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December 2, 2014

VIA FEDERAL EXPRESS – STANDARD

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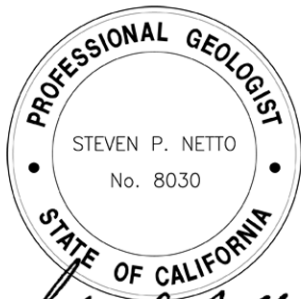
Re: Transmittal of Additional Groundwater Assessment and Monitor Well Construction Report, (MW-41), Raytheon Company, 1901 West Malvern Avenue, Fullerton, California

Dear Mr. Jeffers:

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

Sincerely,

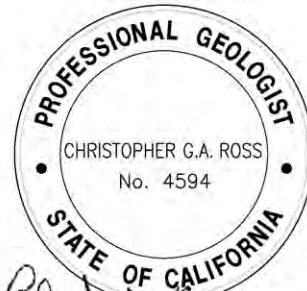
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December 2, 2014
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DECEMBER 2, 2014

ADDITIONAL GROUNDWATER ASSESSMENT
AND
MONITOR WELL CONSTRUCTION REPORT
(MW-41)

RAYTHEON COMPANY
1901 WEST MALVERN AVENUE
FULLERTON, CALIFORNIA

PREPARED FOR:
RAYTHEON COMPANY



HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY • ENGINEERING

ADDITIONAL GROUNDWATER ASSESSMENT
AND
MONITOR WELL CONSTRUCTION REPORT

(MW-41)

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1901 WEST MALVERN AVENUE
FULLERTON, CALIFORNIA

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ACRONYMS AND ABBREVIATIONS

AGAWP	Additional Groundwater Assessment Work Plan
ASTM	American Society for Testing and Materials
bls	Below land surface
CACA	Corrective Action Consent Agreement
1,1-DCE	1,1-Dichloroethylene
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
QA/QC	Quality assurance/quality control
Raytheon	Raytheon Company
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
the Site	1901 West Malvern Avenue, Fullerton, California
UAS	Upper Aquifer System
SOPs	Standard operating procedures
VOCs	Volatile Organic Compounds

ADDITIONAL GROUNDWATER ASSESSMENT
AND
MONITOR WELL CONSTRUCTION REPORT

(MW-41)

RAYTHEON COMPANY
1901 WEST MALVERN AVENUE
FULLERTON, CALIFORNIA

1.0 INTRODUCTION

This Additional Groundwater Assessment and 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 site 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. 6 pursuant to general requirements of a Resource Conservation and Recovery Act (RCRA) Corrective Action Consent Agreement (CACA) between California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) and Raytheon (H+A, 2013d; DTSC, 2003). The AGAWP Addendum No. 6 was approved by DTSC on February 11, 2014 (DTSC, 2014).

1.1 PURPOSE AND SCOPE

This report describes the drilling and installation of monitor well MW-41. The initial and confirmation groundwater sampling results from the newly constructed monitor well were submitted separately as part of the Third Quarter 2014 Groundwater Monitoring Data Submittal (H+A, 2014). Monitor well MW-41 was installed to delineate the distribution of volatile organic compounds (VOCs) and 1,4-dioxane in the Target Zone (Unit B) to the west of the Site, west of monitor well MW-34B, and in the vicinity of monitor wells MW-37 and MW-38.

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 AGAWP Addendum No. 6 (H+A, 2013d).
- 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 well.
- Section 4 summarizes conclusions 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 AGAWP Addendum No. 6 and the respective objectives.

1.2.1 Groundwater Assessment Task 1: Install and Sample One Unit B Monitor Well in the Vicinity of Monitor Wells MW-37 and MW-38

In August 2014, off-Site monitor well MW-41 was installed approximately 15 feet north of monitor wells MW-37 and MW-38 (Figure 2). This well was constructed with a single screen in the target zone (Figure 3).

1.2.2 Objectives

The objective of this task was to correlate hydrostratigraphic units and to delineate the distribution of VOCs and 1,4-dioxane in the Target Zone in the vicinity of monitor wells MW-37 and MW-38.

Installation and sampling of monitor well MW-41 has established the following:

- The water level in monitor well MW-41 correlates well with nearby Target Zone monitor wells.
- The delineation of VOCs and 1,4-dioxane in the Target Zone west of the monitor well MW-34 cluster has been refined. VOCs, principally 1,1-dichloroethylene (1,1-DCE) and 1,4-dioxane, have been detected at low-levels in groundwater samples collected from monitor well MW-41, providing additional information on the distribution of these compounds in the Target Zone (H+A, 2014).
- The western extent of VOCs and 1,4-dioxane in groundwater within the Target Zone has been delineated.

The objective of this task was met by the drilling, installation, and sampling of monitor well MW-41.

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 reports summarize installation of monitor wells MW-31 through MW-40, which provided information that was used to delineate the lower portion of the structural fold observed beneath and in the vicinity of the Site (H+A, 2010b, 2011, 2013a, and 2013c).

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). Correlation of strata with thicknesses on the order of several feet or less is typically not possible between boreholes. However, some larger-scale stratigraphic zones are regionally extensive and can be correlated across 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 2013 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, 2010b, 2011, 2013a, and 2013c). The following provides a general overview based on the RCRA Facility Investigation (RFI) (H+A, 1998) 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, 2010b, 2011, and 2013a) (Figure 4). 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 installation of 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 data collected during this most recent phase of groundwater assessment are generally consistent with the conceptual model developed previously. The primary geologic/hydrogeologic structural feature at and in the vicinity of the Site is the monoclinical fold exhibited by a local southward dip of approximately 42 degrees in the hydrogeologic units underlying the terrace deposits between exploratory boring EB-1 and monitor well MW-31 (H+A, 2010b). These dipping units become nearly horizontal in the OCGB south of the Site. Data collected during the recent assessment were used to refine the trend of this fold to the west and make minor adjustments to the basal elevation contours of the Target Zone (Unit B) (Figure 5).

3.0 TARGET ZONE GROUNDWATER ASSESSMENT WELL INSTALLATION

One monitor well, identified as MW-41, was drilled and constructed off-Site in August 2014 as outlined in the AGAWP Addendum No. 6 (H+A, 2013d). The location of monitor well MW-41 was selected in concurrence with DTSC, in the vicinity of existing monitor wells MW-37 and MW-38, on Meadowbrook Way near the intersection with Rockledge Drive in Buena Park, California (Figure 2) (DTSC, 2014).

Prior to drilling, the well location was cleared for underground utilities by Underground Service Alert and GeoVision Geophysical Services, Corona, California, using various subsurface utility detection technologies. Monitor well MW-41 was drilled and installed during the period August 12 through August 26, 2014. Monitor well MW-41 was drilled using mud rotary methods by BC² Environmental, Orange, California.

Drilling and well construction was conducted in accordance with the AGAWP Addendum No. 6 (H+A, 2013d), 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).

