APRIL 4, 2011

ADDITIONAL GROUNDWATER ASSESSMENT
MONITOR WELL CONSTRUCTION REPORT
(MW-34 AND MW-35)
RAYTHEON COMPANY
1901 WEST MALVERN AVENUE
FULLERTON, CALIFORNIA

PREPARED FOR:
RAYTHEON COMPANY

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY • ENGINEERING

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April 4, 2011

VIA FEDERAL EXPRESS – STANDARD

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CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
DEPARTMENT OF TOXIC SUBSTANCES CONTROL
9211 Oakdale Avenue
Chatsworth, CA 91311-6505

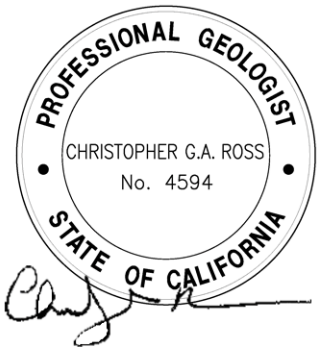
Re: Transmittal of Additional Groundwater Assessment, Monitor Well Construction Report (MW-34 and MW-35), Raytheon Company, 1901 West Malvern Avenue, Fullerton, California

Dear Mr. Jeffers:

Enclosed are one hard copy and one compact disc that contains an electronic copy of the above-referenced report. If you have any questions or require further information, please contact us at 858-455-6500.

Sincerely,

HARGIS + ASSOCIATES, INC.



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(MW-34 AND MW-35)

RAYTHEON COMPANY
1901 WEST MALVERN AVENUE
FULLERTON, CALIFORNIA

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ACRONYMS AND ABBREVIATIONS

1,1-DCE	1,1-Dichloroethylene
AGAWP	Additional Groundwater Assessment Work Plan
ASTM	American Society for Testing and Materials
bls	Below land surface
CACA	Corrective Action Consent Agreement
COPCs	Compounds of potential concern
DTSC	California Environmental Protection Agency, Department of Toxic Substances Control
DWR	California Department of Water Resources
H+A	Hargis + Associates, Inc.
LAS	Lower Aquifer System
MAS	Middle Aquifer System
msl	Mean sea level
OCGB	Orange County Groundwater Basin
PVC	Polyvinyl Chloride
Raytheon	Raytheon Company
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
the Site	1901 West Malvern Avenue, Fullerton, California
SOPs	Standard operating procedures
Target Zone	Site Conceptual Model Hydrostratigraphic Unit B
UAS	Upper Aquifer System
VOCs	Volatile Organic Compounds
Work Plan Addendum 3	Additional Groundwater Assessment Work Plan Addendum No. 3

ADDITIONAL GROUNDWATER ASSESSMENT MONITOR WELL CONSTRUCTION REPORT

(MW-34 AND MW-35)

RAYTHEON COMPANY
1901 WEST MALVERN AVENUE
FULLERTON, CALIFORNIA

1.0 INTRODUCTION

This Additional Groundwater Assessment Monitor Well Construction Report has been prepared by Hargis + Associates, Inc. (H+A) on behalf of Raytheon Company (Raytheon), for the former Hughes Aircraft Company facility located at 1901 West Malvern Avenue, Fullerton, California (the Site) (Figures 1 and 2).

Activities described in this report were conducted in accordance with the Additional Groundwater Assessment Work Plan (AGAWP) Addendum No. 3 (Work Plan Addendum 3) pursuant to general requirements of a Resource Conservation and Recovery Act (RCRA) Corrective Action Consent Agreement (CACA) between the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) and Raytheon (H+A, 2010b and DTSC, 2003). The Work Plan Addendum 3 was approved by DTSC on November 8, 2010 (DTSC, 2010).

1.1 PURPOSE AND SCOPE

This report describes the drilling and installation of triple-clustered monitor well MW-34 (which was completed as three separately constructed monitor wells in separate boreholes spaced approximately 10 feet apart from one another: MW-34A, MW-34B, and MW-34C) and triple-nested monitor well MW-35 (which was completed as three separately cased wells installed in the same borehole: MW-35A, MW-35B, and MW-35C). Data submittals detailing initial and confirmation groundwater sampling results from the newly constructed monitor wells

were recently submitted (H+A, 2011a and 2011b). The monitor wells were installed to delineate the distribution of volatile organic compounds (VOCs), principally 1,1-dichloroethylene (1,1-DCE), and 1,4-dioxane in the Site Conceptual Model Hydrostratigraphic Unit B (Target Zone) to the west and south of the Site, and to assess regional groundwater quality above the Target Zone in the groundwater basin to the south of the Site.

The "Target Zone" is a simplified term used to describe a predominantly sandy interval that appears to be the primary transport interval along which compounds of potential concern (COPCs) have or might preferentially migrate in groundwater. The Target Zone is and has been referred to "Unit B", "B zone", and/or "primary transport zone".

This report is organized as follows:

- Section 1 includes the purpose and organization of the report, and summarizes the objectives and findings from the well construction conducted as part of the tasks outlined in the Work Plan Addendum 3 (H+A, 2010b).
- Section 2 presents a general description of the regional geologic and hydrogeologic framework of the Site vicinity.
- Section 3 presents a description of the methods used during drilling and construction of the additional monitor wells.
- Section 4 summarizes conclusions of this additional assessment and provides recommendations.
- Section 5 lists the references cited in this report.

1.2 GROUNDWATER ASSESSMENT TASKS AND OBJECTIVES

The following describes the tasks presented in the Work Plan Addendum 3 and the respective objectives.

1.2.1 Groundwater Assessment Task 1: Install One Triple-Nested Monitor Well West of the Site and North of Existing Monitor Well MW-32

The monitor well MW-34 cluster was installed to the west of the Site and north of monitor well MW-32, and was constructed as three closely-spaced (clustered) wells screened at different depths with the uppermost screen in Unit A (MW-34A), the middle screen in the Target Zone (MW-34B), and the lowermost screen in the first relatively transmissive hydrostratigraphic interval below Unit B, which is a discrete coarser interval within the entire relatively finer section between Unit B and Unit C referred to as Unit BC (MW-34C).

1.2.1.1 Objectives

The objectives of this task were to: 1) provide information regarding the lateral and vertical extent of VOCs and 1,4-dioxane in the groundwater to the west of the Site and north of nested Monitor Well MW-32; and 2) provide information regarding the depth of the Target Zone to the north of monitor well MW-32.

Installation of clustered monitor well MW-34 has accomplished the following:

- Provided additional water quality data to assess the lateral and vertical delineation of COPCs in groundwater to the west of the Site (H+A, 2011b);
- Provided additional water level data to assess the groundwater flow direction in the Target Zone and vertical hydraulic gradients above and below the Target Zone to the west of the Site (H+A, 2011b);
- Established points for continued monitoring of groundwater levels and water quality in the regional groundwater system to the west of the Site; and
- Evaluation of potential migration pathways of COPCs in groundwater from the Site.

Installation of this triple-clustered monitor well met the objectives of this task. However, results from initial and confirmation groundwater sampling from monitor well MW-34B suggest that additional assessment to the west/west-southwest of this location may be warranted (H+A, 2011b).

1.2.2 Groundwater Assessment Task 2: Install One Triple-Nested Monitor Well South of Existing Monitor Well MW-32

Monitor well MW-35 was installed south of nested monitor well MW-32 and was constructed as a triple-nested monitor well with the uppermost screen in the first relatively thick and transmissive hydrostratigraphic unit above the Site Conceptual Model Unit A (MW-35A), the middle screen in Unit A (MW-35B), and the lowermost screen in the Target Zone (MW-35C).

1.2.2.1 Objectives

The objectives of this task were to: 1) provide information regarding the lateral extent of VOCs and 1,4-dioxane in the Target Zone to the south of existing monitor well MW-32; 2) provide information regarding the depth of the Target Zone to the south of monitor well MW-32; and 3) to assess regional water quality above the Target Zone within the groundwater basin to the south of the Site.

Installation of nested monitor well MW-35 has accomplished the following:

- Provided additional water quality data to assess the extent of COPCs in groundwater to the south of the Site; 1,1-DCE and 1,4-dioxane have not been detected in groundwater samples collected from nested monitor well MW-35 (H+A, 2011a);
- Provided additional water level data to assess the groundwater flow direction in the Target Zone (H+A, 2011a);
- Established points for continued monitoring of groundwater levels and water quality in the regional groundwater system to the south of the Site; and
- Evaluation of potential migration pathways of COPCs in groundwater from the Site.

Installation of this nested monitor well met the objectives of this task. Additional assessment in the vicinity of nested monitor well MW-35 is not warranted at this time.

2.0 REGIONAL GEOLOGIC AND HYDROGEOLOGIC OVERVIEW

This section presents a summary of recent investigations conducted at the Site since 2008 that are pertinent to additional groundwater assessment activities that are summarized herein. A summary of investigations conducted prior to 2003, Site conditions, regulatory background, and areas of the Site that are the subjects of the CACA are presented in the Corrective Measures Study Workplan and the AGAWP (H+A, 2003a and 2003b). A description of the geologic and hydrogeologic conditions at and in the vicinity of the Site is provided in the Deep Boring and Well Construction and Groundwater Sampling Report, and the Additional Groundwater Assessment Primary Transport Zone (Target Zone) Well Construction and Groundwater Sampling Report (H+A, 2005 and 2009). Results of aquifer hydraulic testing conducted at monitor well MW-31 and extraction well EW-02 are summarized in the Aquifer Hydraulic Testing and Preliminary Groundwater Capture Zone Analysis Technical Memorandum (H+A, 2010a). The most recent well construction report summarizes installation of monitor wells MW-31, MW-32, and MW-33, which provided information that delineated the lower portion of the structural fold observed beneath and in the vicinity of the Site (H+A, 2010c).

2.1 REGIONAL HYDROGEOLOGY FRAMEWORK

The Site is located within the Orange County Groundwater Basin (OCGB). Aquifers in the OCGB have been divided into three separate systems called the upper, middle, and lower regional groundwater systems (California Department of Water Resources [DWR], 1967).

The Upper Aquifer System (UAS) is located within the OCGB to the south of Malvern Avenue. The UAS in this area includes stream terrace and older alluvial deposits as well as the La Habra/Lakewood formation. It is believed that coarse-grained facies in the La Habra/Lakewood formation, corresponding to the upper aquifer, pinch out south of the Coyote Hills or are folded and unconformably truncated near the southern boundary of the Site (H+A, 2005).

The Middle Aquifer System (MAS) underlies the UAS to the south of Malvern Avenue and extends to approximately -1,500 feet mean sea level (msl) in this area. The MAS is believed to include the

Coyote Hills formation and the San Pedro formation and may include portions of the La Habra formation incised as channels into the underlying Coyote Hills formation.

The Lower Aquifer System (LAS) underlies the MAS and extends to the base of the freshwater zone. The LAS is believed to include portions of the Fernando group of Pliocene age. The base of the freshwater zone in the vicinity of the Site is estimated to be approximately -300 feet msl just north of the Site and -3,000 feet msl south of the Site in the OCGB (DWR, 1967). The base of the freshwater zone immediately beneath the Site has not been established.

Groundwater production in the OCGB is primarily from the lower portion of the UAS and the upper portion of the MAS between approximately -250 feet msl and 1,000 feet msl (DWR, 1967).

2.2 SITE HYDROGEOLOGY

Site hydrostratigraphic units consist of strata having similar hydraulic properties and lithologic characteristics, which have been correlated across the Site. The soils encountered at the Site are generally interbedded sand, silty to clayey sand, sandy silt, and sandy clay, with local gravel layers (H+A, 1998). Evaluation of strata on a relatively small scale, on the order of inches to a foot or two, indicate that soil types encountered in the subsurface are typically very discontinuous, precluding detailed correlation between boreholes. However, some larger-scale correlations have been made at the Site and vicinity as described below.

The conceptual groundwater model for the Site was refined after completion of additional groundwater assessment activities in 2004 and confirmed and further refined during the 2008 through 2011 well construction activities. Specific results of prior additional assessment activities were documented after discrete phases of work in several well construction and groundwater sampling reports, (H+A, 2005, 2009 and 2010c). The following provides a general overview based on the RCRA Facility Investigation (RFI) and well construction reports for the Site.

Two localized perched zones were identified under portions of the Site during the course of the RFI (H+A, 1998). Perched zones were identified based on the occurrence and behavior of

groundwater, and are not clearly expressed lithologically. The perched zones do not represent a usable source of groundwater due to the limited area over which they occur and the small quantities of water flowing through these zones.

The water table in the regional groundwater system beneath the Site occurs in sand, silt, and clay (H+A, 1998). The upper portion of the regional groundwater system is heterogeneous as indicated by the differences in the lithology encountered during the construction of the groundwater monitor wells. The hydraulic conductivity of these sediments was estimated to range from approximately 0.1 foot per day to approximately 100 feet per day. Wells completed in lithologic intervals with varying degrees of hydraulic communication with each other and with aquifer units in the OCGB respond differently to changes in regional water levels. Those in good communication respond rapidly to regional changes, while those in finer-grained or isolated lithologic units exhibit a dampened and delayed response to regional water level changes. This differential response may also appear as a reversal of the vertical hydraulic gradients in the vicinity of paired monitor well groupings. Such reversals tend to be repeated, representing a seasonally-linked pattern of gradient reversals, from downwards during periods of expected high basin-wide groundwater extraction to upwards during the shorter winter season (H+A, 2005).

