were noted. Sections of the core were reactive with HCl and others were not. These zones were interspersed throughout the lengths of the core. A distinction was made between moist and wet sections of the core for interpretive (post-logging re-examination) purposes. None of these partially or more fully saturated core sections were reactive with HCl. This tends to suggest that a form of secondary porosity (i.e., development of a subsequent or separate porosity system due to dissolution, leaching, or the presence of fractures [now discounted]) exists interspersed throughout the feldspathic sandstone and is observable where either saturations presently exist, or where the feldspathic sandstone is not reactive with HCl. It is suspected that these non-reactive zones may serve to port water during wet seasons or wet years.

Depth correlations between these non-reactive or water-bearing zones do not seem to exist even between close boreholes. These observations suggest the following:

- Water is being transported through the feldspathic sandstone primarily in zones of secondary porosity that do not react with HCl. It is not presently known what HCl-reactive mineral is missing, but this would appear to be the result of differential weathering, as bedding surfaces within the feldspathic sandstone have not been noted.

- As local recharge occurs, more of these non HCl-reactive zones may be activated, changing the local "aquifer" hydrodynamics.

Due to the above reasons, flow in the Site 1 environment appears to be complex.

AQUIFER CHARACTERISTICS

Information collected during this round of assessment suggest that there are two predominant hydrogeologic environments at Site 1 and the downgradient area; a probable single flow regime in the alluvium and a second water-bearing zone in the feldspathic sandstone. The flow regime in the feldspathic sandstone aquifer appears, from the information presently available, to be quite complex.

Groundwater in the alluvium is considered to be unconfined. Groundwater levels found in the feldspathic sandstone tend to reflect a regionally gradual potentiometric surface, generally reflecting the surface topography, throughout Site 1. This surface does not necessarily correspond to where saturations were found in the sandstone during drilling, but often rise above these levels to the site-wide potentiometric surface. This would tend to suggest some mechanism of confinement. This hydrogeologic environment appears to be complicated by the development of secondary porosity within the feldspathic sandstone, which is suspected of being responsible for the varying water saturations found there. Secondary porosity refers to development of a subsequent or separate system of openings (porosity) that are not part of the native matrix (such as dissolution or leaching). In this case, the secondary porosity may be related to a lack of HCl-reactive mineralization.In general, the local groundwater gradient within the feldspathic sandstone tends to reflect drainage of the hills surrounding Site 1 (either towards Site 1 or towards the surrounding terrain), and then along the valleys toward Site 2.

Borehole BH-02, which was subsequently renamed well 01-MW222, was intended to explore the possibility of lower water-bearing units, and was to be screened in the second water-bearing unit if one was identified. What was not known at the time was how many potential water-bearing zones would eventually be identified in the subsurface down to the target depth at this, and the other boreholes completed during this phase of investigation.

Characteristics noted in the cores indicate better potential for understanding the site hydrogeology. These features relate to the degree of weathering of the sandstone, presence or absence of moisture as noted in detail as the core was retrieved, and the relationship that appears to exist regarding HCl reactivity. In only one instance (01-MW219 between 45 and 50 feet bgs) was moisture observed to be associated with the sandstone where reactions with HCl were observed. In all other cases, where the sandstone reacted with HCl, moisture was absent. The moisture or water-bearing zones range from less than one foot to nearly 30 feet in thickness; however, they do not appear to correlate between the wells. This suggests that secondary porosity, manifested by the absence of HCl reactivity, may be a factor in the hydrodynamics of the feldspathic sandstone aquifer. The best example of this may be found in the interpretive log for well 01-MW222 (Figure 3). The borehole for this well was advanced to a maximum depth of 190 feet bgs. The first 25 feet of this borehole were composed of dry, highly weathered feldspathic sandstone that did not react with HCl. The remaining 165 feet of core (from 25-feet bgs to 190-feet bgs) were composed of 150 feet of visually similar feldspathic sandstone with only minor variations, and 20 feet of siltstone in two

beds. However, this same section of core contained ten zones of sandstone which reacted with HCl, four short zones interpreted as "wet" or relatively saturated with water, eleven zones interpreted as "moist" (or less saturated with water) and nine zones that were dry but did not react with HCl. These zones are more or less randomly distributed through the core. The well screen was set between 115 and 130 feet bgs, which included 1-foot saturated (wet) zone and one 2-foot "moist" zone. Water was subsequently gauged at approximately 75 feet above the screen in this well (encompassing some 9 dry zones of core). The resulting impression is that the subsurface of Site 1, though composed predominately of an ostensibly massive feldspathic sandstone, is a complex hydraulic environment that appears to be composed of randomly oriented secondary solution porosity which comprises the "aquifer" in this area.