Liquid and solid waste generated during well construction operations was handled, contained, and disposed of in accordance with SOPs specified in Appendix A of the AGAWP (H+A, 2003b). Waste manifests are provided (Appendix A).

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

3.1 DRILLING OF BOREHOLE

A, nominal 12.25-inch diameter borehole was drilled at monitor well MW-41 to obtain lithologic samples and conduct geophysical logging prior to well construction. Monitor well MW-41 was drilled using a Speedstar 50K mud-rotary drill rig. Temporary steel conductor casing was advanced to approximately 10 feet below land surface (bls).

The well borehole was advanced to approximately 425 feet bls. Drill cutting samples were collected approximately every 5 to 10 feet to the total depth of the borehole for lithologic description. Lithologic logging and soil sampling were conducted during borehole drilling as described in Section 3.2. Downhole geophysical logging was conducted as described in Section 3.3. Following the completion of borehole drilling and geophysical logging, a temporary well was placed with a screen interval from 390 to 420 feet bls to confirm correlation of the Target Zone to this interval using water level and water quality data. The results of the water level measurement and groundwater sampling from the temporary well were consistent with the Target Zone and supported placement of the final screened interval near the base of Unit B. Following removal of the temporary well, the borehole was advanced to 435 feet bls to collect a lithologic sample immediately beneath Unit B. The portion of the borehole below the Target Zone was then backfilled with bentonite chips. The well screen, casing, and construction materials were then installed as described in Section 3.4. Once the monitor well was constructed, the temporary conductor casing was removed and a traffic-rated well vault was installed at the surface as described in Section 3.4.

3.2 LITHOLOGIC LOGGING

Lithologic logging was performed to define the lithology and thickness of geologic materials and to characterize subsurface geologic and hydrogeologic conditions. The lithologic log was compiled based on description of drill cutting grab samples recovered at land surface and driven soil core samples collected at target depths during mud rotary drilling. Grab 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. Core samples were collected by driving a split spoon soil core sampler ahead of the 12.25-inch boring at select depths.

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). The lithologic log for newly constructed monitor well MW-41 has been provided (Appendix B).

3.3 GEOPHYSICAL LOGGING

The following describes geophysical logging conducted during drilling of monitor well MW-41.

At the drill depth of 425 feet bls, the borehole was geophysically logged using downhole wireline logging tools. The following logs were run in the borehole:

- Caliper;
- Gamma ray;
- Spontaneous potential;
- Short- and long-normal resistivity; and
- Laterolog 3 (focused resistivity log).

Geophysical logging was performed on August 14, 2014 by Pacific Surveys, Claremont, California. Geophysical logs of the borehole have been provided (Appendix C).

Geophysical logs were used to evaluate subsurface geology and refine depth determinations of contacts observed based on samples collected during drilling operations. The geophysical logs were also used to correlate with the logs collected at monitor well MW-37, which is located about 15 feet south of monitor well MW-41, to evaluate the depth offset of units between the borings that are up-dip/down-dip from each other within the structural fold.

3.4 WELL CONSTRUCTION

The following section summarizes details of monitor well construction.

3.4.1 Well Construction, Monitor Well MW-41

Monitor well MW-41 was constructed in the Target Zone of the regional groundwater system. Prior to drilling, available information was reviewed, and the base of the Target Zone was anticipated to be approximately 400 to 450 feet bls (H+A, 2013d). The borehole was advanced to a total depth of approximately 425 feet bls to confirm the Target Zone interval by geophysical logging and using data from a temporary well, then the borehole was deepened to 435 feet bls. At the request of DTSC, two core samples were collected during the drilling of the MW-41 pilot boring, one intended to sample coarse-grained strata within Unit B and one from the fine-grained zone that immediately underlies Unit B. The upper core sample was collected prior to running the geophysical log, and the lower core sample from the fine-grained zone was collected after removing the temporary well and deepening the borehole. The final well design was determined based on lithologic and geophysical data and consultation with DTSC.

Upon the completion of borehole drilling, the portion of the borehole below the Target Zone (from 427 to 433 feet bls) was backfilled with medium bentonite chip¹ emplaced via a tremie pipe placed to within a few feet of the borehole bottom. Prior to installing the well casing, a wiper pass of the borehole was conducted to clean the borehole wall and to thin the drilling mud.

Nominal 4-inch diameter stainless steel wire-wrap well screen (0.020-inch factory slotted) and nominal 4-inch diameter Schedule 80 polyvinylchloride (PVC) blank well casing were used to construct monitor well MW-41. A 40-foot screen section was installed from 385 to 425 feet bls and completed with blank casing to near land surface (Table 1; Figure 3). Centralizers were installed approximately at the top, middle, and bottom of the screen interval, and at approximate 60-foot intervals along the blank well casing.

¹ For the purposes of this Report, medium bentonite chips may include coated bentonite pellets.

A filter pack consisting of Monterey No. 2/16 sand was emplaced using a tremie pipe set in the annulus between the well screen and the borehole wall. An approximate 16.5-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 chips to hydrate, a 50 percent by volume No. 8 granular bentonite / 50 percent by volume Monterey No. 3 sand was pumped by tremie pipe in the annulus between the well casing and the borehole wall from the top of the grout filter to approximately 165 feet bls. From 165 feet bls to approximately 5 feet bls neat cement containing approximately 5 percent bentonite was emplaced in the annulus using the same method as above. From approximately 5 feet bls to the land surface, the annulus was filled with concrete. Monitor well MW-41 was completed with a locking, traffic-rated well vault set in concrete and slightly above grade of the surrounding asphalt pavement. Monitor well construction details have been provided (Table 1; Figure 3; Appendix B).

Initial development of monitor well MW-41 was performed immediately following installation and consisted of surging and bailing to remove heavy drilling mud. Development methods incorporated swabbing, bailing, airlifting, and pumping. Approximately 2,650 gallons of fluids was removed from monitor well MW-41 during development, representing approximately 18 casing volumes.

Monitor well MW-41 was equipped with a dedicated electric submersible pump for groundwater purging and sampling. The dedicated pump was set at approximately 360 feet bls, approximately 25 feet above the top of the well screen. Monitor well MW-41 was equipped with approximately 240 feet of 1-inch PVC sounding tube. The bottom 10 feet of the sounding tube consists of 0.020-inch slotted PVC screen.

3.4.2 Surveying

The reference point elevation for newly constructed monitor well MW-41 was surveyed on September 16, 2014. The well was surveyed by Psomas, Santa Ana, California, a licensed surveyor. The reference point elevation was surveyed to the National Geodetic Vertical Datum of 1929 (NGVD29) and converted to the common datum used across the Site (the City of Fullerton datum). The City of Fullerton datum was used to survey groundwater monitor wells during the

RFI. Elevation data for each of the wells are provided in Tables 1 and 2, and the elevation data for monitor well MW-41 is also provided on the lithologic log (Appendix B).