The hydrogeology in the southern portion of the Site is heterogeneous and is interpreted to include a structural fold based on regional subsurface studies and on an evaluation of Site lithology, geophysical, water level, and water quality trends (H+A, 2005, 2009 and 2010c). A conceptual groundwater model was developed as part of the RFI and was subsequently refined to incorporate this structural feature following subsequent phases of additional subsurface exploration, such as exploratory borings and deep monitor wells. The conceptual groundwater model is intended to be descriptive of conditions observed in the subsurface, as well as predictive of geologic and hydrogeologic conditions likely to be encountered in the course of any additional subsurface work. The groundwater conceptual model is intended to describe conditions at both the regional scale and at the smaller, Site-specific scale. It is expected that the conceptual model will continue to be refined with time as it is continuously tested against additional new groundwater monitoring data and other new data that may become available. The conceptual groundwater model has been refined based on available

groundwater monitoring data to date, and the primary geologic/hydrogeologic structural feature at and in the vicinity of the Site is described in the following paragraph.

Strata underlying the southern flank of the Coyote Hills are believed to dip gently southward to the north of the Site, and are well documented to be nearly horizontal in the OCGB south of the Site (DWR, 1967). The southern boundary of the Coyote Hills exhibits a monoclinal fold below the surficial terrace deposits, resulting in local southward dip of approximately 42 degrees between exploratory boring EB-1 and monitor well MW-31 (H+A, 2010c).

3.0 TARGET ZONE GROUNDWATER ASSESSMENT WELL INSTALLATIONS

Two triple-completed monitor wells were drilled and constructed off-Site during the period November 2010 through February 2011, as outlined in the Work Plan Addendum 3 and described in the following sections (H+A, 2010b). Well locations were selected in conjunction with DTSC (Figure 2).

Prior to drilling, well locations were cleared for underground utilities by Underground Services Alert and Spectrum Geophysics, Burbank, California, using various subsurface detection technologies. Triple-clustered monitor well MW-34 was drilled and installed during the period January 10, 2011 through February 3, 2011. Triple-nested monitor well MW-35 was drilled and installed during the period November 15, 2010 through December 20, 2010. Both triple-completed monitor wells MW-34 and MW-35 were drilled using mud-rotary circulation drilling method. The drilling contractor was WDC Inc., Montclair, California, a California-licensed well drilling contractor.

Drilling and well construction was conducted in accordance with the Work Plan Addendum 3 (H+A, 2010b), standard operating procedures (SOPs) specified in Appendix A of the AGAWP (H+A, 2003b) and subsequently amended for the deep groundwater program (H+A, 2004a, 2004b, and 2004c) and subsequent AGAWP addendums and amendments.

Waste generated during well construction operations was handled in accordance with SOPs specified in Appendix A of the AGAWP (H+A, 2003b). Documentation of waste handling and off-Site disposal associated with construction of monitor wells MW-34 and MW-35 has been provided (Appendix A).

The following sections describe drilling equipment, drilling methods, lithologic logging, geophysical logging, and well construction.

3.1 DRILLING OF MUD-ROTARY PILOT BOREHOLES

Nominal 12-inch diameter pilot boreholes were drilled at each monitor well installed to obtain lithologic samples and conduct geophysical logging prior to well construction. Monitor wells MW-34 and MW-35 were drilled using rigs configured to drill via mud-rotary circulation (Speedstar 50K and Speedstar 30K, respectively). At each drilling location, a temporary steel conductor casing was advanced to approximately 10 feet below land surface (bls).

Pilot boreholes were advanced to approximately 709 feet bls and 1,100 feet bls at monitor wells MW-34C and MW-35, respectively. Aggregate grab sample soil cuttings were collected approximately every 5 feet from 10 feet bls to the total depth of the boreholes for lithologic description. In addition, soil core samples were collected for lithologic description from the following locations:

- At monitor well MW-34: soil core samples were collected at 250 feet bls (within Unit A) from the monitor well MW-34A borehole; and at 485 feet bls (within the Target Zone) from within the monitor well MW 34B borehole.

- At monitor well MW-35, soil core samples were collected at 447 feet bls (within the first relatively thick and transmissive unit above Unit A), at 801 feet bls (within Unit A), and at 1,026 feet bls (within the Target Zone).

Drilling was conducted under the direction of H+A field personnel. Lithologic logging and soil sampling was conducted during drilling as described in Section 3.3. Downhole geophysical logging of the completed pilot boreholes was conducted as described in Section 3.4. Following pilot borehole reaming to final diameter, well casing and screen were installed in each borehole, the temporary surface casing was removed, and traffic-rated monitor well vaults were installed at the surface as described in Section 3.5.

3.2 LITHOLOGIC LOGGING

Lithologic logging was used to define the lithology and thickness of geologic materials and to characterize subsurface geologic and hydrogeologic conditions. Lithologic logs were compiled based on description of aggregate grab samples recovered at land surface during mud-rotary drilling. Soil samples for lithologic description were collected during mud-rotary drilling using a sieve-type catcher set at the point where mud circulating out of the borehole enters the mud pit. Aggregate grab samples for lithologic description of the boreholes were collected and marked to represent 5-foot intervals.

Soil type was characterized using the Unified Soil Classification System (American Society for Testing and Materials [ASTM], 1984). Soil color was described using Munsell Soil Color Charts (Munsell Soil Color Charts, 1992). Grain size was estimated using ASTM standards (ASTM, 1984). Lithologic logs for the newly constructed monitor wells have been prepared (Appendix B).

3.3 GEOPHYSICAL LOGGING

The following summarizes the methods and results of geophysical logging conducted during drilling of mud-rotary pilot borings at monitor wells MW-34C and MW-35.

Immediately following advancement of the pilot boreholes to total depth, the boreholes were geophysically logged using downhole wireline logging tools. The following logs were run in each borehole:

- Caliper;
- Deviation (MW-35 only);
- Gamma ray;
- Spontaneous potential;
- Short- and long-normal resistivity; and
- Laterolog 3 (lateral log).

Geophysical logging was performed on December 3, 2010 (MW-35) and January 14, 2011 (MW-34) by Pacific Surveys, Claremont, California. Geophysical logs obtained at the Site in December 2010 and January 2011 have been provided (Appendix C).

Geophysical logs were used to refine depth determinations of contacts observed between soil cutting samples and documented on lithologic logs. Geophysical logs were also used in the evaluation of subsurface hydrogeology to the southwest and west of the Site.

3.4 WELL CONSTRUCTION

Two triple-completed monitor wells were installed off-Site during the period November 2010 through February 2011. This section summarizes details of well construction.

3.4.1 Triple-Clustered Monitor Well MW-34

The monitor well MW-34 cluster was constructed as three separate (approximately 10-foot spaced) monitor wells screened in Unit A (MW-34A), the Target Zone (MW-34B), and within Unit BC (MW-34C) of the regional groundwater system using a mud-rotary drilling rig. The base of Unit A, the Target Zone (Unit B), and first coarse interval within Unit BC at this location were determined based on evaluation of the lithologic and geophysical logs. The lowermost portion of the pilot borehole was backfilled using cement grout with approximately 5 percent bentonite. The cement grout was emplaced using a tremie pipe placed such that cement could be pumped from the bottom of the borehole; the tremie pipe was then gradually withdrawn as the cement level rose during emplacement. The lower portion of the pilot borehole at monitor well MW-34C was grouted to a depth approximately equal to the bottom of the monitor well target screen interval and the cement allowed to set.

Nominal 4-inch diameter stainless steel wire-wrap well screen (0.020-inch factory slotted) and nominal 4-inch diameter Schedule 80 polyvinyl chloride (PVC) well casing were installed from land surface to each target depth. Monitor well screen lengths for MW-34A, MW-34B, and MW-34C were 60 feet, 50 feet, and 20 feet, respectively. Each monitor well was cased from the top of the

screen to near land surface. Centralizers were installed approximately at the top and bottom of each screen interval and at approximate 40-foot intervals along blank well casings. The well screens were installed in monitor well MW-34A, MW-34B, and MW-34C from approximately 220 feet to 280 feet bls, 486 feet to 536 feet bls, and 556 feet to 576 feet bls, respectively (Table 1).

Filter pack of Monterey No. 2/12 sand was emplaced using a tremie pipe set in the annulus between the well screen and the borehole wall. An approximate 20- to 30-foot thick transition seal grout filter was emplaced in the annulus above the filter pack using non-beneficiated medium bentonite chips. After allowing the bentonite to hydrate, bentonite grout was emplaced by tremie pipe in the annulus between the well casing and the borehole wall from the top of the grout filter to approximately 3 feet bls. The grout was allowed to settle and then topped off with additional grout and/or bentonite chips. The well was then completed with concrete to land surface. Monitor wells MW-34A, MW-34B, and MW-34C were each completed with a locking traffic-rated subsurface utility vault set in concrete at land surface, slightly above grade of the surrounding asphalt street. Monitor well construction details have been provided (Table 1; Figures 3 through 5; Appendix B).

Initial development of each of the three MW-34 cluster monitor wells was performed immediately following installation and consisted of surging and bailing to remove heavy drilling mud. Final development methods incorporated swabbing, bailing, airlifting, and pumping. Several thousand gallons of fluids were removed from each MW-34 cluster monitor well during development, representing more than 10 casing volumes for each well.

Each monitor well was equipped with a dedicated nominal 230-volt 1-horsepower 3-inch Grundfos electric submersible pump (22SQ15-220 1-HP 200-240V) for groundwater purging and sampling. Each dedicated pump was set above the top of each respective screen interval, at 200 feet bls (MW-34A), 460 feet bls (MW-34B), and 480 feet bls (MW-34C). Each monitor well was also equipped with 1-inch PVC sounding tube with 20 feet of 0.020-inch slotted screen at the bottom to depths of 190 feet (MW-34A), 240 feet (MW-34B), and 230 feet (MW-34C).

3.4.2 Triple-Nested Monitor Well MW-35

Monitor well MW-35 was constructed as a triple-nested monitor well with screened intervals in the first relatively thick and transmissive unit above Unit A (MW-35A), Unit A (MW-35B), and Target Zone (Unit B) (MW-35C) of the regional groundwater system using a mud-rotary drilling rig. The base of the unnamed unit overlying Unit A, Unit A, and the Target Zone at this location were determined based on evaluation of the lithologic and geophysical logs. The lowermost portion of the pilot borehole was backfilled using cement grout with approximately 5 percent bentonite. The cement grout was emplaced using a tremie pipe placed such that cement could be pumped from the bottom of the borehole; the tremie pipe was then gradually withdrawn as the cement level rose during emplacement. The lower portion of the pilot borehole was grouted to a depth approximately equal the bottom of the lowermost monitor well target screen interval and the cement allowed to set.

Nominal 4-inch diameter stainless steel wire-wrap well screen (0.020-inch factory slotted) and nominal 4-inch diameter Schedule 80 PVC well casing were installed from land surface to each target depth. Monitor well screen lengths for MW-35A, MW-35B, and MW-35C were 50 feet, 60 feet, and 50 feet, respectively. Each monitor well was cased from the top of the screen to near land surface. Centralizers were installed approximately at the top and bottom of each screen interval and at approximate 40-foot intervals along blank well casings. The well screens were installed in monitor well MW-35A, MW-35B, and MW-35C from approximately 420 feet to 470 feet bls, 745 feet to 805 feet bls, and 990 feet to 1,040 feet bls, respectively (Table 1).

Filter pack of Monterey No. 2/12 sand was emplaced using a tremie pipe set in the annulus between the well screen and the borehole wall. Seals were emplaced in the annulus above the filter pack of each screen interval using non-beneficiated medium bentonite chips. The thickness of the seal between the MW-35C and MW-35B well screens is approximately 160 feet. The thickness of the seal between the MW-35B and MW-35A well screens is approximately 240 feet. The thickness of the transition grout filter seal above the MW-35A well screen is approximately 25 feet (Table 1; Figure 6). After allowing the bentonite to hydrate, bentonite grout was emplaced by tremie pipe in the annulus between the well casing and the borehole wall from

the top of the grout filter to approximately 3 feet bls. The grout was allowed to settle and then topped off with additional grout and/or bentonite chips. The well was then completed with concrete to land surface. Nested monitor well MW-35 was completed with a locking traffic-rated subsurface utility vault set in concrete at land surface, slightly above grade of the surrounding asphalt street. Monitor well construction details have been provided (Table 1; Figure 6; Appendix B).

Initial development of each of the three nested monitor well MW-35 screens was performed immediately following installation and consisted of surging and bailing to remove heavy drilling mud. Final development methods incorporated swabbing, bailing, airlifting, and pumping. Approximately 10,000 to 20,000 gallons of fluids were removed from each nested monitor well during development, representing more than 20 to 25 casing volumes for each well.