During well development and groundwater sampling activities, it was noted that development and purge recoveries were relatively low. This is consistent with the slug test data collected in the central portion of Site 1 during June of 2004. The slug test data indicates that hydraulic conductivities range from $4.8x10^{-3}$ feet per day (ft/day) to $2.2x10^{-4}$ ft/day. Using an average hydraulic conductivity of $2.0x10^{-3}$ ft/day ($4.8x10^{-3}$, $2.2x10^{-4}$ and $7.9x10^{-4}$ feet/day), an average hydraulic gradient of 0.05 feet per foot (from current groundwater elevations), and an assumed porosity of 0.2 (20 percent), the average linear groundwater velocity at Site 1 is $4.9x10^{-4}$ ft/day, or 0.18 feet per year. Using the most productive of the three wells (01-PZ07 with hydraulic conductivity of $4.8x10^{-3}$ ft/day) would give a result of 0.44 feet per year. This suggests that hydraulic conductivities may be very low within the Site 1 feldspathic sandstone.

SUMMARY AND CONCLUSIONS

Data collected from the Tier III-C investigation, as well as previous investigations, indicate the following:

- The main perchlorate plume in the central portion of Site 1 appears to be delineated.
- Additional perchlorate was detected between Sites 1 and 2 in the general areas of 01-PZ 15 and 01-MW-211 that warrants additional investigation.

To further assess the lateral and vertical distribution of perchlorate between Site 1 and Site 2, to assess the potential existence of paleochannels in the recent alluvial sediments in the wash (if any), and to provide screening data for the possible future siting of groundwater monitoring wells (if necessary), further work is recommended. Those recommendations are summarized in a January 17, 2005 memorandum to Gordon Brown entitled, "MCAS El Toro IRP Site 1 Further Perchlorate Investigation Recommendations, Remedial Investigation (RI) Tier III-D".

REFERENCES

USEPA, 2001, *Record of Decision for the Western Groundwater Operable Unit OU-3 Aerojet Sacramento Site, Rancho Cordova, California*, United States Environmental Protection Agency Region 9, San Francisco, California, July 20, 2001

ITRC, 2002, A Systematic Approach to In-Situ Bioremediation in Groundwater including Decision Trees on In-Situ Bioremediation for Nitrates, Carbon Tetrachloride, and Perchlorate, Interstate Technology Regulatory Council, Technical/Regulatory Guidelines, August, 2002.

Table 1. Site 1 Perchlorate Concentrations

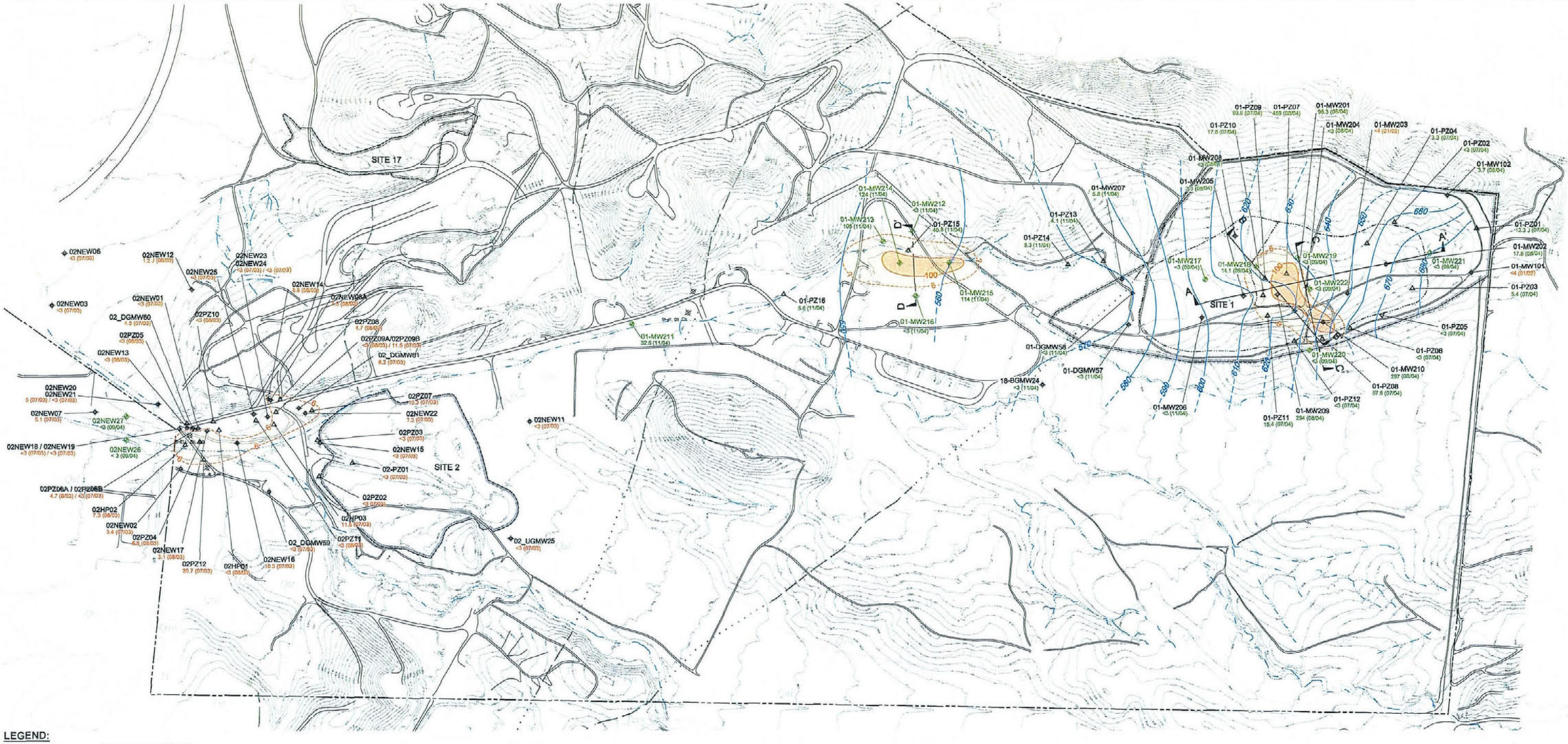
Monitoring Well / Piezometer ID	Perchlorate Concentration (Month/Year Shown) (µg/L)	November 2004 Perchlorate Concentration (µg/L)
01-MW101	<4 (01/02)	NS
01-MW102	3.7 (08/04)	NS
01-MW201	96.3 (08/04	NS
01-MW202	17.8 (08/04)	NS
01-MW203	<4 (01/02)	NS
01-MW204	<3 (08/04)	NS
01-MW205	3.3 (08/04)	NS
01-MW206	<4 (01/02)	<3
01-MW207	6.1 (08/04)	5.8
01-MW208	<3 (08/04)	NS
01-MW209	294 (08/04)	NS
01-MW210	297 (08/04)	NS
01-MW211	34.8 (09/04)	32.6
01-MW212	<3 (09/04)	<3
01-MW213	94.9 (09/04)	105
01-MW214	146 (09/04)	124
01-MW215	121 (09/04)	114
01-MW216	<3 (09/04)	<3
01-MW217	<3 (09/04)	NS
01-MW218	14.1 (09/04)	NS
01-MW219	<3 (09/04)	NS
01-MW220	<3 (09/04)	NS
01-MW221	<3 (09/04)	NS
01-MW222	<3 (09/04)	NS