3.5 WELL SAMPLING

Groundwater samples were collected from the monitor well MW-41 temporary well casing on August 18, 2014. Initial and confirmation groundwater samples were collected from the final monitor well MW-41 well casing on September 10 and September 24, 2014, respectively. During each sampling event, field quality assurance/quality control (QA/QC) samples were collected which included field duplicate and split laboratory samples as well as trip blanks. Analytical results for detected compounds, which were 1,1-DCE and 1,4-dioxane, were included in the Third Quarter 2014 Data Submittal for Groundwater Monitoring and Groundwater Extraction and Treatment Pilot Testing and are summarized below (H+A, 2014).

Well Identifier / Sample Identifier	Date Sampled	QA/QC Sample Code	1,1-DCE	1,4-DIOXANE
			concentrations in groundwater (ug/l)	
			(Federal/California MCL) (7/6)	(California Notification Level) (1)
MW-41-420	08/19/14	ORG	2.6	0.49
MW-4100-420	08/19/14	DUP	2.6	0.51
MW-41-420	08/19/14	SPT	2.0	1.3
MW-41	09/10/14	ORG	2.6	0.49
MW-4100	09/10/14	DUP	2.1	0.42
MW-41	09/10/14	SPT	1.8	<1.0
MW-41	09/24/14	ORG	< 0.50	< 0.20
MW-4100	09/24/14	DUP	< 0.50	< 0.20
MW-41	09/24/14	SPT	<1.0	<1.0

NOTE: Detections are shown in **BOLD** type.

FOOTNOTES

- QA/QC = quality assurance/quality control
- 1,1-DCE = 1,1-dichloroethylene
- ug/l = micrograms per liter
- MCL = drinking water Maximum Contaminant Level
- ORG = original sample
- DUP = field duplicate sample
- SPT = split laboratory sample
- < = less than; the value is the laboratory reporting limit for that compound

Groundwater sampling was conducted in accordance with methods and procedures established for the Site (H+A, 2003a, 2003b, and 2014). Routine data quality assessment was conducted and indicated that all QA/QC groundwater sample and laboratory QA/QC results are within acceptable criteria, and there were no detections of VOCs or 1,4-dioxane in associated trip and/or laboratory method blanks.

4.0 DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

The scope of work presented in the AGAWP Addendum No. 6 has been completed as documented in this Report.

Monitor well MW-41, installed in August 2014, provided additional lithologic and hydrologic information that was used to delineate the western extent of VOCs and 1,4-dioxane in Target Zone groundwater near monitor wells MW-37 and MW-38. It is recommended that monitor well MW-41 be added to the Site groundwater monitoring program for water level monitoring and groundwater sampling.

Water levels measured in Unit B monitor wells on August 18 to 19, 2014, indicate a westerly flow within the Target Zone in the area of the Site, becoming southwesterly in the western portion of the monitor well network, and vertical hydraulic gradients into the Target Zone from above and below (Table 2; Figure 6) (H+A, 2013b).

Monitor well MW-41 provided additional lithologic information that suggested the structural feature identified at and to the immediate west of the Site continues westward along the base of the west Coyote Hills. This structural feature, a monoclinial fold dipping to the south, is consistent with the groundwater conceptual model. The elevation of the bottom of the Target Zone decreases to the south, and is most steeply dipping with an approximate east-west strike in the vicinity of the southern portion of the Site (Figure 5).

Both water level and water quality from the temporary and final well installations at monitor well MW-41 provide multiple lines of evidence that monitor well MW-41 is screened within the Target Zone (Unit B). Low- to non-detect levels of VOCs and 1,4-dioxane at monitor well MW-41 suggest the western extent of Site-derived contaminants has been delineated and no further monitor well installations are recommended as part of the groundwater assessment for the Site.

The need for additional groundwater monitor wells to support future Corrective Measures Implementations will be evaluated as part of the upcoming Corrective Measures Study. Based on the results of this groundwater assessment, previous assessments and on-going site-wide groundwater monitoring, and in accordance with recent discussions with DTSC, Raytheon believes the groundwater assessment for the Site has been completed sufficiently for the purposes of conducting the Corrective Measures Study, and therefore recommends that DTSC approves completion of groundwater assessment for the Site and provides authorization to proceed with preparation of the Corrective Measures Study.

5.0 REFERENCES CITED

- American Society for Testing and Materials, 1984. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), Designation D2488. Annual Book of ASTM Standards; Volume 04.08, Soil and Rock Building Stones. Philadelphia, Pennsylvania: ASTM.
- California Department of Water Resources, 1967. Progress Report on Groundwater Geology of the Coastal Plain of Orange County. DWR Southern District; July 1967.
- California Environmental Protection Agency, Department of Toxic Substances Control, 2003. Corrective Action Consent Agreement, Raytheon Company, 1901 W. Malvern Ave., Fullerton, California 92634, EPA ID No. CAD063109243. Docket HWCA: P3-01/02-001. January 15, 2003.
- _____, 2014. Email from W. Jeffers to C. Ross, H+A, re: Approval of Raytheon - Groundwater Assessment Work Plan Add. No. 6, February 11, 2014.
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- _____, 2003a. Groundwater Monitoring Workplan and Sampling and Analysis Plan, Raytheon Company, (Former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. April 25, 2003.
- _____, 2003b. Additional Groundwater Assessment Workplan, Raytheon Company, (Former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. April 25, 2003.
- _____, 2004a. Additional Groundwater Assessment Workplan, Addendum No. 1, Raytheon Company, 1901 West Malvern Avenue, Fullerton, California. March 23, 2004.
- _____, 2004b. Letter from C.G.A. Ross to W.F. Jeffers, DTSC; re: Amendment A, Additional Groundwater Assessment Workplan Addendum 1, Former Raytheon Company Site, 1901 West Malvern Avenue, Fullerton, California. June 1, 2004.
- _____, 2004c. Letter from C.G.A. Ross to W.F. Jeffers, DTSC; re: Amendment B, Additional Groundwater Assessment Workplan Addendum 1, Former Raytheon Company Site, 1901 West Malvern Avenue, Fullerton, California. July 29, 2004.
- _____, 2005. Deep Boring and Well construction and Groundwater Sampling Report, Raytheon Company (formerly Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. March 30, 2005.