Each monitor well was equipped with a dedicated nominal 230-volt ¾-to-1-horsepower 3-inch Grundfos electric submersible pump (10SQ07-240 ¾-HP 200-240V in MW-35A, and 22SQ15-220 1-HP 200-240V in MW-35B and MW-35C) for groundwater purging and sampling. Each dedicated pump was set above the top of each screen interval, at 400 feet bls (MW-35A) and 460 feet bls (MW-35B and MW-35C). Each monitor well was also equipped with 1-inch PVC sounding tube with 20 feet of 0.020-inch slotted screen at the bottom to depths of 260 feet (MW-35A), 200 feet (MW-35B), and 200 feet (MW-35C).

3.4.3 Surveying

The reference point elevations for newly constructed monitor wells were surveyed on February 25, 2011. Reference point elevations were surveyed to the Orange County datum (NGVD29) and converted to a common datum used for all other monitor wells at the Site (the City of Fullerton vertical datum). Wells were surveyed by Psomas, Santa Ana, California, a licensed surveyor.

4.0 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

The scope of work presented in the Work Plan has been completed and documented in this report.

Drilling and installation of monitor wells MW-34 and MW-35 provided additional lithologic information that confirmed the presence of the structural fold on the southern portion of the Site and to the west of the Site which flattens south of the Site and Malvern Avenue (Figures 8 and 9). This structural feature, a monoclinal fold dipping to the south, is consistent with the groundwater conceptual model. The elevation of the base of the Target Zone decreases to the south (Figure 9). The bottom of the Target Zone is at approximately -380 feet msl near clustered monitor well MW-34 (approximately 540 feet bls) and approximately -960 feet msl near nested monitor well MW-35 (approximately 1040 feet bls).

Water levels measured in Unit B monitor wells on March 1, 2011, indicate a northwesterly groundwater flow direction within the Target Zone in the area of the Site, and vertical hydraulic gradients into the Target Zone from above and below (Table 2; Figure 7). By mid March 2011, the groundwater flow within the Target Zone appeared to have shifted to a more westerly direction and vertical gradients were consistently downward from above and below the Target Zone (H+A, 2011b).

Initial and confirmation groundwater sampling results from monitor wells MW-34 and MW-35 were previously submitted to the DTSC under separate cover (H+A, 2011a and 2011b). 1,1-DCE and 1,4-dioxane were not detected in any of the groundwater samples collected from the monitor well MW-35 well screens, providing lateral delineation of the extent of these COPCs within the Target Zone to between monitor wells MW-32 and MW-35. VOCs and 1,4-dioxane were not detected in the groundwater samples collected from the monitor well MW-34A and MW-34C well screens, providing vertical delineation of the extent of COPCs to within the Target Zone in this area. Results from the Target Zone monitor well at the MW-34 cluster (MW-34B) indicate the presence of COPCs within the Target Zone in this area, and may warrant additional

assessment to the west/west-southwest of this area. A groundwater assessment work plan providing recommendations for additional groundwater assessment is being prepared and will be submitted to DTSC for review and approval prior to the installation of additional monitor wells

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HARGIS + ASSOCIATES, INC.

TABLE 1

WELL CONSTRUCTION SUMMARY

Well Identifier	Date Installed	Current Land Surface Elevation (feet msl)	Current Reference Point Elevation (feet msl)	Total Depth of Borehole (feet bls)	Perforated Interval (feet bls)	Screen Slot Size (inches)	Borehole Diameter (inches)	Casing Diameter (inches) (a)	Filter Pack Interval (feet bls)	Filter Pack Sand Size	Grout Filter/ Intermediate Seal Interval (feet bls) (b)	Annular Seal Interval (feet bls) (c)
Regional Groundwater System Monitor Wells, Extraction Wells and Piezometers												
MW-06	1/16/1997	185.0	184.70	190.9	149.6 - 189.6	0.010	8.5	2	145.4 - 190.9	#2/16	139.4 - 145.4 (d)	0 - 139.4
MW-08	1/22/1997	156.6	155.91	167.2	126.1 - 166.1	0.010	8.5	2	120.7 - 167.2	#2/16	115.7 - 120.7	0 - 115.7
MW-09	3/21/1997	180.5	180.10	194.2	152.2 - 192.2	0.010	8.5	2	146.2 - 194.2	#2/16	141.2 - 146.2	0 - 141.2
MW-13	4/16/1997	142.5	142.19	159.6	120.6 - 159.6	0.010	8.5	2	114.6 - 159.6	#2/16	109.6 - 114.6	0 - 109.6
MW-15	5/18/1998	145.5	144.92	174.7	120.8 - 170.8	0.010	8.5	2	115.8 - 174.8	#2/16	112.8 - 115.8	0 - 112.8
MW-16	11/20/1999	143.0	142.73	179.5	148.5 - 178.5	0.010	11.0	4	144.5 - 179.5	#2/16	134.5 - 144.5 (e)	0 - 134.5
MW-17	5/31/2000	142.8	142.66	203.7	173.1 - 193.1 (i)	0.020	10.0	4	159.7 - 193.1	#2/16	156.2 - 159.7 193.1 - 203.7 (j)	0 - 156.2
MW-18	5/24/2000	142.4	142.11	195.6	164.1 - 194.1	0.020	10.0	4	158.9 - 194.5	#2/16	154.2 - 158.9	0 - 154.2
MW-19	5/26/2000	142.7	142.72	205.5	184.9 - 204.9	0.020	10.0	4	177.0 - 205.3	#2/16	171.5 - 177.0	0 - 171.5
MW-20	6/26/2003	184.4	184.19	200.0	158.6 - 198.2	0.020	11.0	4 (f)	158.0 - 200.0	#2/12	151.0 - 158.0 (g)	0 - 151.1 (h)
MW-21	7/17/2003	143.3	141.18	238.3	212.1 - 232.1	0.010	8.0	4 (k)	205.0 - 234.5	#2/16	202.0 - 205.0 234.5 - 238 (j)	0 - 202.0 (h)
MW-22	8/13/2003	139.4	138.65	245.0	217.4 - 237.4	0.020	8.0	4 (l)	215.0 - 238.0	#2/12	208.0 - 215.0 (m)	0 - 208.0 (h)
MW-23	8/18/2003	137.8	137.33	235.6	215.2 - 235.2	0.020	8.0	4 (n)	209.4 - 235.6	#2/12	203.5 - 209.4 (m)	0 - 203.5 (h)
MW-24	9/15/2004	143.1	142.83	338.0	310.3 - 330.3	0.030	10.6	4 (o)	306 - 330	#3	301 - 306 (p)	0 - 301 (h)
MW-25	9/10/2004	143.0	142.64	805	449.4 - 479.8	0.010	8.5 (q)	2 (r)	429 - 485	#2/16	418 - 429	0 - 418 (h)
MW-26A (s)	10/1/2004	137.6	137.04	805	279 - 309	0.020	12.25 (q)	2 (t)	274 - 315	#2/12	266 - 274	0 - 266 (h)
MW-26B (s)	10/1/2004	137.6	137.05	805	339 - 379	0.020	12.25 (q)	2 (u)	334 - 387	#2/12	266 - 274	0 - 266 (h)
MW-26C (s)	10/1/2004	137.6	137.22	805	459 - 499	0.020	12.25 (q)	2 (v)	435 - 499	#2/12	387 - 435 (w)	0 - 266 (h)
MW-27	4/22/2008	137.6	137.16	550	475 - 505.2 (cc)	0.030	11.25 (q)	4 (z)	468 - 520	#3	457.5 - 468	0 - 457.5 (h)
MW-28	5/5/2008	141.4	140.77	425	335 - 375	0.040	12.25 (q)	4 (z)	325.4- 377	#8	318 - 325.4	0 - 318 (h)
MW-29	8/15/2008	142.7	142.34	265.7	200 - 240	0.020	10.0 (aa)	4 (z)	185 - 246	#2/12	176 - 185	0 - 176 (h)
MW-30A(s)	11/26/2008	130.2	129.44	635 (j)	524-564	0.020	14.25	3 (y)	515.9-570.5	#2/12	495.5-515.9	0-495.5 (bb)
MW-30B(s)	11/26/2008	130.2	129.39	635 (j)	596-616	0.020	14.25	3 (y)	586.8-625	#2/12	586.8-570.5	0-495.5 (bb)
MW-31	10/2/2009	120.3	119.60	1,100 (jj)	946-996	0.020	13	6(kk)	922-1,006	#2/12	904-922	0-904
MW-32A(s)	12/10/2009	93.4	92.88	1,153 (gg)	890-905	0.020	18.5	4(dd)	880-910	#2/12	832-880	0-832
MW-32B(s)	12/10/2009	93.4	92.89	1,153 (gg)	969-999	0.020	18.5	4(dd)	960-1,004.5	#2/12	910-960	0-832
MW-32C(s)	12/10/2009	93.4	92.88	1,153 (gg)	1,070-1,090	0.020	18.5	4(dd)	1,054-1,100	#2/12	1,004.5-1,054	0-832
MW-33	7/2/2010	83.8	83.19	1,080 (hh)	980-1,020	0.020	11	4(dd)	970-1,025	#2/12	924-970	0-924 (ii)
MW-34A	2/3/2011	154.0	153.25	290	220 - 280	0.020	12.25	4(dd)	211 - 290	#2/12	175 - 211	0 - 175
MW-34B	2/1/2011	153.9	153.11	540	486 - 536	0.020	12.25	4(dd)	475 - 540	#2/12	449 - 475	0 - 449
MW-34C	1/19/2011	154.1	153.29	709 (ll)	556 - 576	0.020	12.25	4(dd)	551 - 582	#2/12	530 - 551	0 - 530
MW-35A	12/20/2010	94.3	93.57	1,101	420 - 470	0.020	18	4(dd)	401 - 482	#2/12	376 - 401	0 - 376
MW-35B	12/20/2010	94.3	93.56	1,101	745 - 805	0.020	18	4(dd)	725 - 816	#2/12	482 - 725	0 - 376
MW-35C	12/20/2010	94.3	93.55	1101 (ll)	990 - 1,040	0.020	12.25	4(dd)	980 - 1048	#2/12	816 - 980	0 - 376
EW-01	5/16/2005	143.3	141.07	195	138.1-188.1	0.020	7.6	4 (x)	134.1-195	#2/12	129-134.1 (m)	0-129 (h)
EW-02	10/20/2009	136.0	132.97	473 (ee)	410-460	0.030	17.0	8 (ff)	400-465	#3	384-400	0-384
Perched Zone Piezometers												
P-07	6/6/1997	142.7	142.31	116.8	107.7 - 117.7	0.010	8.5	2	104.7 - 117.7	#2/16	101.7 - 104.7	0 - 101.7
P-09	6/30/2003	184.3	183.86	130.0	109.6 - 129.6	0.010	11.0	4	114.0 - 130.0	#2/16	101.0 - 108.0 (g)	0 - 101.0 (h)

NOTE: Refer to page 2 of this table for footnotes.