Table 1. Site 1 Perchlorate Concentrations

Monitoring Well / Piezometer ID	Perchlorate Concentration (Month/Year Shown) (µg/L)	November 2004 Perchlorate Concentration (µg/L)
01-DGMW57	<4 (06/02)	<3
01-DGMW58	<4 (01/02)	<3
18BGMW24	<4 (03/03)	<3
01-PZ01	12.3 J (07/04)	NS
01-PZ02	<3 (07/04)	NS
01-PZ03	5.4 (07/04)	NS
01-PZ04	3.3 (07/04)	NS
01-PZ05	<3 (07/04)	NS
01-PZ06	<3 (07/04)	NS
01-PZ07	459 (08/04)	NS
01-PZ08	57.6 (07/04	NS
01-PZ09	93.6 (07/04)	NS
01-PZ10	17/6 (07/04)	NS
01-PZ11	15.4 (07/04)	NS
01-PZ12	<3 (07/04)	NS
01-PZ13	4.3 (07/04)	4.1
01-PZ14	6.1 (07/04)	5.3
01-PZ15	37.4 (07/04)	40.8
01-PZ16	6.3 (07/04)	5.6

Notes:

< = less than
ID = identification
J = estimated concentration
NS = not sampled



LEGEND:

- MCAS EL TORO BOUNDARY
- EOD RANGE BOUNDARY
- IRP SITE BOUNDARY (1, 2, AND 17)
- STREAM OR WASH (INTERPOLATED FROM TOPOGRAPHIC DATA)
- EXISTING FENCE
- 01-MW219 — NEWLY INSTALLED GROUNDWATER MONITORING WELL (CONTINUOUS CORE COLLECTED)
- 590 — GROUNDWATER CONTOUR ELEVATION, DASHED WHERE INFERRED (GROUNDWATER ELEVATIONS COLLECTED ON NOVEMBER 5, 2004)
- 01-MW209 — EXISTING GROUNDWATER MONITORING WELL
- 01-PZ11 — EXISTING PIEZOMETER
- 459 (08/04) — PERCHLORATE CONCENTRATION (MONTH AND YEAR INDICATED) GREEN INDICATES RECENT DATA
- J — INDICATES ESTIMATED VALUE
- 6 — INFERRED PERCHLORATE ISO-CONCENTRATION CONTOUR ABOVE 6 µg/L (BASED ON NOVEMBER 2004 SAMPLING AND PREVIOUS ROUNDS), QUERIED WHERE UNCERTAIN
- 100 — INFERRED PERCHLORATE ISO-CONCENTRATION CONTOUR ABOVE 100 µg/L (BASED ON NOVEMBER 2004 SAMPLING AND PREVIOUS ROUNDS)
- GEOLOGIC FAULT, DOTTED WHERE INFERRED
- C — C' CROSS-SECTION LOCATION

DESCRIPTION OF MAP UNITS:

Qal	Flood Plain and Stream Channel Deposits (Holocene and Late Pleistocene)
Qsw	Sheetwash Deposits (Holocene to Middle Pleistocene)
Qtr	Trail Ridge Sands (Pleistocene)
Tn	Niguel Formation
Tco	Oso Member
Tm	Monterey Formation (Miocene)
Tt	Topanga Foundation (middle Miocene)
Tvs	Sespe and Vaqueros Formations

NORTH

350 0 350 700

SCALE IN FEET

DRAFT
FOR DISCUSSION PURPOSES ONLY
FINAL REVIEW PENDING

Phase II RI — Perchlorate Summary Memo

Sites 1 and 2 Monitoring Wells, Cross-Section Locations, and Perchlorate Concentrations

Date: 12-04 | Former MCAS El Toro | Figure 1

Project No. 36097

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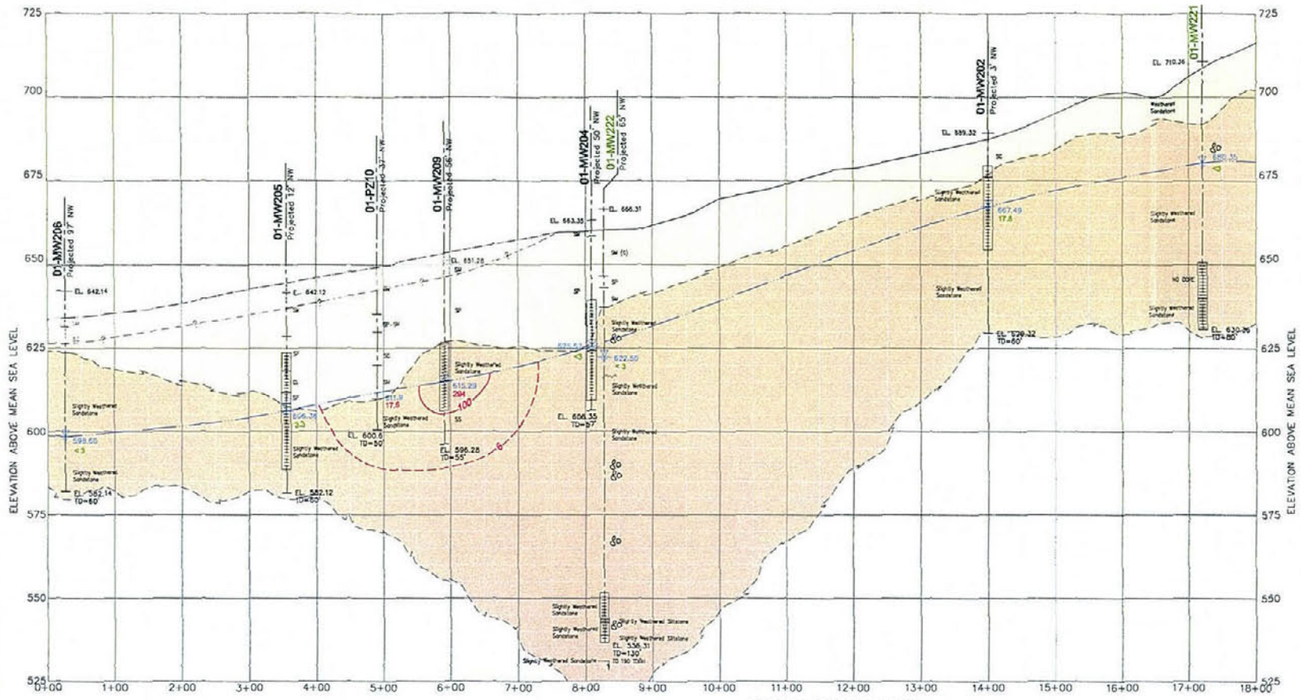
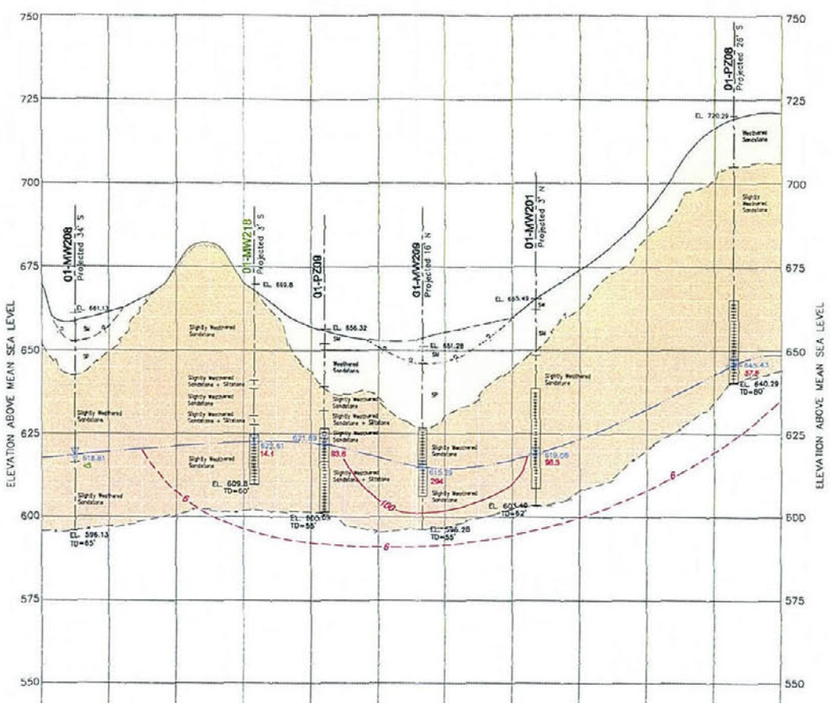
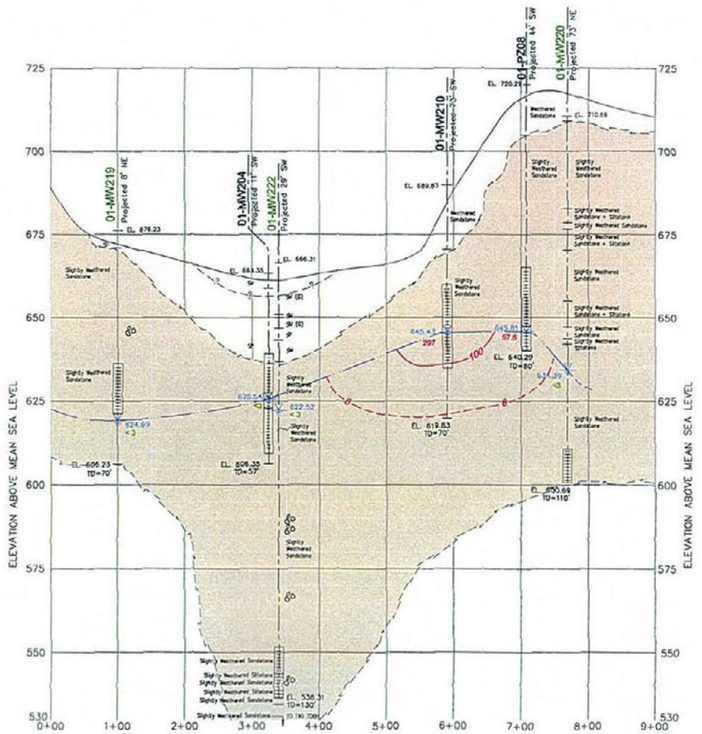