- _____, 2009. Additional Groundwater Assessment Primary Transport Zone (Target Zone) Well Construction and Groundwater Sampling Report, Raytheon Company (Former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. March 26, 2009.
- _____, 2010a. Technical Memorandum to W. Jeffers, DTSC, re: Summary of Aquifer Hydraulic Testing and Preliminary Groundwater Capture Zone Analysis, Former Raytheon Company Facility (Formerly Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. February 16, 2010.
- _____, 2010b. Well Construction and Groundwater Sampling Report Additional Groundwater Assessment Primary Transport Zone (Target Zone) and Groundwater Extraction Treatment System Pilot Testing, Raytheon Company (Former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. November 18, 2010.
- _____, 2011. Additional Groundwater Assessment Monitor Well Construction Report (MW-34 and MW-35) Raytheon Company (former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. April 4, 2011.
- _____, 2013a. Additional Groundwater Assessment and Monitor Well Construction Report, (MW-36 and MW-37), Raytheon Company, 1901 West Malvern Avenue, Fullerton, California. June 13, 2013.
- _____, 2013b. Data Submittal for Groundwater Monitoring and Groundwater Extraction and Treatment Pilot Testing, Third Quarter 2013, Raytheon Company (Former Hughes Aircraft Company Facility), 1901 West Malvern Avenue, Fullerton, California. (In Press)
- _____, 2013c. Additional Groundwater Assessment and Monitor Well Construction Report, (MW-38, MW-39 and MW-40), Raytheon Company, 1901 West Malvern Avenue, Fullerton, California. October 4, 2013.
- _____, 2013d. Additional Groundwater Assessment Work Plan Addendum No.6, Raytheon Company (former Hughes Aircraft Company), 1901 West Malvern Avenue, Fullerton, California. December 19, 2013.
- _____, 2014. Letter from S. Netto et.al., H+A, to W. Jeffers, DTSC re: Data Submittal for Groundwater Monitoring and Groundwater Extraction and Treatment Pilot Testing, Third Quarter 2014, Raytheon Company (Former Hughes Aircraft Company) Facility, 1901 West Malvern Avenue, Fullerton, California. October 28, 2014.
- Munsell Soil Color Charts, 1992 edition. Newburgh, New York: Kollmorgen Instruments Corporation.

TABLE 1
WELL CONSTRUCTION SUMMARY

Well Identifier	Date Installed	Current	Current	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/	Annular Seal Interval (feet bls) (c)
		Land Surface Elevation (feet msl)	Reference Point Elevation (feet msl)								Intermediate Seal Interval (feet bls) (b)	
<u>Regional Groundwater System Monitor Wells, Extraction Wells and Piezometers</u>												
MW-06	1/16/1997	184.96	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	156.60	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	180.48	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	142.44	141.84	159.5	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	145.54	144.95	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	142.98	142.40	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	142.70	142.70	203.6	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	142.39	142.32	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	142.72	142.06	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	184.36	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	143.34	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	139.39	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	137.75	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	143.05	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	142.97	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	137.64	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	137.64	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	137.64	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	137.60	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	141.38	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	148.83	139.81	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	130.20	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	130.20	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	120.31	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	93.35	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	93.35	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	93.35	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	83.80	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	154.00	153.25	290	220 - 280	0.020	12.25	4(dd)	211 - 290	#2/12	175 - 211	0 - 175
MW-34B	2/1/2011	153.90	153.11	540	486 - 536	0.020	12.25	4(dd)	475 - 540	#2/12	449 - 475	0 - 449
MW-34C	1/19/2011	154.10	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	94.30	93.57	1,101	420 - 470	0.020	18	4(dd)	401 - 482	#2/12	376 - 401	0 - 376
MW-35B	12/20/2010	94.30	93.56	1,101	745 - 805	0.020	18	4(dd)	725 - 816	#2/12	482 - 725	0 - 376
MW-35C	12/20/2010	94.30	93.55	1101 (ll)	990 - 1,040	0.020	12.25	4(dd)	980 - 1,048	#2/12	816 - 980	0 - 376
MW-36	1/3/2012	87.19	86.65	1030 (mm)	934 - 954 974 - 994	0.020	12.25	4(dd)	914 - 1,003	#2/12	95 -853 (oo), 853 - 914 (pp)	0 - 95 (qq)
MW-37	10/17/2012	156.02	155.60	916	770-820	0.020	12.25	4(dd)	755-834	#2/12	229-724 (rr) 724-755 (pp)	0-229 (ss)
MW-38	7/29/2013	155.70	154.90	203	150-200	0.020	10	4(z)	140-203	#2/12	120-140 (pp)	0-120 (qq)
MW-39	7/25/2013	84.71	84.25	1,080 (ll)	982-1,012	0.020	12.25	4(dd)	974-1,017	#2/12	156 -917 (rr) 917-974 (pp)	0-156 (qq)
MW-40	7/2/2013	124.09	123.40	1040 (ll)	930-970	0.030	12.25	6(dd)	916-975	#3	175 -880 (rr) 880-916 (pp)	0-175 (qq)
MW-41	8/22/2014	156.02	155.60	436.3 (mm)	385-425	0.020	12.25	4(dd)	373.5-427	#2/16	165-357 (rr) 357-373.5 (pp)	0-165 (qq)
EW-01	5/16/2005	143.30	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	136.04	132.97	473 (ee)	410-460	0.030	17.0	8 (ff)	400-465	#3	384-400	0-384
<u>Perched Zone Piezometers</u>												
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)

**TABLE 1
WELL CONSTRUCTION SUMMARY**

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

FOOTNOTES

msl = Mean sea level, City of Fullerton datum

bls = Below current land surface (October 2004)

(a) = Schedule 40 polyvinyl chloride (PVC) 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, less than 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, less than 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, less than 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; Schedule 80 polyvinyl chloride 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; Schedule 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 approximately 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 approximately 5% bentonite-cement grout