TABLE 1

WELL CONSTRUCTION SUMMARY

FOOTNOTES

ns = Not surveyed
msl = Mean sea level, City of Fullerton datum
bls = Below current land surface (October 2004)
(a) = Schedule 40 polyvinylchloride screen and casing, unless otherwise indicated
(b) = Medium bentonite chip seal, unless otherwise indicated
(c) = Bentonite grout annular seal unless otherwise indicated, completed at surface with vault set in concrete
(d) = No. 60 silica sand
(e) = Includes 2.0 feet of No. 60 silica sand placed above filter pack
(f) = Schedule 80 polyvinyl chloride screen and casing
(g) = Includes 2.5 to 3.0 feet of No. 60 silica sand placed above bentonite chip seal
(h) = Cement/bentonite grout, Type I/II Portland, <5% bentonite
(i) = Well plug, approximately 0.5-foot length, set at bottom of perforated interval
(j) = Bottom of borehole backfilled with bentonite chips
(k) = Stainless steel wire wrap screen; Schedule 10 stainless steel casing 122.0 - 212.1 feet bls; Schedule 40 mild steel casing 0 - 122.0 feet bls
(l) = Stainless steel wire wrap screen; Schedule 10 stainless steel casing 112.4 - 217.4 feet bls; Schedule 40 mild steel casing 0 - 112.4 feet bls
(m) = 1/4-inch coated bentonite pellets
(n) = Stainless steel wire wrap screen; Schedule 10 stainless steel casing 110.1 - 215.2 feet bls; Schedule 40 mild steel casing 0 - 110.1 feet bls
(o) = Mild steel wire wrap screen and Schedule 40 mild steel well casing
(p) = Includes 1 to 2 feet of #2/16 sand placed above bentonite chip seal
(q) = Below filter pack, diameter of the original pilot borehole is 5 to 6.25 inches to total depth of boring. Lower borehole backfilled with cement/bentonite grout, Type I/II Portland, <5% bentonite
(r) = Stainless steel wire wrap screen, Schedule 10 stainless steel casing 429.4 - 449.4 feet bls, Schedule 80 polyvinylchloride casing 429.0 - 429.4 feet bls, Schedule 40 mild steel casing 0 - 429.0 feet bls
(s) = Nested wells MW-26A, MW-26B, MW-26C, and MW-32A, MW-32B, MW-32C are constructed with three separate well casings in a single borehole; nested well MW-30A and MW-30B is constructed with two separate casings in a single borehole.
(t) = Stainless steel wire wrap screen; Schedule 10 stainless steel casing 259 - 279 feet bls and 0 - 19 feet bls; Schedule 40 mild steel casing 19 - 259 feet bls
(u) = Stainless steel wire wrap screen; Schedule 10 stainless steel casing 319 - 339 feet bls; Schedule 40 mild steel casing 0 - 319 feet bls
(v) = Stainless steel wire wrap screen; Schedule 10 stainless steel casing 439 - 459 feet bls; Schedule 40 mild steel casing 0 - 439 feet bls
(w) = #8 granular bentonite with exception of heavy mud/formational caving filling annular interval from 417 to 428 feet bls
(x) = Stainless steel wire wrap screen; Schedule 10 stainless steel casing 118.1-138.1 feet bls; Schedule 40 mild steel casing 0-118.1 feet bls
(y) = Schedule 40 Stainless steel endcaps; Schedule 10 stainless steel casing; Stainless steel wire wrap screen
(z) = Schedule 80 PVC blank and screen casing
(aa) = Below filter pack, diameter of the original pilot borehole is 8 inches to total depth of boring. Lower borehole backfilled with cement/bentonite grout, Type I/II Portland, <5% bentonite
(bb) = Neat cement
(cc) = Depth of screen interval adjusted to account for loss at bottom of casing due to breakage in casing wall. Original casing (515 ft bls) was sealed at 505.2 ft bls
(dd) = Schedule 40 Stainless steel endcaps; SCH 80 PVC casing; Stainless steel wire wrap screen
(ee) = Pilot borehole drilled to a total depth of 493 feet bls and backfilled with 5% bentonite-cement grout seal to 465 feet bls
(ff) = Schedule 40 Stainless steel endcaps; SCH 40 stainless steel casing; Stainless steel wire wrap screen; 2.5-foot stainless steel sump
(gg) = Pilot borehole drilled to a total depth of 1,153 feet bls and backfilled with 5% bentonite-cement grout seal to 1,100 feet bls
(hh) = Pilot borehole drilled to a total depth of 1,080 feet bls and backfilled with 5% bentonite-cement grout seal to 1,025 feet bls
(ii) = Annular seal interval is composed of cement grout with ~5% bentonite from 720 to 924 feet bls and bentonite grout from near land surface to 720 feet bls
(jj) = Pilot borehole drilled to a total depth of 1,100 feet bls and backfilled with 5% bentonite-cement grout seal to 1,006 feet bls
(kk) = Schedule 40 Stainless steel endcaps; Schedule 40 stainless steel casing; Stainless steel wire wrap screen; 5-foot stainless steel sump
(ll) = Bottom of borehole backfilled with ~5% bentonite-cement grout

TABLE 2

WATER LEVEL SUMMARY
TARGET ZONE (UNIT B)
DECEMBER 2007 THROUGH MARCH 2011

Well Identifier	Date Measured	Reference Point Elevation (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation System On
Regional Groundwater System Monitor and Extraction Wells					
MW-16	12/10/07	142.73	150.10	-7.37	
	12/20/07	142.73	150.49	-7.76	
	03/17/08	142.73	150.44	-7.71	
	06/23/08	142.73	152.46	-9.73	
	07/11/08	142.73	153.82	-11.09	
	07/14/08	142.73	153.73	-11.00	
	07/15/08	142.73	153.81	-11.08	
	07/30/08	142.73	155.17	-12.44	
	09/22/08	142.73	159.91	-17.18	
	10/22/08	142.73	162.00	-19.27	
	12/15/08	142.73	164.63	-21.90	
	12/19/08	142.73	164.07	-21.34	
	02/25/09	142.73	159.44	-16.71	
	03/16/09	142.73	159.56	-16.83	
	03/18/09	142.73	160.35	-17.62	
	04/29/09	142.73	154.63	-11.90	
	04/29/09	142.73	154.68	-11.95	
	05/27/09	142.73	156.56	-13.83	
	06/22/09	142.73	157.90	-15.17	
	06/26/09	142.73	158.59	-15.86	
	08/31/09	142.73	160.61	-17.88	
	09/10/09	142.73	161.06	-18.33	
	10/23/09	142.73	158.83	-16.10	
	10/30/09	142.73	157.98	-15.25	
	11/04/09	142.73	157.58	-14.85	
	12/07/09	142.73	156.03	-13.30	
	01/19/10	142.73	154.70	-11.97	
	03/01/10	142.73	149.08	-6.35	
	06/07/10	142.73	144.31	-1.58	
	09/07/10	142.73	151.63	-8.90	
	12/06/10	142.73	150.27	-7.54	
MW-26C	12/10/07	137.28	160.43	-23.15	
	12/20/07	137.28	160.88	-23.60	
	01/21/08	137.28	157.99	-20.71	
	02/21/08	137.28	155.52	-18.24	
	03/17/08	137.28	154.73	-17.45	
	04/21/08	137.28	155.21	-17.93	
	05/27/08	137.06	158.25	-21.19	
	06/10/08	137.06	159.70	-22.64	
	06/23/08	137.06	161.15	-24.09	
	07/16/08	137.06	164.52	-27.46	
	08/26/08	137.06	169.10	-32.04	
	09/22/08	137.06	170.89	-33.83	
	10/22/08	137.06	171.58	-34.52	
	12/15/08	137.06	169.04	-31.98	

TABLE 2

WATER LEVEL SUMMARY
TARGET ZONE (UNIT B)
DECEMBER 2007 THROUGH MARCH 2011

Well Identifier	Date Measured	Reference Point Elevation (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation System On
Regional Groundwater System Monitor and Extraction Wells (continued)					
MW-26C	01/07/09	137.06	163.22	-26.16	
(Cont'd)	03/16/09	137.06	153.10	-16.04	
	03/18/09	137.06	152.44	-15.38	
	04/29/09	137.06	148.57	-11.51	
	06/22/09	137.06	152.47	-15.41	
	06/26/09	137.06	155.40	-18.34	
	08/31/09	137.06	158.68	-21.62	
	09/10/09	137.06	161.04	-23.98	
	10/13/09	137.06	156.48	-19.42	
	10/14/09	137.06	156.42	-19.36	
	10/23/09	137.06	154.73	-17.67	
	10/30/09	137.06	154.12	-17.06	
	11/04/09	137.06	153.77	-16.71	
	12/07/09	137.06	150.92	-13.86	
	01/19/10	137.06	149.68	-12.62	
	02/10/10	137.06	145.81	-8.75	
	02/12/10	137.06	145.52	-8.46	
	03/01/10	137.06	143.18	-6.12	
	06/07/10	137.06	140.37	-3.31	
	07/30/10	137.06	144.04	-6.98	
	09/07/10	137.22	147.97	-10.75	
	12/06/10	137.22	145.78	-8.56	
	03/01/11	137.22	128.33	8.89	
MW-27	05/27/08	137.16	157.80	-20.64	
	06/10/08	137.16	159.22	-22.06	
	06/23/08	137.16	160.75	-23.59	
	07/16/08	137.16	164.03	-26.87	
	08/26/08	137.16	168.65	-31.49	
	09/22/08	137.16	170.52	-33.36	
	10/22/08	137.16	171.19	-34.03	
	12/15/08	137.16	168.92	-31.76	
	01/07/09	137.16	163.06	-25.90	
	03/16/09	137.16	153.24	-16.08	
	03/18/09	137.16	152.49	-15.33	
	04/29/09	137.16	148.59	-11.43	
	06/22/09	137.16	152.42	-15.26	
	06/24/09	137.16	154.08	-16.92	
	08/31/09	137.16	158.65	-21.49	
	09/10/09	137.16	160.81	-23.65	
	10/13/09	137.16	156.43	-19.27	
	10/14/09	137.16	156.35	-19.19	
	10/23/09	137.16	154.73	-17.57	
	10/30/09	137.16	154.10	-16.94	
	11/04/09	137.16	153.77	-16.61	

TABLE 2

WATER LEVEL SUMMARY
TARGET ZONE (UNIT B)
DECEMBER 2007 THROUGH MARCH 2011

Well Identifier	Date Measured	Reference Point Elevation (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation System On
Regional Groundwater System Monitor and Extraction Wells (continued)					
MW-27	12/07/09	137.16	150.98	-13.82	
(Cont'd)	01/19/10	137.16	149.60	-12.44	
	03/01/10	137.16	143.25	-6.09	
	03/02/10	137.16	143.02	-5.86	
	06/07/10	137.16	139.74	-2.58	
	07/30/10	137.16	143.73	-6.57	
	09/07/10	137.16	147.75	-10.59	
	12/06/10	137.16	145.39	-8.23	
	03/01/11	137.16	127.65	9.51	
MW-28	05/16/08	140.77	160.41	-19.64	
	05/27/08	140.77	161.69	-20.92	
	06/10/08	140.77	163.08	-22.31	
	06/23/08	140.77	164.55	-23.78	
	07/16/08	140.77	167.88	-27.11	
	08/26/08	140.77	174.46	-33.69	
	09/22/08	140.77	174.45	-33.68	
	10/22/08	140.77	175.11	-34.34	
	12/15/08	140.77	172.87	-32.10	
	01/07/09	140.77	166.82	-26.05	
	03/16/09	140.77	157.25	-16.48	
	03/18/09	140.77	156.45	-15.68	
	04/29/08	140.77	152.49	-11.72	
	06/22/09	140.77	156.45	-15.68	
	06/24/09	140.77	157.74	-16.97	
	08/31/09	140.77	162.68	-21.91	
	09/10/09	140.77	164.54	-23.77	
	10/13/09	140.77	160.35	-19.58	
	10/14/09	140.77	160.32	-19.55	
	10/23/09	140.77	158.57	-17.80	
	10/30/09	140.77	158.02	-17.25	
	11/04/09	140.77	157.61	-16.84	
	12/07/09	140.77	154.74	-13.97	
	01/19/10	140.77	153.63	-12.86	
	03/01/10	140.77	147.29	-6.52	
	03/04/10	140.77	146.80	-6.03	
	06/07/10	140.77	143.98	-3.21	
	07/30/10	140.77	147.43	-6.66	
	09/07/10	140.77	151.67	-10.90	
	12/06/10	140.77	149.96	-9.19	
	03/01/11	140.77	132.48	8.29	

TABLE 2

WATER LEVEL SUMMARY
TARGET ZONE (UNIT B)
DECEMBER 2007 THROUGH MARCH 2011

Well Identifier	Date Measured	Reference Point Elevation (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation System On
Regional Groundwater System Monitor and Extraction Wells (continued)					
MW-29	08/15/08	142.21	174.90	-32.69	
	08/19/08	142.21	174.44	-32.23	
	08/26/08	142.21	175.21	-33.00	
	09/22/08	142.21	177.31	-35.10	
	10/22/08	142.21	178.13	-35.92	
	12/15/08	142.34	176.26	-33.92	
	01/07/09	142.34	170.00	-27.66	
	03/16/09	142.34	160.00	-17.66	
	03/18/09	142.34	159.22	-16.88	
	04/29/09	142.34	154.91	-12.57	
	06/22/09	142.34	158.97	-16.63	
	06/24/09	142.34	159.99	-17.65	
	08/31/09	142.34	165.42	-23.08	
	09/10/09	142.34	167.01	-24.67	
	10/13/09	142.34	162.76	-20.42	
	10/14/09	142.34	162.78	-20.44	
	10/23/09	142.34	161.07	-18.73	
	10/30/09	142.34	160.59	-18.25	
	11/04/09	142.34	160.05	-17.71	
	12/07/09	142.34	156.92	-14.58	
	01/19/10	142.34	156.32	-13.98	
	03/01/10	142.34	149.84	-7.50	
	03/04/10	142.34	149.36	-7.02	
	06/07/10	142.34	146.45	-4.11	
	07/30/10	142.34	149.78	-7.44	
	09/07/10	142.34	154.30	-11.96	
	12/06/10	142.34	153.12	-10.78	
	03/01/11	142.34	135.43	6.91	
MW-30A	12/04/08	129.44	164.15	-34.71	
	12/05/08	129.44	164.29	-34.85	
	12/15/08	129.44	162.77	-33.33	
	01/07/09	129.44	156.65	-27.21	
	03/16/09	129.44	145.68	-16.24	
	03/18/09	129.44	144.93	-15.49	
	04/29/09	129.44	141.29	-11.85	
	06/22/09	129.44	145.32	-15.88	
	06/24/09	129.44	148.04	-18.60	
	08/31/09	129.44	151.45	-22.01	
	09/10/09	129.44	154.83	-25.39	
	10/13/09	129.44	149.24	-19.80	
	10/14/09	129.44	149.22	-19.78	
	10/23/09	129.44	147.49	-18.05	
	10/30/09	129.44	146.87	-17.43	
	11/04/09	129.44	146.56	-17.12	