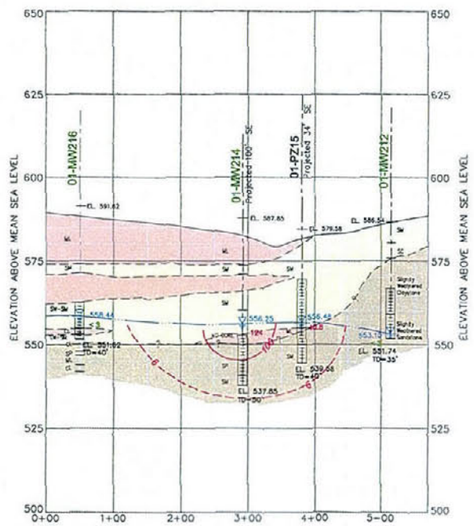
CROSS-SECTION A-A'



CROSS-SECTION B-B'



CROSS-SECTION C-C'



CROSS-SECTION D-D'

LEGEND:

- GROUNDWATER MONITORING WELL (PROJECTED DISTANCE FROM CROSS-SECTION) GREEN INDICATES NEWLY INSTALLED WELL
- GROUND SURFACE (ELEVATION AT WELL LOCATION)
- GROUND SURFACE (ELEVATION ON CROSS-SECTION)
- GEOLOGIC CONTACT
- LITHOLOGY (SEE LEGEND AT RIGHT)
- CONTACT CORRELATION INTERPRETATION
- SCREEN INTERVAL
- GROUNDWATER ELEVATION (MEASURED ON 11/9/04)
- PERCHLORATE CONCENTRATION (MEASURED IN JULY-NOVEMBER 2004
- TOTAL DEPTH OF WELL (BELOW GROUND SURFACE)
- TD 190 TDBH TOTAL DEPTH OF BOREHOLE
- INFERRED PERCHLORATE ISO-CONCENTRATION CONTOUR ABOVE 6 µg/L (BASED ON NOVEMBER 2004 SAMPLING AND PREVIOUS ROUNDS)
- INFERRED PERCHLORATE ISO-CONCENTRATION CONTOUR ABOVE 100 µg/L (BASED ON NOVEMBER 2004 SAMPLING AND PREVIOUS ROUNDS)

LITHOLOGIC LEGEND:

- SAND (INCLUDES SILTY AND CLAYEY SANDS)
- SILT AND OR CLAY
- DECOMPOSED BEDROCK AND/OR ALLUVIUM WHERE PRESENT
- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS), DECOMPOSED BEDROCK AND ALLUVIUM
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)
- FRACTURE
- CALICHE NODULES OR CALCIUM CARBONATE CONCRETIONS