(mm) = Bottom of borehole backfilled with bentonite pellets

(oo) = High solids bentonite grout

(pp) = Bentonite chips

(qq) = Portland cement with approximately 5% bentonite

(rr) = Medium bentonite chips and #2/12 Sand; 1:1 dry volume mix

(ss) = Portland cement with approximately 2.5% bentonite

TABLE 2
GROUNDWATER LEVELS
THIRD QUARTER 2014

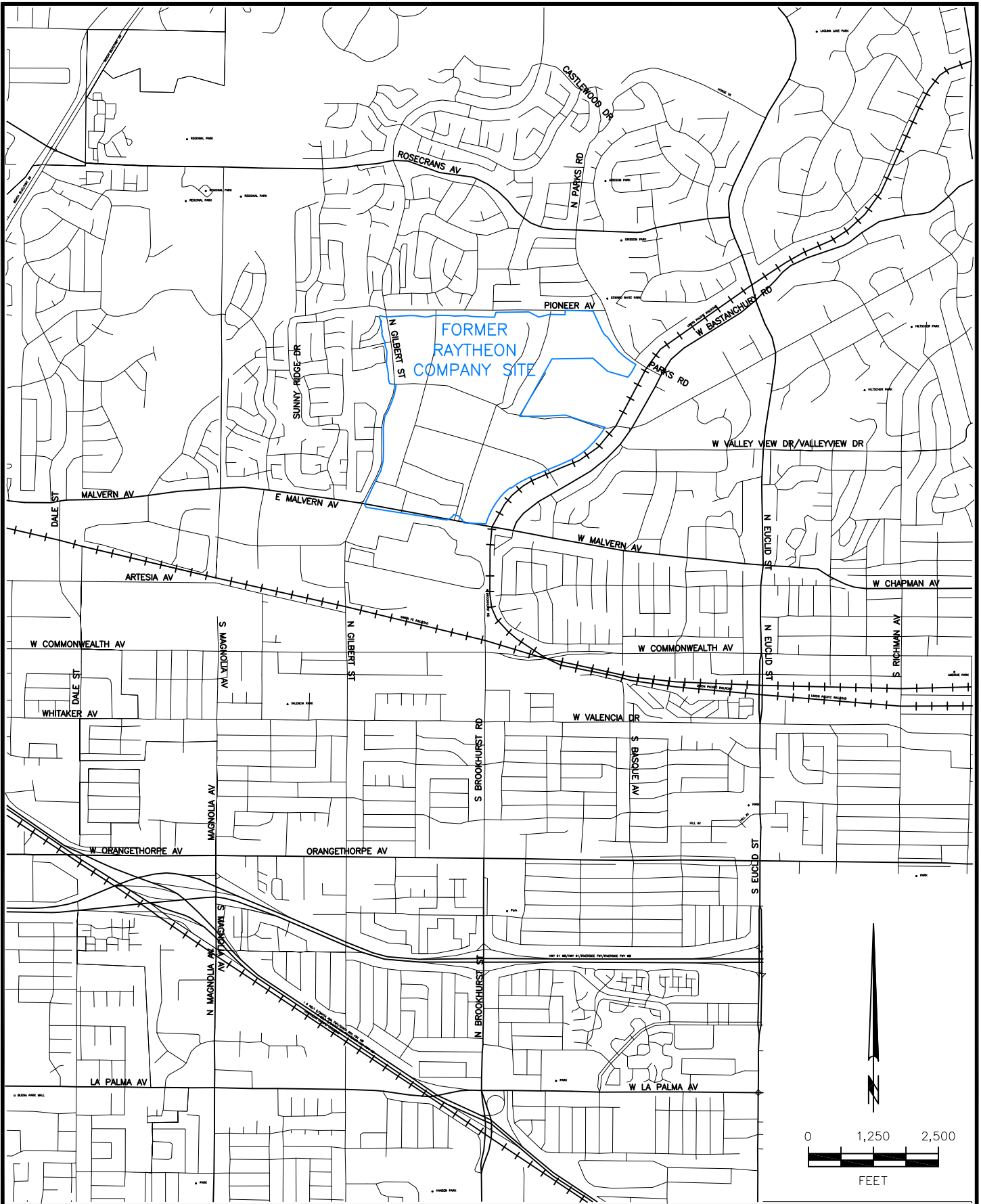
Well Identifier	Date Measured	Reference Point Elevation ^(a) (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation Well Operational Status ^(b)
Regional Groundwater System Monitor and Extraction Wells					
MW-06	08/18/14	184.70	184.60	0.10	
MW-08	08/18/14	155.91	146.40	9.51	
MW-09	08/20/14	180.10	181.10	-1.00	
MW-13	08/18/14	141.84	146.71	-4.87	
MW-15	08/18/14	144.95	147.95	-3.00	
MW-16	08/18/14	142.40	155.65	-13.25	
MW-17	08/18/14	142.70	155.51	-12.81	
MW-18	08/18/14	142.32	155.01	-12.69	
MW-19	08/18/14	142.06	154.73	-12.67	
MW-20	08/18/14	184.19	177.61	6.58	
MW-21	08/18/14	141.18	145.70	-4.52	
MW-22	08/18/14	138.65	150.82	-12.17	
MW-23	08/18/14	137.33	150.88	-13.55	
MW-24	08/18/14	142.83	144.45	-1.62	
MW-25	08/18/14	142.64	149.70	-7.06	
MW-26A	08/18/14	137.04	139.88	-2.84	
MW-26B	08/18/14	137.05	139.80	-2.75	
MW-26C	08/18/14	137.22	157.33	-20.11	
MW-27	08/18/14	137.16	157.02	-19.86	
MW-28	08/18/14	140.77	160.73	-19.96	
MW-29	08/18/14	139.81	160.95	-21.14	
MW-30A	08/18/14	129.44	151.26	-21.82	
MW-30B	08/18/14	129.39	147.46	-18.07	
MW-31	08/18/14	119.60	142.35	-22.75	
MW-32A	08/18/14	92.88	120.55	-27.67	
MW-32B	08/18/14	92.89	118.71	-25.82	

TABLE 2
GROUNDWATER LEVELS
THIRD QUARTER 2014

Well Identifier	Date Measured	Reference Point Elevation ^(a) (feet msl)	Depth to Water (feet bls)	Water Level Elevation (feet msl)	Remediation Well Operational Status ^(b)
<u>Reginal Groundwater System Monitor and Extraction Wells (continued)</u>					
MW-32C	08/18/14	92.88	101.60	-8.72	
MW-33	08/18/14	83.19	115.30	-32.11	
MW-34A	08/18/14	153.25	171.15	-17.90	
MW-34B	08/18/14	153.11	177.51	-24.40	
MW-34C	08/18/14	153.29	175.77	-22.48	
MW-35A	08/18/14	93.57	98.60	-5.03	
MW-35B	08/18/14	93.56	111.30	-17.74	
MW-35C	08/18/14	93.55	120.07	-26.52	
MW-36	08/18/14	86.65	120.00	-33.35	
MW-37	08/18/14	155.60	167.65	-12.05	
MW-38	08/18/14	154.90	173.52	-18.62	
MW-39	08/18/14	84.25	118.09	-33.84	
MW-40	08/18/14	123.40	143.09	-19.69	
MW-41					
Temporary Well ^(c)	08/19/14	156.02	186.17	-30.15	
MW-41	09/10/14	155.60	185.65	-30.05	
	09/24/14	155.60	186.05	-30.45	
EW-01	08/18/14	141.07	159.40	-18.33	
EW-02	08/18/14	132.97	153.84	-20.87	
<u>Perched Zone Water Levels</u>					
P-07	08/18/14	142.31	112.83	29.48	
P-09	08/18/14	183.86	120.73	63.13	