TABLE 2

WATER LEVEL SUMMARY
TARGET ZONE (UNIT B)
DECEMBER 2007 THROUGH MARCH 2011

Well Identifier	Date Measured	Reference Point Elevation (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation System On
Regional Groundwater System Monitor and Extraction Wells (continued)					
MW-30A	12/07/09	129.44	143.60	-14.16	
(Cont'd)	01/19/10	129.44	142.52	-13.08	
	03/01/10	129.44	135.95	-6.51	
	03/03/10	129.44	135.69	-6.25	
	06/07/10	129.44	133.44	-4.00	
	07/30/10	129.44	137.11	-7.67	
	09/07/10	129.44	140.90	-11.46	
	12/06/10	129.44	138.63	-9.19	
	03/01/11	129.44	120.97	8.47	
MW-30B	12/04/08	129.39	160.82	-31.43	
	12/05/08	129.39	161.49	-32.10	
	12/15/08	129.39	160.27	-30.88	
	01/07/09	129.39	154.82	-25.43	
	03/16/09	129.39	144.60	-15.21	
	03/18/09	129.39	143.96	-14.57	
	04/29/09	129.39	141.03	-11.64	
	06/22/09	129.39	144.02	-14.63	
	06/24/09	129.39	147.85	-18.46	
	08/31/09	129.39	149.39	-20.00	
	09/10/09	129.39	154.06	-24.67	
	10/13/09	129.39	147.92	-18.53	
	10/14/09	129.39	147.93	-18.54	
	10/23/09	129.39	146.17	-16.78	
	10/30/09	129.39	145.42	-16.03	
	11/04/09	129.39	145.25	-15.86	
	12/07/09	129.39	142.39	-13.00	
	01/19/10	129.39	140.64	-11.25	
	03/01/10	129.39	134.60	-5.21	
	06/07/10	129.39	130.92	-1.53	
	09/07/10	129.39	136.39	-7.00	
	12/06/10	129.39	133.99	-4.60	
MW-31	10/13/09	123.7	140.92	-17.2	
	10/14/09	123.7	140.85	-17.1	
	10/23/09	119.60	136.95	-17.35	
	10/30/09	119.60	136.26	-16.66	
	11/02/09	119.60	136.18	-16.58	
	12/07/09	119.60	133.45	-13.85	
	01/19/10	119.60	131.88	-12.28	
	02/10/10	119.60	127.61	-8.01	
	02/12/10	119.60	127.51	-7.91	
	03/01/10	119.60	124.99	-5.39	
	06/07/10	119.60	122.62	-3.02	
	07/30/10	119.60	126.69	-7.09	

TABLE 2

WATER LEVEL SUMMARY
TARGET ZONE (UNIT B)
DECEMBER 2007 THROUGH MARCH 2011

Well Identifier	Date Measured	Reference Point Elevation (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation System On
Regional Groundwater System Monitor and Extraction Wells (continued)					
MW-31	09/07/10	119.60	129.42	-9.82	
(Cont'd)	12/06/10	119.60	125.45	-5.85	
	03/01/11	119.60	108.80	10.80	
MW-32A	01/04/10	92.88	110.20	-17.32	
	01/19/10	92.88	107.34	-14.46	
	02/10/10	92.88	101.90	-9.02	
	02/12/10	92.88	102.03	-9.15	
	03/01/10	92.88	99.24	-6.36	
	06/07/10	92.88	97.01	-4.13	
	09/07/10	92.88	104.02	-11.14	
	12/06/10	92.88	100.08	-7.20	
MW-32B	01/04/10	92.89	109.29	-16.40	
	01/19/10	92.89	106.40	-13.51	
	02/10/10	92.89	101.75	-8.86	
	02/12/10	92.89	101.68	-8.79	
	03/01/10	92.89	99.18	-6.29	
	03/04/10	92.89	99.22	-6.33	
	06/07/10	92.89	96.71	-3.82	
	07/30/10	92.89	100.91	-8.02	
	09/07/10	92.89	103.45	-10.56	
	12/06/10	92.89	99.75	-6.86	
	03/01/11	92.89	82.87	10.02	
MW-32C	01/05/10	92.88	102.93	-10.05	
	01/19/10	92.88	102.03	-9.15	
	02/10/10	92.88	100.10	-7.22	
	02/12/10	92.88	100.03	-7.15	
	03/01/10	92.88	98.65	-5.77	
	06/07/10	92.88	93.19	-0.31	
	09/07/10	92.88	96.89	-4.01	
	12/06/10	92.88	94.01	-1.13	
MW-33	07/16/10	83.19	89.80	-6.61	
	07/30/10	83.19	92.32	-9.13	
	09/07/10	83.19	94.86	-11.67	
	12/06/10	83.19	90.88	-7.69	
	03/01/11	83.19	73.60	9.59	
MW-34A	02/25/11	153.25	142.78	10.47	
	03/10/11	153.25	142.26	10.99	
	03/15/11	153.25	143.61	9.64	

TABLE 2

WATER LEVEL SUMMARY
TARGET ZONE (UNIT B)
DECEMBER 2007 THROUGH MARCH 2011

Well Identifier	Date Measured	Reference Point Elevation (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation System On
Regional Groundwater System Monitor and Extraction Wells (continued)					
MW-34B	02/25/11	153.11	146.89	6.22	
	03/01/11	153.11	146.32	6.79	
	03/10/11	153.11	146.80	6.31	
	03/15/11	153.11	147.91	5.20	
MW-34C	02/25/11	153.29	145.40	7.89	
	03/01/11	153.29	144.88	8.41	
	03/10/11	153.29	148.34	4.95	
	03/15/11	153.29	149.75	3.54	
MW-35A	01/19/11	93.57	77.69	15.88	
	02/03/11	93.57	77.51	16.06	
MW-35B	01/19/11	93.56	84.50	9.06	
	02/03/11	93.56	84.59	8.97	
MW-35C	01/19/11	93.55	88.79	4.76	
	02/03/11	93.55	88.62	4.93	
	03/01/11	93.55	82.54	11.01	
EW-1	12/10/07	142.5(a)	164.54	-22.0	
	12/20/07	142.5(a)	164.75	-22.3	
	01/21/08	140.3 (a)	162.41	-22.1	
	03/17/08	140.3 (a)	156.96	-16.7	
	05/27/08	141.13	160.10	-18.97	
	06/10/08	141.13	161.48	-20.35	
	06/23/08	141.13	162.89	-21.76	
	07/09/08	141.07(b)	165.87	-24.80	Pilot GETS
	07/11/08	141.07(b)	165.59	-24.52	
	07/14/08	141.07(b)	165.71	-24.64	
	07/15/08	141.07(b)	167.64	-26.57	Pilot GETS
	07/30/08	141.07(b)	168.45	-27.38	Pilot GETS
	08/14/08	141.07(b)	> 172.65	< -31.58	Pilot GETS
	08/25/08	141.07(b)	171.89	-30.82	Pilot GETS
	09/22/08	141.07(b)	> 172.65	< -31.58	Pilot GETS
	10/22/08	141.07	> 172.65	< -31.58	Pilot GETS
	12/15/08	141.07	171.93	-30.86	
	01/07/09	141.07	165.86	-24.79	
	02/25/09	141.07	162.17	-21.10	Pilot GETS
	03/16/09	141.07	157.84	-16.77	Pilot GETS
	03/18/09	141.07	158.69	-17.62	Pilot GETS
	04/29/09	141.07	152.31	-11.24	
	04/29/09	141.07	152.85	-11.78	Pilot GETS
	05/27/09	141.07	155.10	-14.03	Pilot GETS
	06/22/09	141.07	156.88	-15.81	Pilot GETS
	06/26/09	141.07	157.98	-16.91	Pilot GETS

TABLE 2

WATER LEVEL SUMMARY
TARGET ZONE (UNIT B)
DECEMBER 2007 THROUGH MARCH 2011

Well Identifier	Date Measured	Reference Point Elevation (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation System On
Regional Groundwater System Monitor and Extraction Wells (continued)					
EW-1	06/29/09	141.07	158.68	-17.61	Pilot GETS
(Cont'd)	07/22/09	141.07	164.06	-22.99	Pilot GETS
	08/14/09	141.07	168.21	-27.14	Pilot GETS
	08/31/09	141.07	163.05	-21.98	Pilot GETS
	09/10/09	141.07	164.32	-23.25	Pilot GETS
	09/11/09	141.07	164.23	-23.16	Pilot GETS
	10/08/09	141.07	> 172.65	< -31.58	Pilot GETS
	10/23/09	141.07	158.25	-17.18	Pilot GETS
	10/30/09	141.07	157.75	-16.68	
	11/04/09	141.07	157.23	-16.16	
	12/07/09	141.07	154.56	-13.49	
	12/09/09	141.07	155.28	-14.21	
	01/19/10	141.07	153.29	-12.22	
	03/01/10	141.07	147.07	-6.00	
	06/07/10	141.07	142.43	-1.36	
	09/07/10	141.07	150.09	-9.02	
	12/06/10	141.07	148.66	-7.59	
	03/01/11	141.07	131.68	9.39	
EW-2	10/23/09	137.6	137.92	-0.3	
	10/30/09	137.6	156.81	-19.2	
	10/31/09	137.6	155.97	-18.3	
	11/04/09	136.2	153.21	-17.0	
	12/07/09	132.97	UTM	--	
	02/10/10	132.97	142.49	-9.52	
	03/01/10	132.97	139.89	-6.92	
	03/22/10	132.97	136.73	-3.76	Pre-Startup
	03/22/10	132.97	143.6	-10.6	Pilot GETS
	03/23/10	132.97	143.25	-10.3	Pilot GETS
	03/24/10	132.97	144.42	-11.5	Pilot GETS
	03/25/10	132.97	144.60	-11.6	Pilot GETS
	03/26/10	132.97	144.99	-12.0	Pilot GETS
	06/07/10	132.97	143.34	-10.4	Pilot GETS
	07/30/10	132.97	145.5	-12.5	Pilot GETS
	08/02/10	132.97	146.95	-14.0	Pilot GETS
	09/02/10	132.97	150.82	-17.9	Pilot GETS
	09/07/10	132.97	150.46	-17.5	Pilot GETS
	12/07/10	132.97	148.62	-15.7	Pilot GETS
	01/13/11	132.97	138.52	-5.6	Pilot GETS
	02/03/11	132.97	136.61	-3.6	Pilot GETS
	03/02/11	132.97	130.70	2.3	Pilot GETS

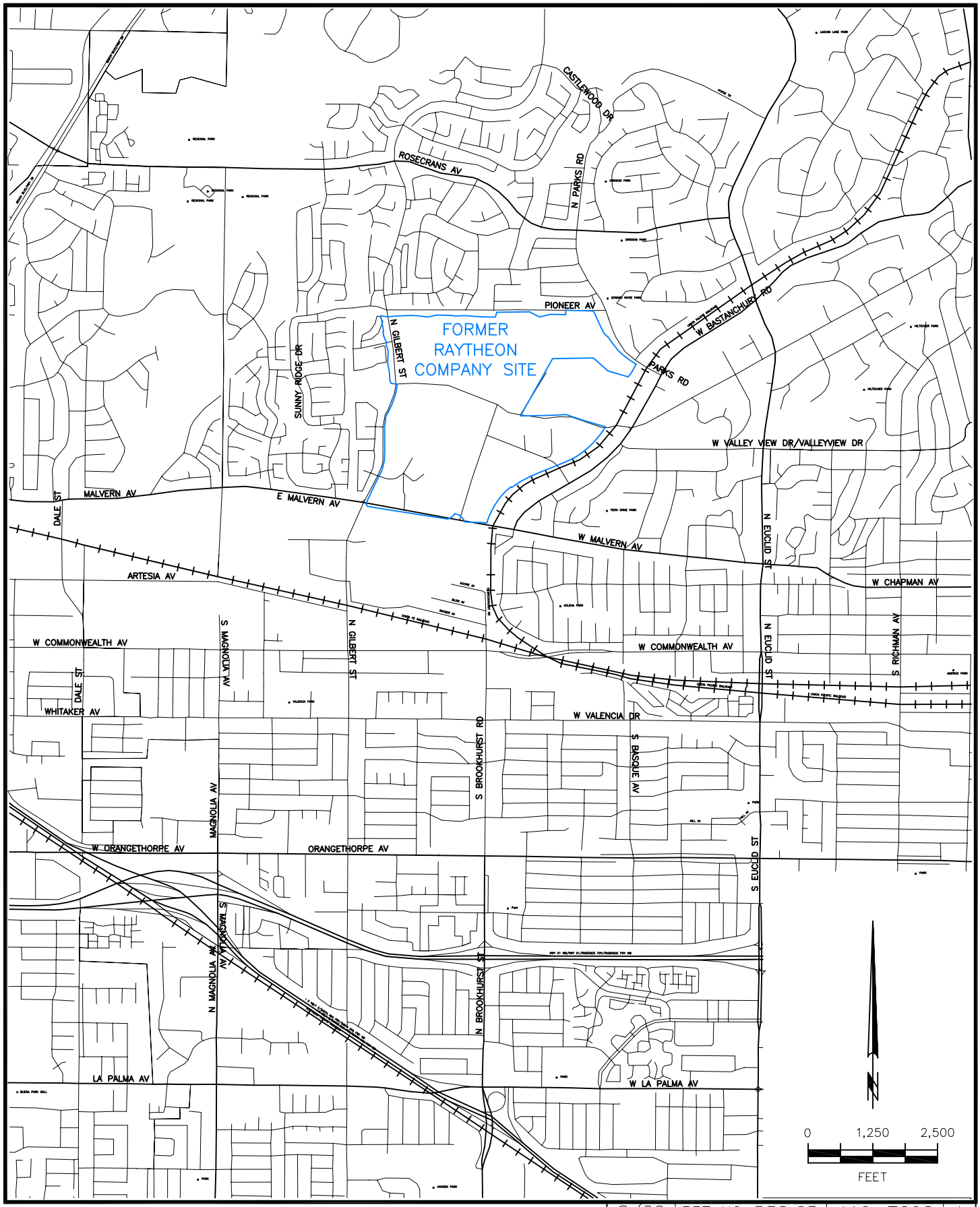
FOOTNOTES

msl = Mean sea level bls = Below land surface

(a) Pump/sounding tube pulled and new reference point elevation at top of casing estimated.