NOTE:

UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

- ML CLAYEY SILT
- SC SANDY CLAY
- SM SILTY SAND
- SW (G) SILTY SAND WITH GRAVEL
- SP POORLY GRADED SAND

SCALE IN FEET VERTICAL: 20', 10', 5', 0
SCALE IN FEET HORIZONTAL: 0, 50', 100'

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Phase II RI	Perchlorate Summary Memo

Site 1
Cross-Sections A-A' thru D-D'

Remedial Investigation, Site 1 - EOD Range

Date: 12-04	Former MCAS El Toro	Figure 2
Project No. 36097	EarthTech, A Tyco International Ltd. Company	

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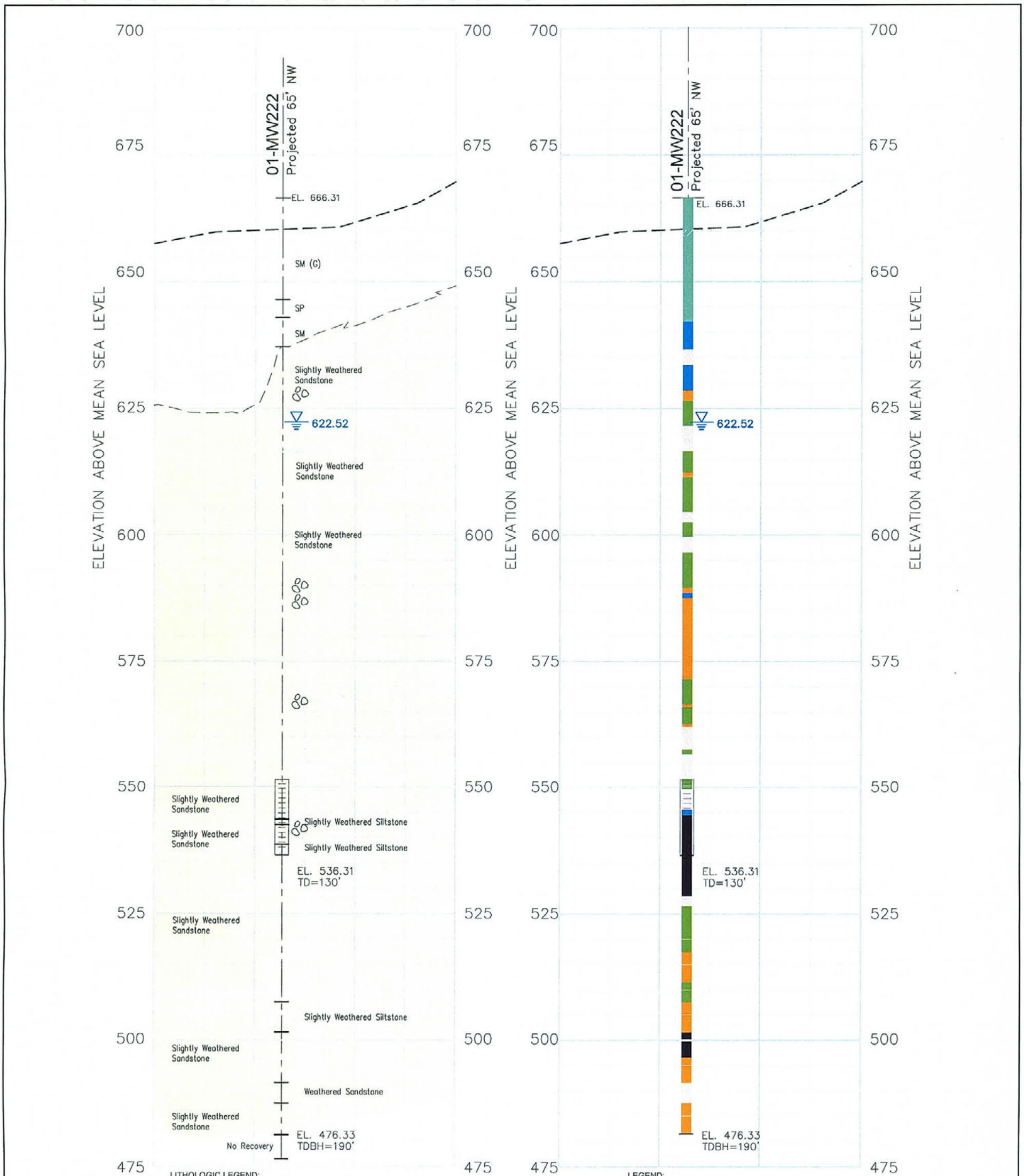


LITHOLOGIC LEGEND:

- WEATHERED BEDROCK (INCLUDES MODERATELY AND HIGHLY WEATHERED BEDROCK OF THE CAPISTRANO AND NIGUEL FORMATIONS)
- SLIGHTLY WEATHERED BEDROCK (CAPISTRANO AND NIGUEL FORMATIONS)
- FRACTURE
- CALICHE NODULES OR CALCIUM CARBONATE CONCRETIONS