FOOTNOTES

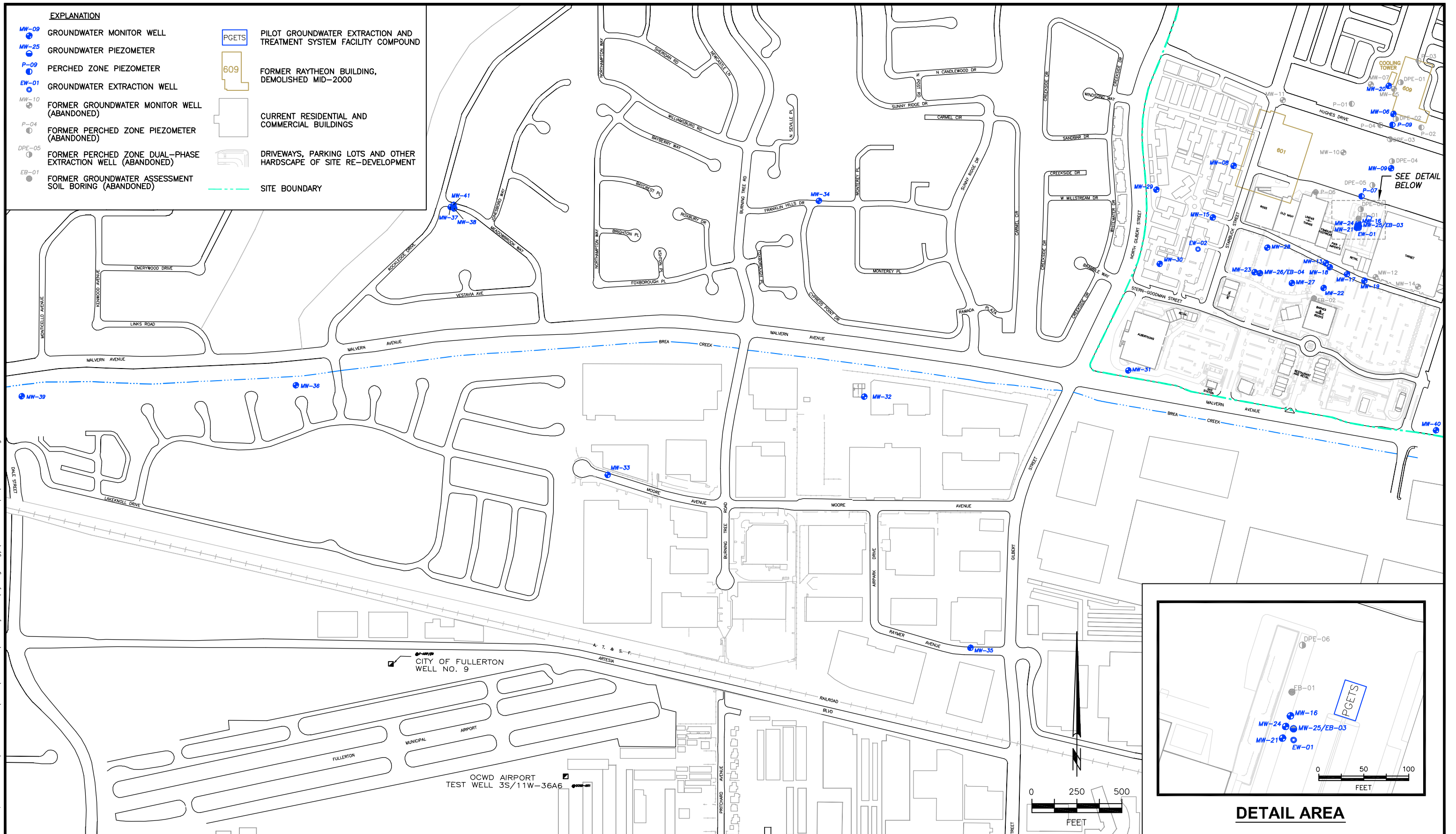
- (a) Reference point elevations are relative to City of Fullerton datum.
 - (b) Operating remediation well(s), if any, are indicated if pumping at time of water level measurement
 - (c) Water level measured in MW-41 temporary well casing on 8/19/14 during monitor well MW-41 drilling and construction activities
- bls = Below land surface
msl = Mean sea level



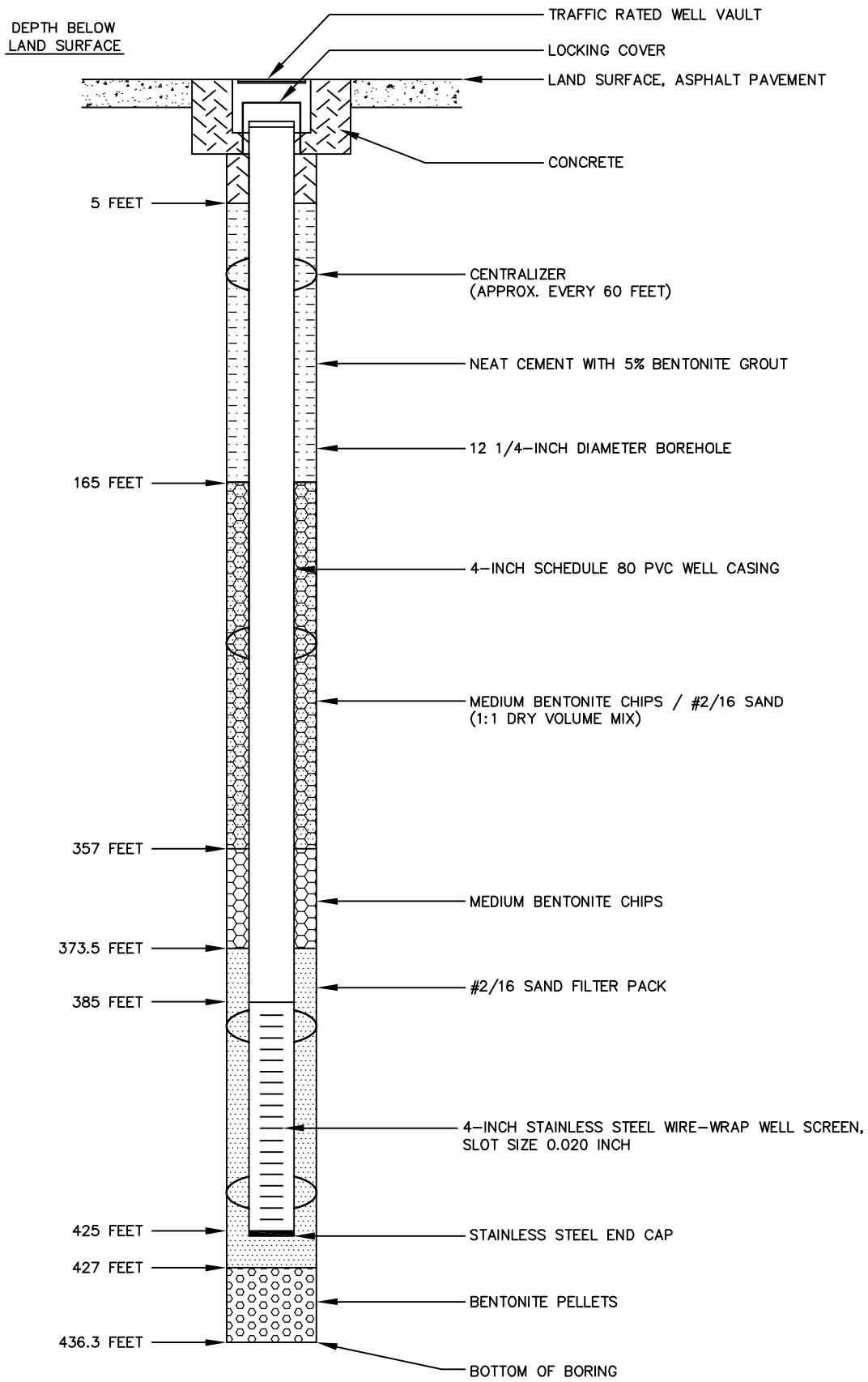
HARGIS + ASSOCIATES, INC.
Hydrogeology/Engineering