(b) Measuring point elevation change due to pump reinstallation, elevation survey in January 2009.

Pilot GETS = Pilot Groundwater Extraction and Treatment System On, water level not static

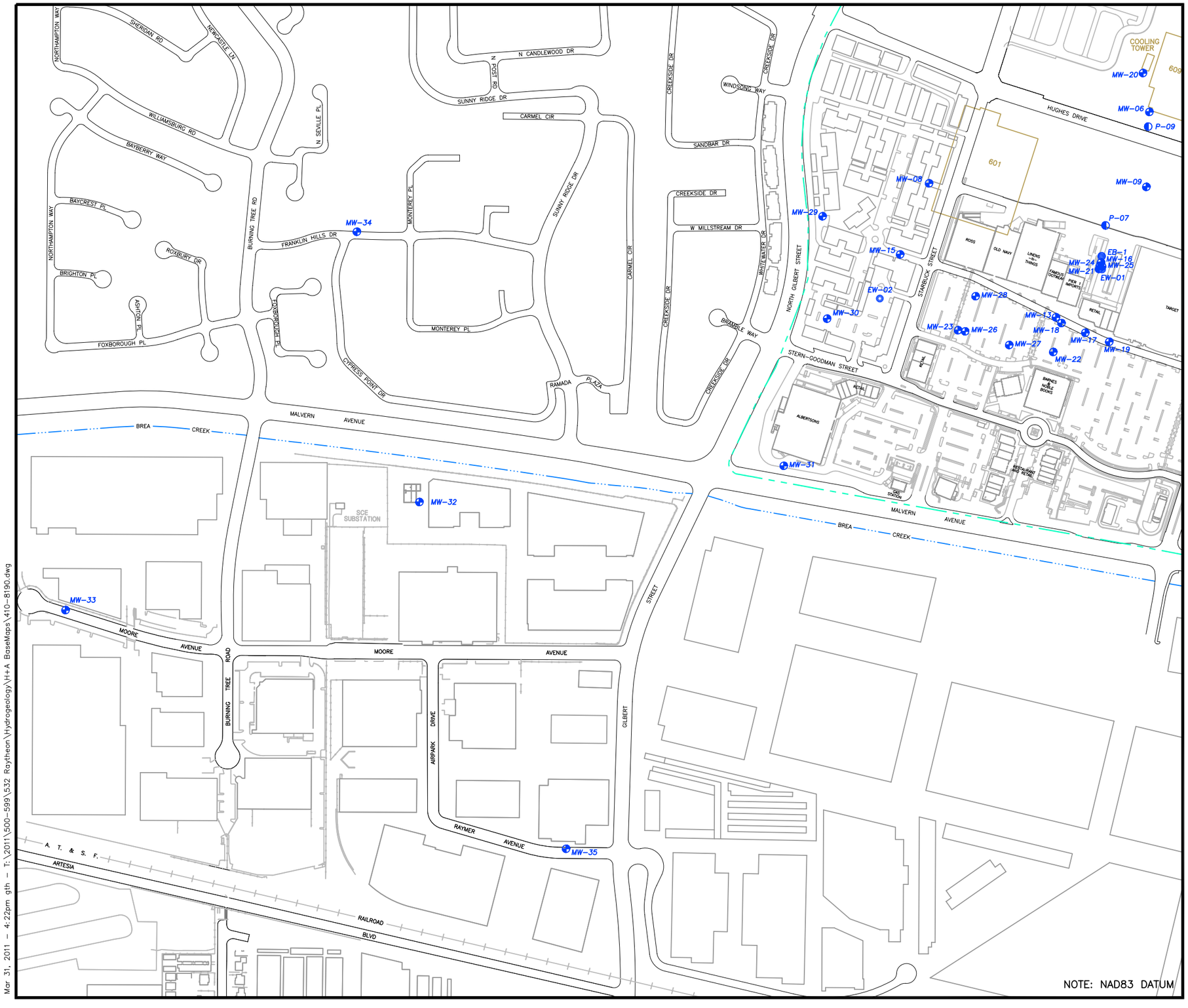


Nov 12, 2010 - 9:32am ADE - T:\2009\500-599\532 Raytheon\Hydrogeology\H+A BaseMaps\410-7298.dwg

HARGIS + ASSOCIATES, INC.
Hydrogeology/Engineering

8/09	RPT NO. 532.65	410-7298	A

FIGURE 1. SITE LOCATION



EXPLANATION

- MW-09 — GROUNDWATER MONITOR WELL
- MW-25 — GROUNDWATER PIEZOMETER
- P-09 — PERCHED ZONE PIEZOMETER
- EW-01 — GROUNDWATER EXTRACTION WELL
- EB-1 — EXPLORATORY BORING
- GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
- 609 — FORMER RAYTHEON BUILDING, DEMOLISHED MID-2000
- CURRENT RESIDENTIAL AND COMMERCIAL BUILDINGS
- DRIVEWAYS, PARKING LOTS AND OTHER HARDSCAPE OF SITE RE-DEVELOPMENT
- SITE BOUNDARY

0 400 800

FEET

RAYTHEON COMPANY
FULLERTON, CALIFORNIA

WELL AND PIEZOMETER LOCATIONS

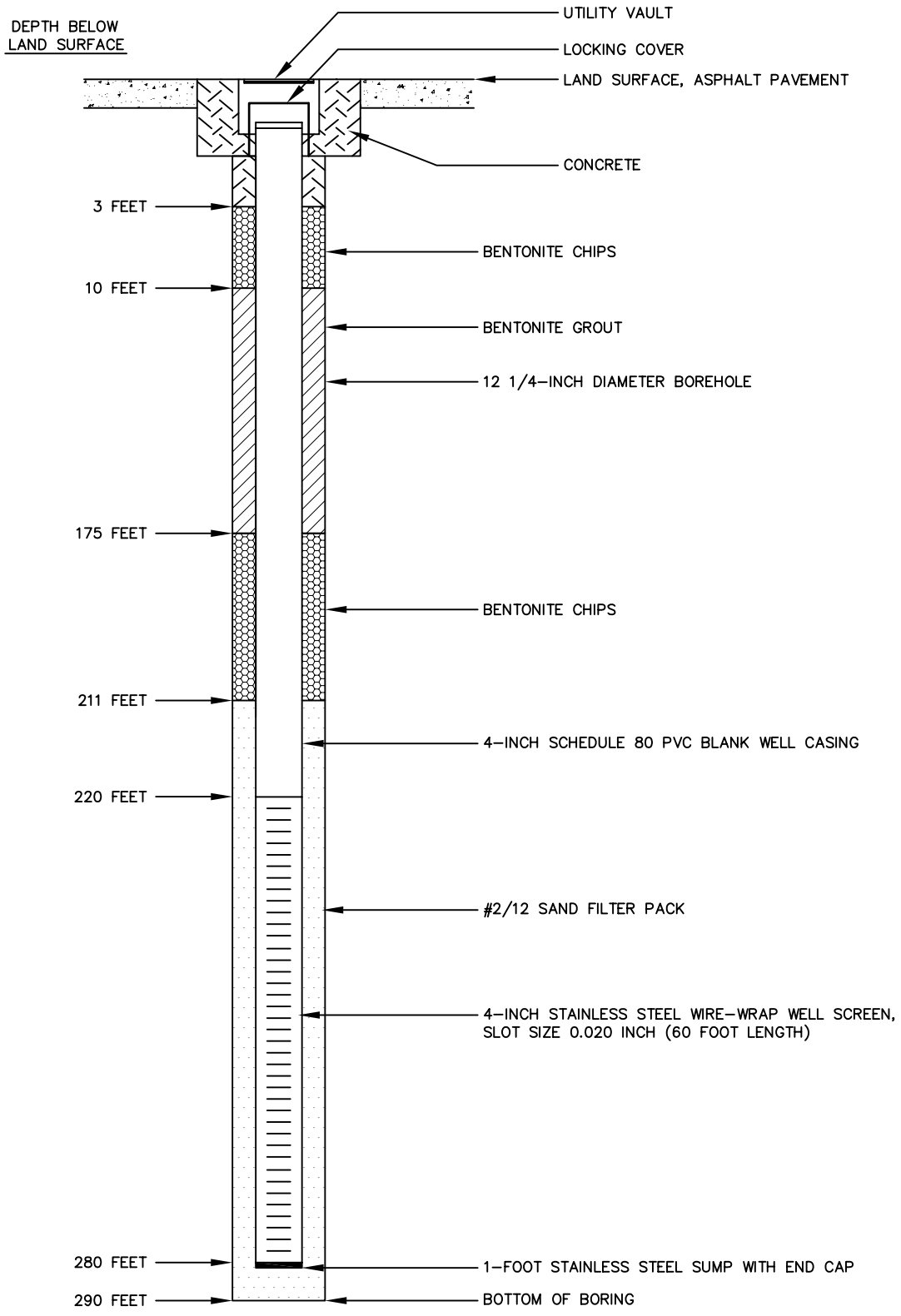
HARGIS + ASSOCIATES, INC.
Hydrogeology/Engineering

03/11

FIGURE 2

PREP BY GLW REV BY SPN RPT NO. 532.05 | 410-8190 | A

Mar 31, 2011 – 4:22pm gth – T:\2011\500-599\532 Raytheon\Hydrogeology\H+A BaseMaps\410-8190.dwg



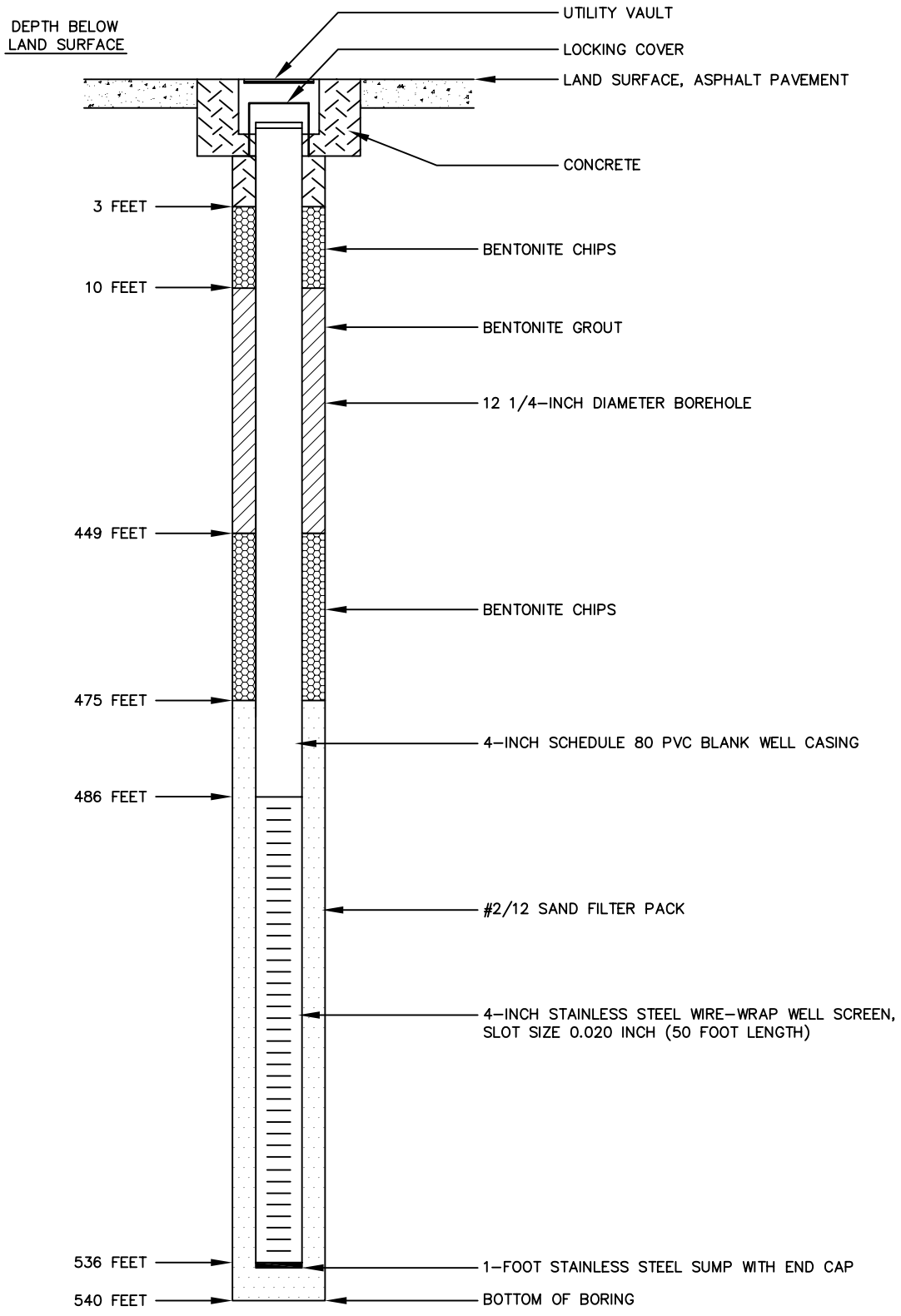
NOT TO SCALE

Apr 01, 2011 - 2:53pm ADH - T:\2011\500-599\532 Raytheon\Hydrogeology\WellDiag\710-0662.dwg