NOTE:

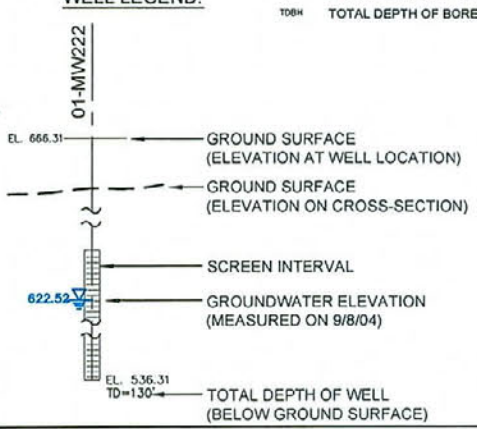
UNIFIED SOIL CLASSIFICATION SYSTEM, (USCS) USED TO DESCRIBE TEXTURE AND IS NOT INTENDED TO INTERPRET EARTH MATERIAL AS SOIL, WITHIN THE BEDROCK UNITS.

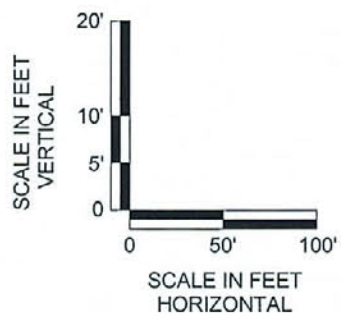
SM	SILTY SAND
SM (G)	SILTY SAND WITH GRAVEL
SP	POORLY GRADED SAND
TDBH	TOTAL DEPTH OF BOREHOLE

LEGEND:

- ALLUVIUM
- FELDSS-A ("A" HORIZON, DECOMPOSITION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B ("B" HORIZON, ACCUMULATION ZONE; DRY, NON-REACTIVE WITH HCL)
- FELDSS-B-HCL ("B" HORIZON; DRY, REACTS WITH HCL)
- FELDSS-B-M ("B" HORIZON, MOIST, NON-REACTIVE WITH HCL)
- FELDSS-B-W ("B" HORIZON, WET , NON-REACTIVE WITH HCL)
- SILTSTONE (NIGUEL FORMATION OR CAPISTRANO FORMATION, NON-REACTIVE WITH HCL)

WELL LEGEND:



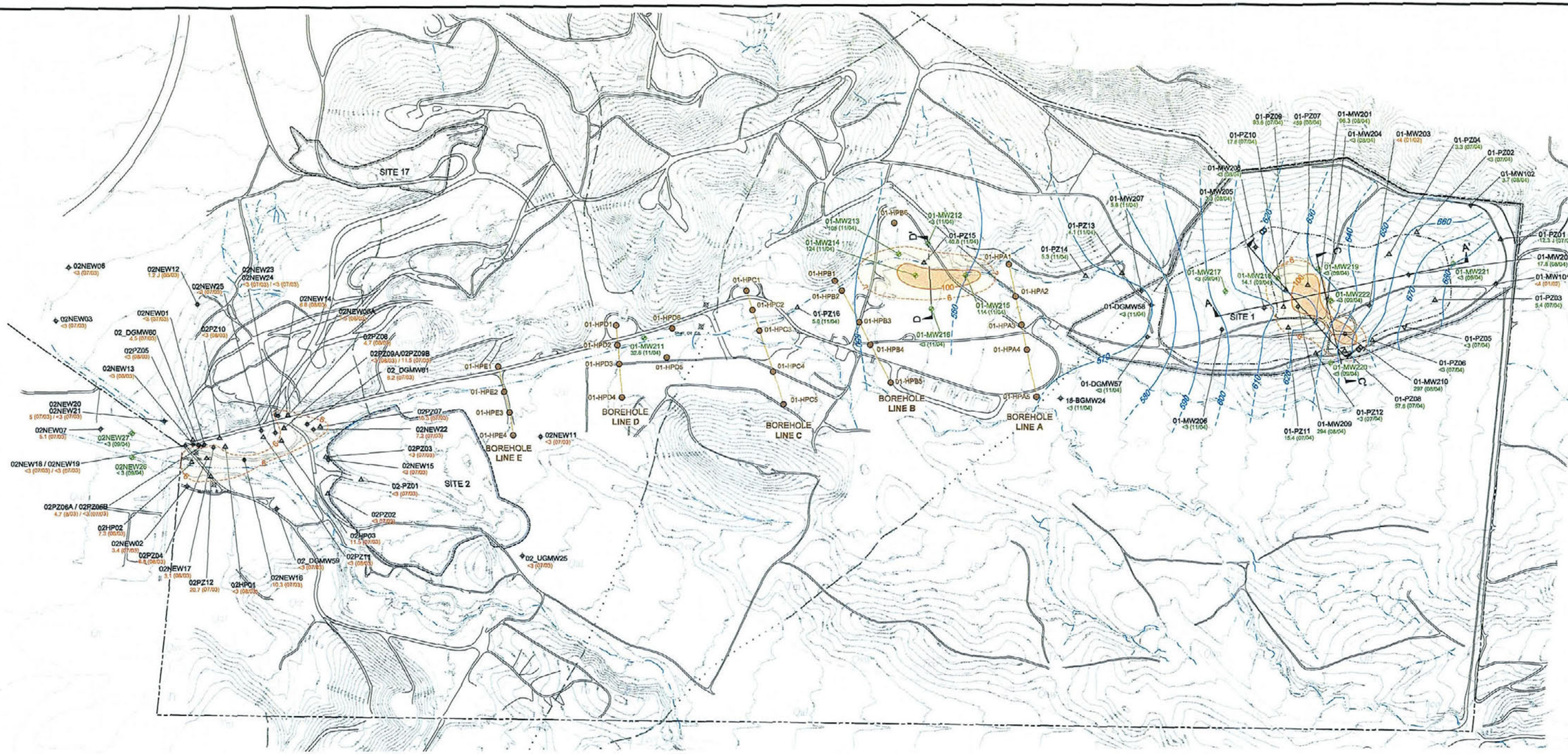


DRAFT

FOR DISCUSSION PURPOSES ONLY

Phase II RI	Perchlorate Summary Memo	
01-MW222 INTERPRETIVE LOG Remedial Investigation, Site 1 - EOD Range		
Date: 12-04	Former MCAS El Toro	Figure 3
Project No. 36097	EarthTech A Tyco International Ltd. Company	

File: G:\us\LongBeachCA\work\Remediation\Projects\36097 (CTO-72)\Site 1\CAD\Figures\Site 1 Proposed Hydropunch Location Map.dwg Time: Dec 08, 2004 - 8:04am



LEGEND:

- 01-HPA5 — PROPOSED HYDROPUNCH SAMPLING LOCATION
- 01-MW219 — NEWLY INSTALLED GROUNDWATER MONITORING WELL (CONTINUOUS CORE COLLECTED)
- 850 — GROUNDWATER CONTOUR ELEVATION, DASHED WHERE INFERRED (GROUNDWATER ELEVATIONS COLLECTED ON NOVEMBER 5, 2004)
- 01-MW209 — EXISTING GROUNDWATER MONITORING WELL
- 01-PZ11 — EXISTING PIEZOMETER
- 459 (05/04) — PERCHLORATE CONCENTRATION (MONTH AND YEAR INDICATED) GREEN INDICATES RECENT DATA
- J — INDICATES ESTIMATED VALUE
- MCAS EL TORO BOUNDARY
- EOD RANGE BOUNDARY
- IRP SITE BOUNDARY (1, 2, AND 17)
- STREAM OR WASH (INTERPOLATED FROM TOPOGRAPHIC DATA)
- EXISTING FENCE
- 6 — INFERRED PERCHLORATE ISO-CONCENTRATION CONTOUR ABOVE 6 µg/L (BASED ON NOVEMBER 2004 SAMPLING AND PREVIOUS ROUNDS). QUERIED WHERE UNCERTAIN
- 100 — INFERRED PERCHLORATE ISO-CONCENTRATION CONTOUR ABOVE 100 µg/L (BASED ON NOVEMBER 2004 SAMPLING AND PREVIOUS ROUNDS)
- GEOLOGIC FAULT, DOTTED WHERE INFERRED
- C — C' — CROSS-SECTION LOCATION

DESCRIPTION OF MAP UNITS:

Qal	Flood Plain and Stream Channel Deposits (Holocene and Late Pleistocene)
Qsw	Sheetwash Deposits (Holocene to Middle Pleistocene)
Qtr	Trail Ridge Sands (Pleistocene)
Tn	Niguel Formation
Tco	Oso Member
Tm	Monterey Formation (Miocene)
Tt	Topanga Foundation (middle Miocene)
Tvs	Sespe and Vaqueros Formations

NORTH

350 0 350 700

SCALE IN FEET

DRAFT
FOR DISCUSSION PURPOSES ONLY
FINAL REVIEW PENDING

Phase II RI — Perchlorate Summary Memo

Site 1
Proposed Hydropunch Sampling Location Map

Date: 12-04	Former MCAS El Toro	Figure 4
Project No. 36097	EarthTech, A Tyco International Ltd. Company	

EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY

DOCUMENT TRANSMITTAL

Contract No. N62742-94-D-0048

To: Remedial Project Manager
Naval Facilities Engineering Command
Southwest Division
Mr. Gordon Brown
1230 Columbia Street, Suite 870
San Diego, CA 92101-8517

DATE: January 20, 2004
CTO #: 072
LOCATION: MCAS, El Toro

FROM: Hsien W. Chen

DESCRIPTION: Sampling and Analysis Plan Amendment No. 3, Phase II Remedial Investigation, Remedial Investigation Tier II-C Assessment Results, and MCAS El Toro IRP Site 1 Further Perchlorate Investigation, Tier III-D

TYPE: _____ Contract Deliverable (Cost) ___✓___ CTO Deliverable (Technical) _____ Other

VERSION: _____ REVISION #s: _____

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