FIGURE 1. SITE LOCATION

Oct 08, 2014 - 3:14pm ESS - T: 2014\500-599\532 Raytheon_Hydrogeology\H+A BaseMaps\410-9312.dwg



**FIGURE 2.
WELL AND PIEZOMETER LOCATIONS**



NOT TO SCALE

Oct 09, 2014 - 3:51pm ESS - T: \2014\500-599\532 Roytheon\Hydrogeology\WellDiag\710-0827.dwg

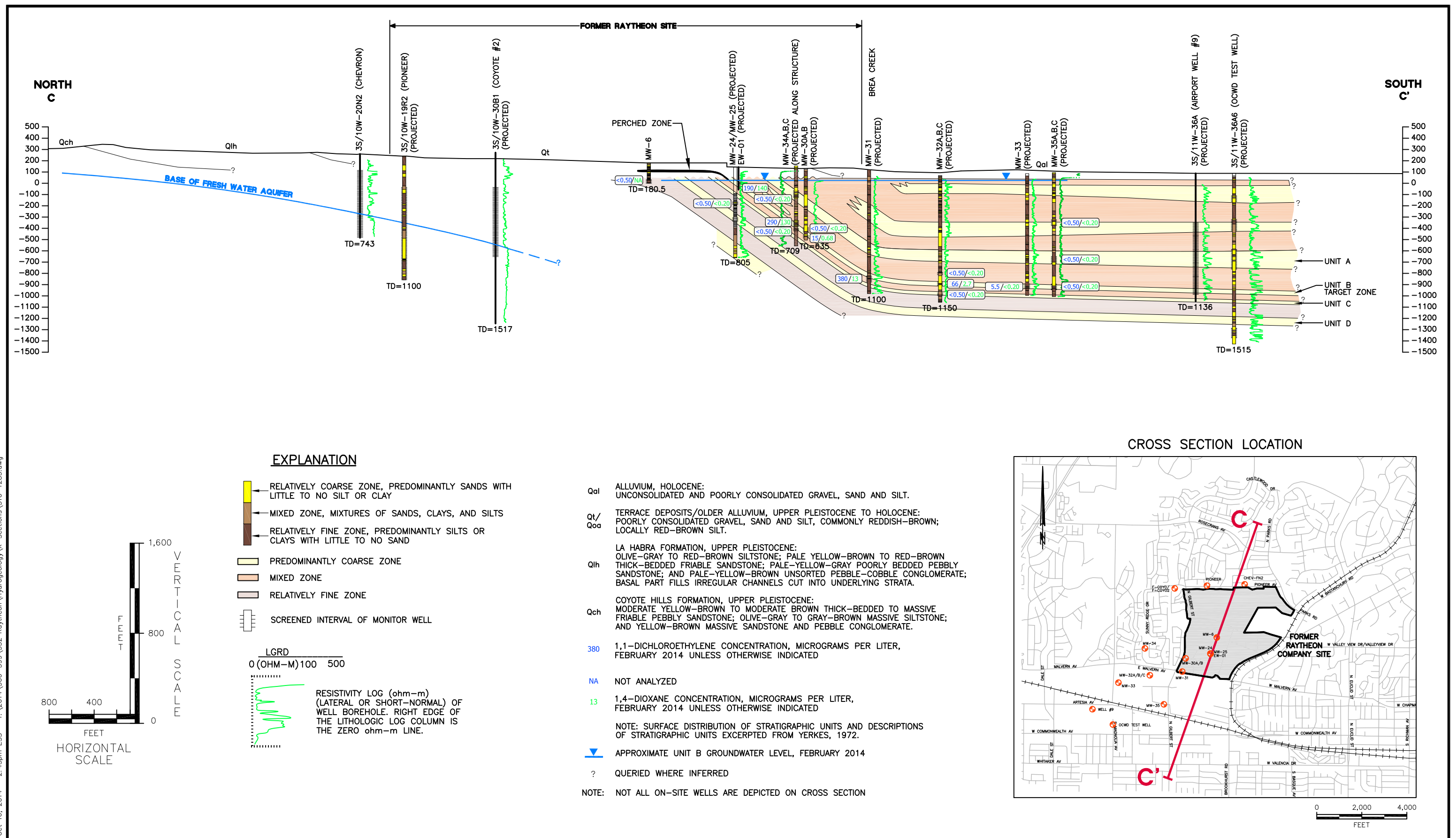


HARGIS + ASSOCIATES, INC.
Hydrogeology/Engineering

10/14 | RPT NO. 532.03 | 710-0827 | A

FIGURE 3.
SCHEMATIC CONSTRUCTION DIAGRAM
MONITOR WELL MW-41

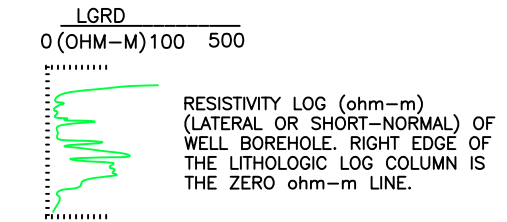
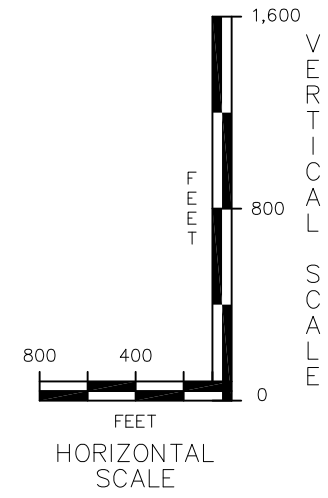
Oct 16, 2014 - 2:43pm ESS - T: \\2014\500-599\532 Raytheon_Hydrogeology\X-Sect\310-1285.dwg



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

- 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.
- 380 1,1-DICHLOROETHYLENE CONCENTRATION, MICROGRAMS PER LITER, FEBRUARY 2014 UNLESS OTHERWISE INDICATED
- NA NOT ANALYZED
- 13 1,4-DIOXANE CONCENTRATION, MICROGRAMS PER LITER, FEBRUARY 2014 UNLESS OTHERWISE INDICATED
- NOTE: SURFACE DISTRIBUTION OF STRATIGRAPHIC UNITS AND DESCRIPTIONS OF STRATIGRAPHIC UNITS EXCERPTED FROM YERKES, 1972.
- APPROXIMATE UNIT B GROUNDWATER LEVEL, FEBRUARY 2014
- ? QUERIED WHERE INFERRED
- NOTE: NOT ALL ON-SITE WELLS ARE DEPICTED ON CROSS SECTION