HARGIS + ASSOCIATES, INC.
Hydrogeology/Engineering

4/11	RPT NO. 532.05	710-0662	A

FIGURE 3.
WELL CONSTRUCTION SCHEMATIC
MONITOR WELL MW-34A



NOT TO SCALE

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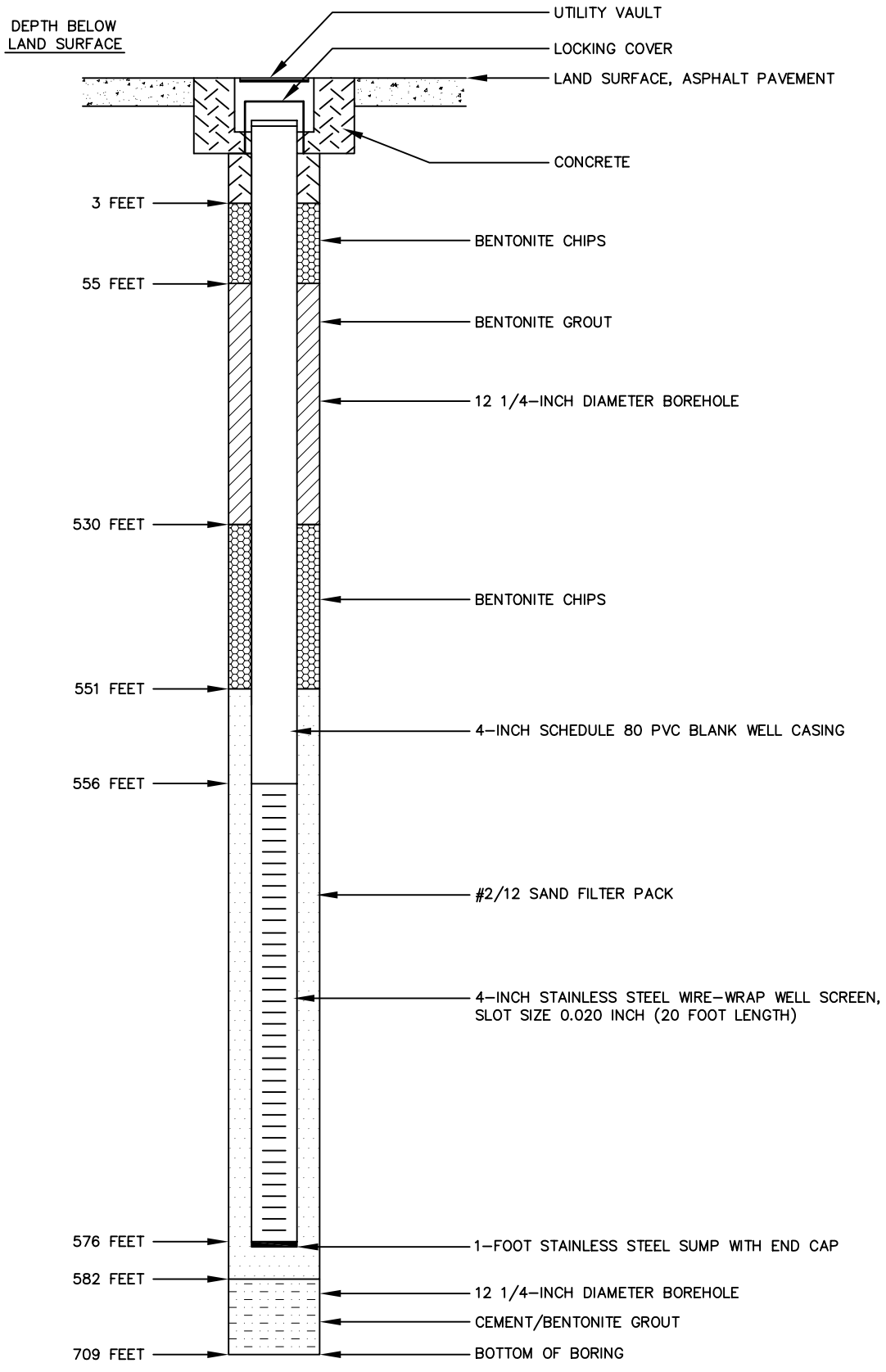
4/11	RPT NO. 532.05	710-0663	A

FIGURE 4.
WELL CONSTRUCTION SCHEMATIC
MONITOR WELL MW-34B



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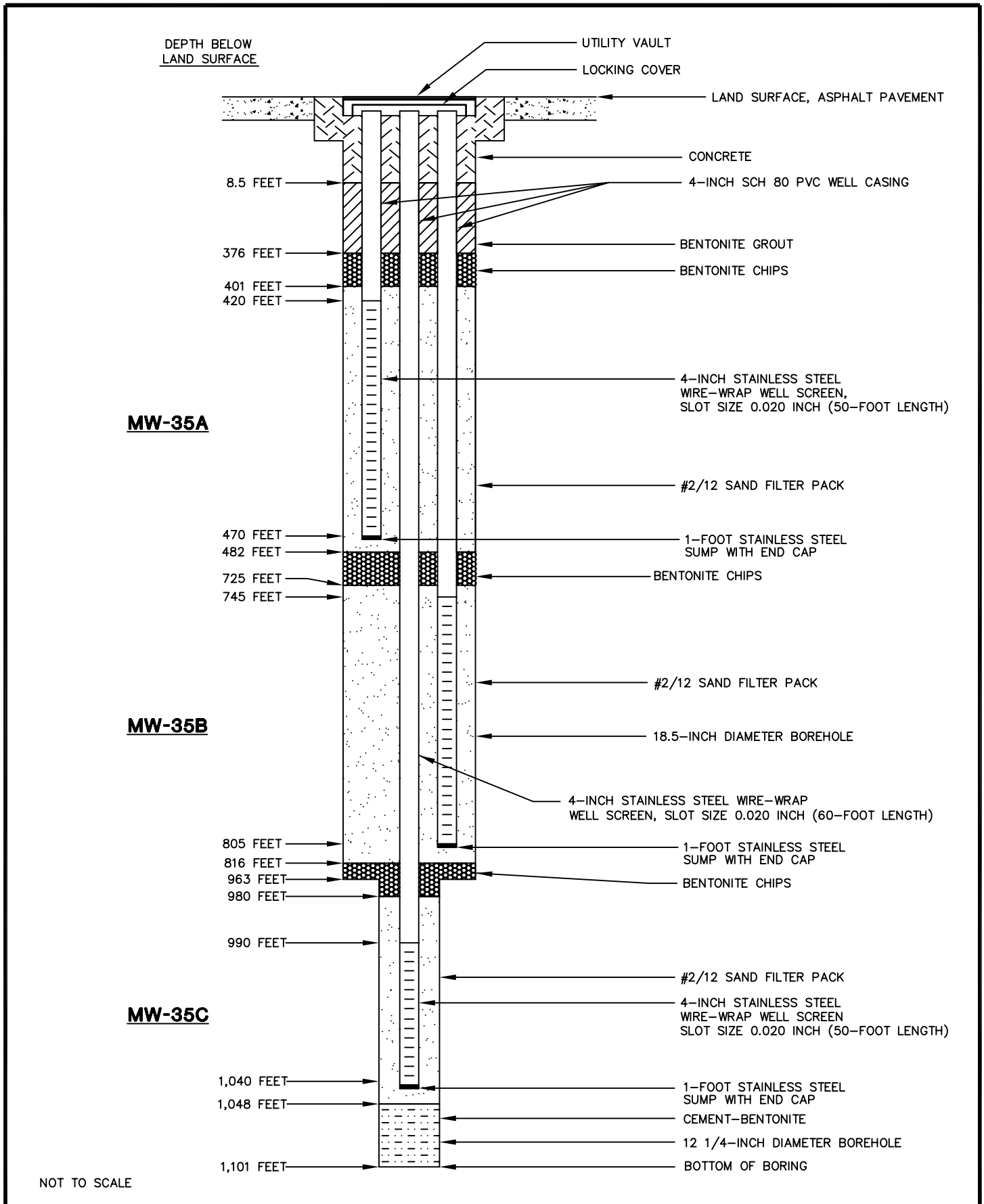
Hydrogeology/Engineering

4/11	RPT NO. 532.05	710-0664	A

FIGURE 5.
WELL CONSTRUCTION SCHEMATIC
MONITOR WELL MW-34C



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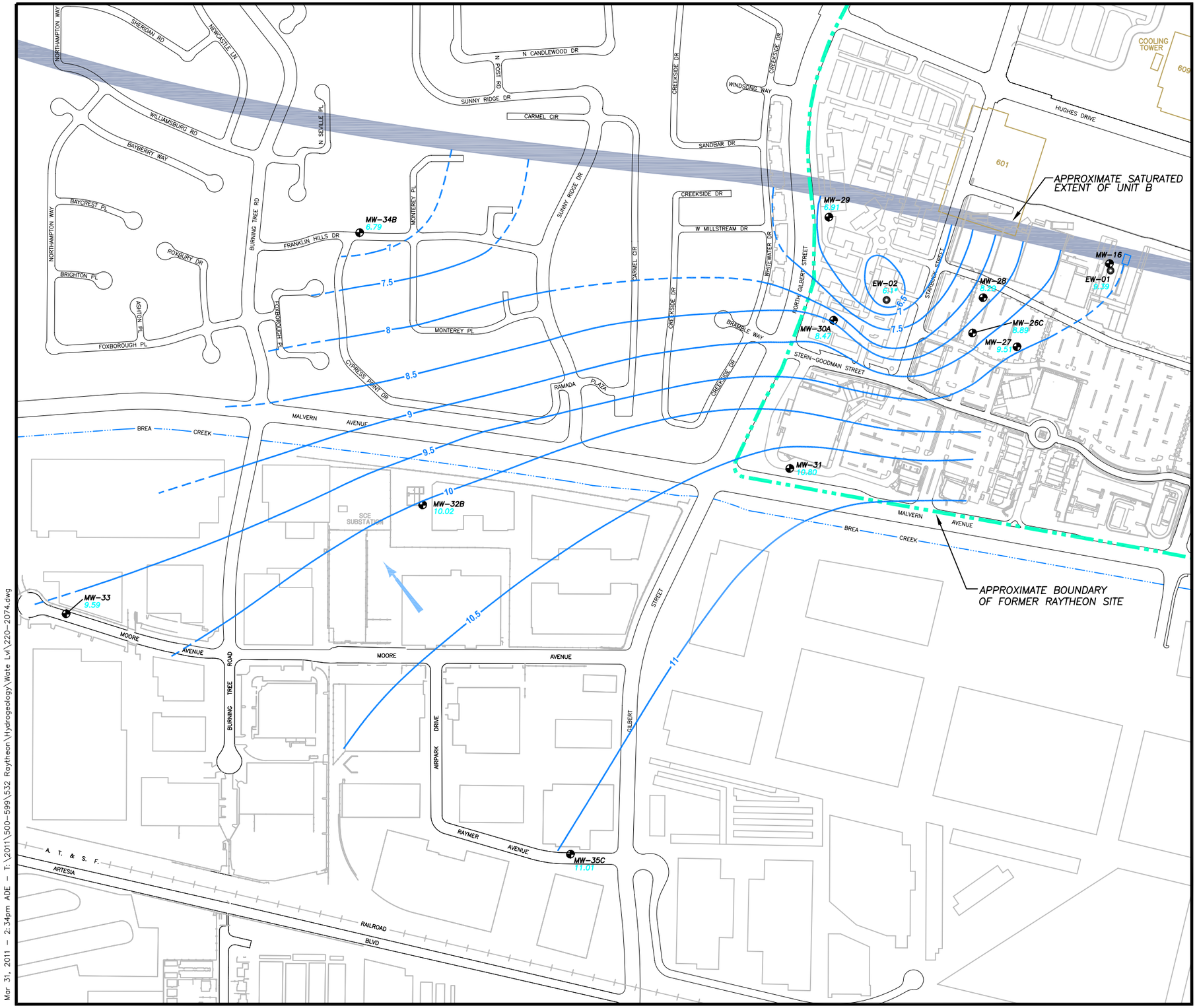
4/11	RPT NO. 532.05	710-0665	A

FIGURE 6.
WELL CONSTRUCTION SCHEMATIC
TRIPLE-NESTED MONITOR WELL MW-35



EXPLANATION

- MW-29 — GROUNDWATER MONITOR WELL
- EW-01 — GROUNDWATER EXTRACTION WELL
- 9.39 — WATER LEVEL ELEVATION, MEASURED MARCH 1, 2011 (FEET MEAN SEA LEVEL)
- EXTRACTION WELL EW-02 PUMPING DURING WATER LEVEL GAUGING; ESTIMATED WATER LEVEL BASED ON THIEM EQUATION
- 10.5 ---- EQUAL WATER LEVEL ELEVATION CONTOUR, DASHED WHERE APPROXIMATE (FEET MEAN SEA LEVEL)
- 609 — FORMER RAYTHEON BUILDING, DEMOLISHED MID-2000
- DRIVEWAYS, PARKING LOTS AND OTHER HARDSCAPE OF SITE RE-DEVELOPMENT
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW, MARCH 2011

0 400 800

FEET

NOTE: NAD83 DATUM

RAYTHEON COMPANY
FULLERTON, CALIFORNIA

WATER LEVEL ELEVATION TARGET ZONE (UNIT B) MARCH 1, 2011

HARGIS + ASSOCIATES, INC.
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FIGURE 7

PREP BY AMB REV BY SPN RPT NO. 532.31 | 220-2074 | A

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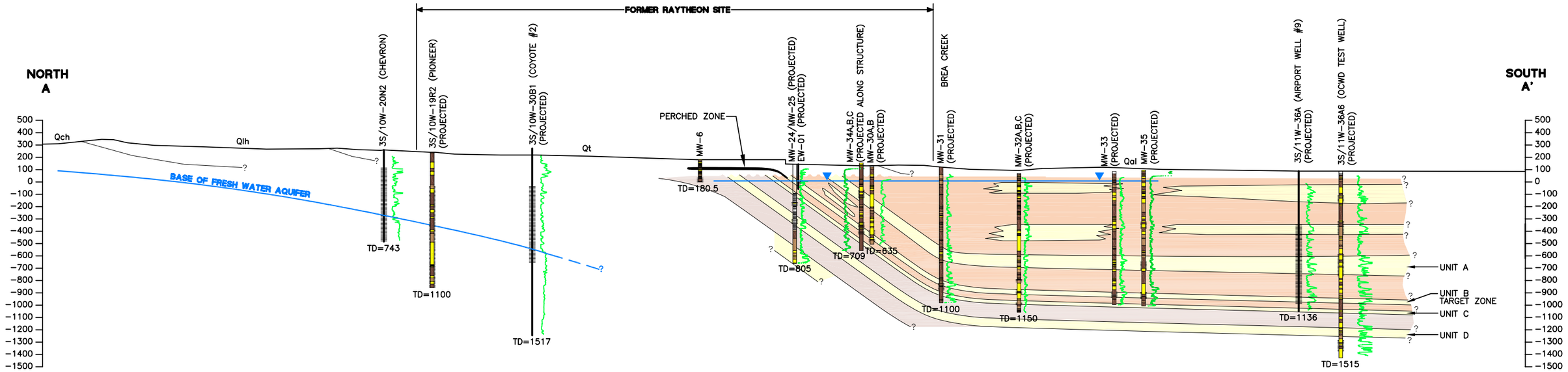
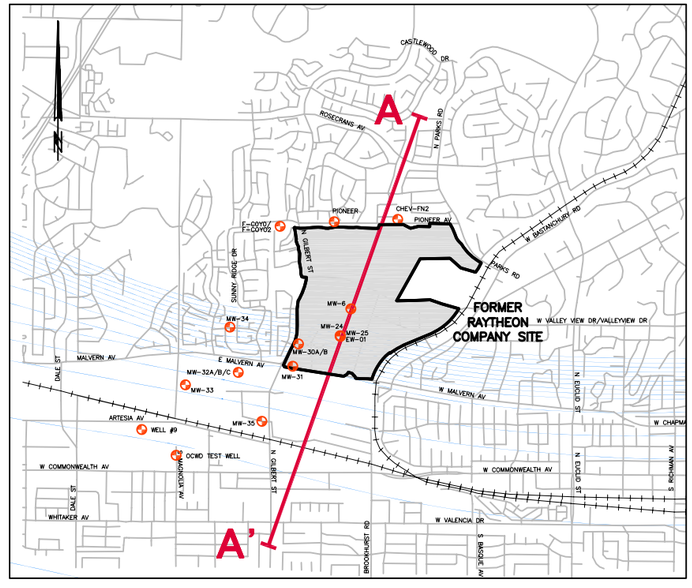
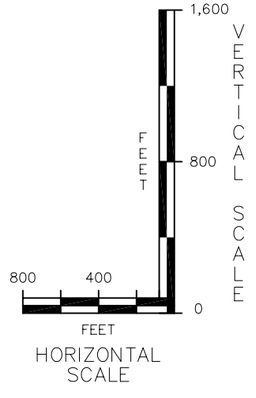


CROSS SECTION LOCATION





EXPLANATION

- RELATIVELY COARSE ZONE, PREDOMINANTLY SANDS WITH LITTLE TO NO SILT OR CLAY
- MIXED ZONE, MIXTURES OF SANDS, CLAYS, AND SILTS
- RELATIVELY FINE ZONE, PREDOMINANTLY SILTS OR CLAYS WITH LITTLE TO NO SAND
- PREDOMINANTLY COARSE ZONE
- MIXED ZONE
- RELATIVELY FINE ZONE
- SCREENED INTERVAL OF MONITOR WELL

RESISTIVITY LOG (ohm-m) (LATERAL OR SHORT-NORMAL) OF WELL BOREHOLE. RIGHT EDGE OF THE LITHOLOGIC LOG COLUMN IS THE ZERO ohm-m LINE.

Qal ALLUVIUM, HOLOCENE: UNCONSOLIDATED AND POORLY CONSOLIDATED GRAVEL, SAND AND SILT.

Qt/ Qoa TERRACE DEPOSITS/OLDER ALLUVIUM, UPPER PLEISTOCENE TO HOLOCENE: POORLY CONSOLIDATED GRAVEL, SAND AND SILT, COMMONLY REDDISH-BROWN; LOCALLY RED-BROWN SILT.

Qlh LA HABRA FORMATION, UPPER PLEISTOCENE: OLIVE-GRAY TO RED-BROWN SILTSTONE; PALE YELLOW-BROWN TO RED-BROWN THICK-BEDDED FRIABLE SANDSTONE; PALE-YELLOW-GRAY POORLY BEDDED PEBBLY SANDSTONE; AND PALE-YELLOW-BROWN UNSORTED PEBBLE-COBBLE CONGLOMERATE; BASAL PART FILLS IRREGULAR CHANNELS CUT INTO UNDERLYING STRATA.

Qch COYOTE HILLS FORMATION, UPPER PLEISTOCENE: MODERATE YELLOW-BROWN TO MODERATE BROWN THICK-BEDDED TO MASSIVE FRIABLE PEBBLY SANDSTONE; OLIVE-GRAY TO GRAY-BROWN MASSIVE SILTSTONE; AND YELLOW-BROWN MASSIVE SANDSTONE AND PEBBLE CONGLOMERATE.

NOTE: SURFACE DISTRIBUTION OF STRATIGRAPHIC UNITS AND DESCRIPTIONS OF STRATIGRAPHIC UNITS EXCERPTED FROM YERKES, 1972.

▽ APPROXIMATE UNIT B GROUNDWATER LEVEL, MARCH 2011

? QUERIED WHERE INFERRED

NOTE: NOT ALL ON-SITE WELLS ARE DEPICTED ON CROSS SECTION

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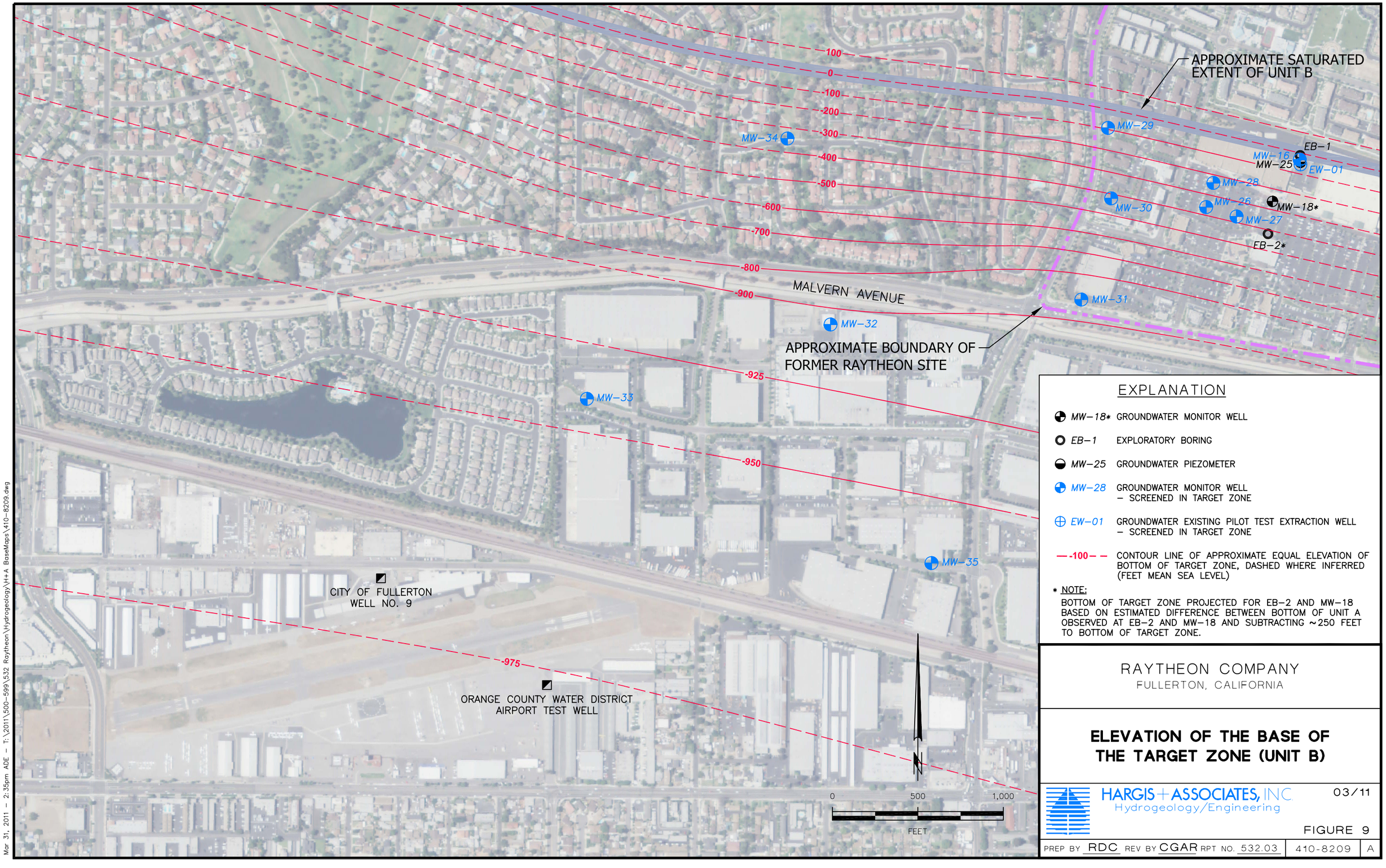
FIGURE 8. REGIONAL CONCEPTUAL MODEL HYDROGEOLOGIC CROSS-SECTION A-A'



EXPLANATION

- MW-18* GROUNDWATER MONITOR WELL
- EB-1 EXPLORATORY BORING
- MW-25 GROUNDWATER PIEZOMETER
- MW-28 GROUNDWATER MONITOR WELL – SCREENED IN TARGET ZONE
- EW-01 GROUNDWATER EXISTING PILOT TEST EXTRACTION WELL – SCREENED IN TARGET ZONE
- -100 CONTOUR LINE OF APPROXIMATE EQUAL ELEVATION OF BOTTOM OF TARGET ZONE, DASHED WHERE INFERRED (FEET MEAN SEA LEVEL)

* NOTE:
BOTTOM OF TARGET ZONE PROJECTED FOR EB-2 AND MW-18 BASED ON ESTIMATED DIFFERENCE BETWEEN BOTTOM OF UNIT A OBSERVED AT EB-2 AND MW-18 AND SUBTRACTING ~250 FEET TO BOTTOM OF TARGET ZONE.

RAYTHEON COMPANY
FULLERTON, CALIFORNIA

ELEVATION OF THE BASE OF THE TARGET ZONE (UNIT B)

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FIGURE 9

PREP BY RDC REV BY CGAR RPT NO. 532.03 | 410-8209 | A

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