CROSS SECTION LOCATION

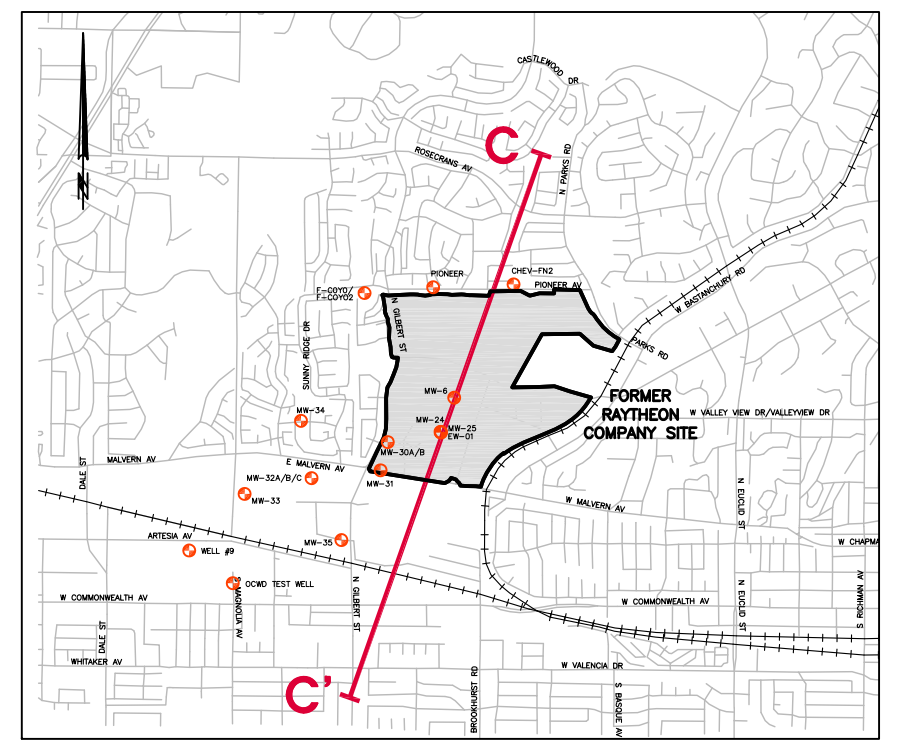
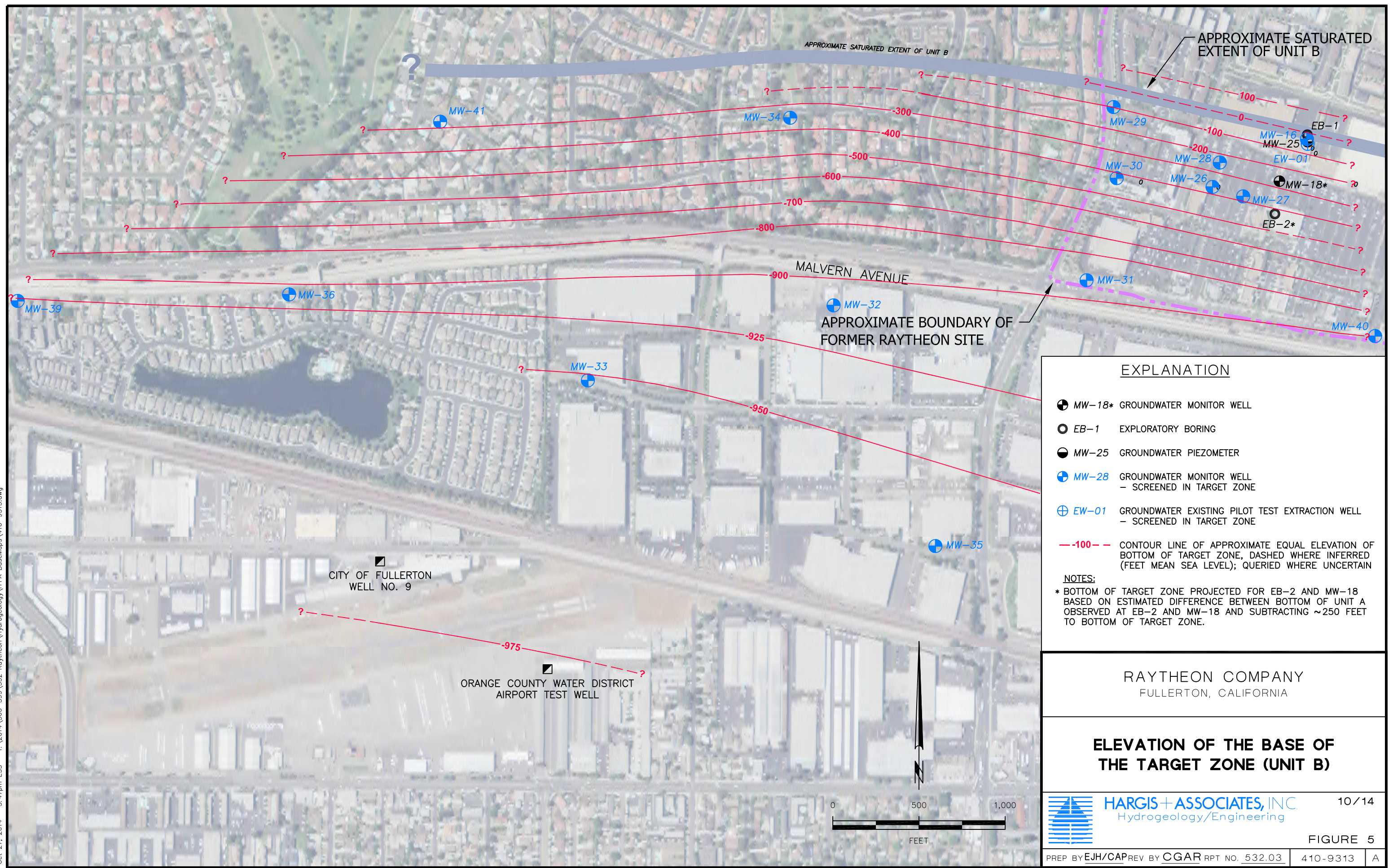


FIGURE 4.
REGIONAL CONCEPTUAL GROUNDWATER MODEL HYDROGEOLOGIC CROSS-SECTION C-C'

Oct 27, 2014 - 3:47pm ESS - T:\2014\500-599\532 Roytheon\Hydrogeology\H+A BaseMaps\410-9313.dwg



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); QUERIED WHERE UNCERTAIN

NOTES:

* 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)

HARGIS+ASSOCIATES, INC.
Hydrogeology/Engineering

10/14

FIGURE 5

PREP BY EJH/CAP REV BY CGAR RPT NO. 532.03 410-9313 | A

Oct 28, 2014 - 9:19am ESS - T: \\2014\500-599\532 Raytheon\Hydrogeology\Water Lvl\220-2247.dwg

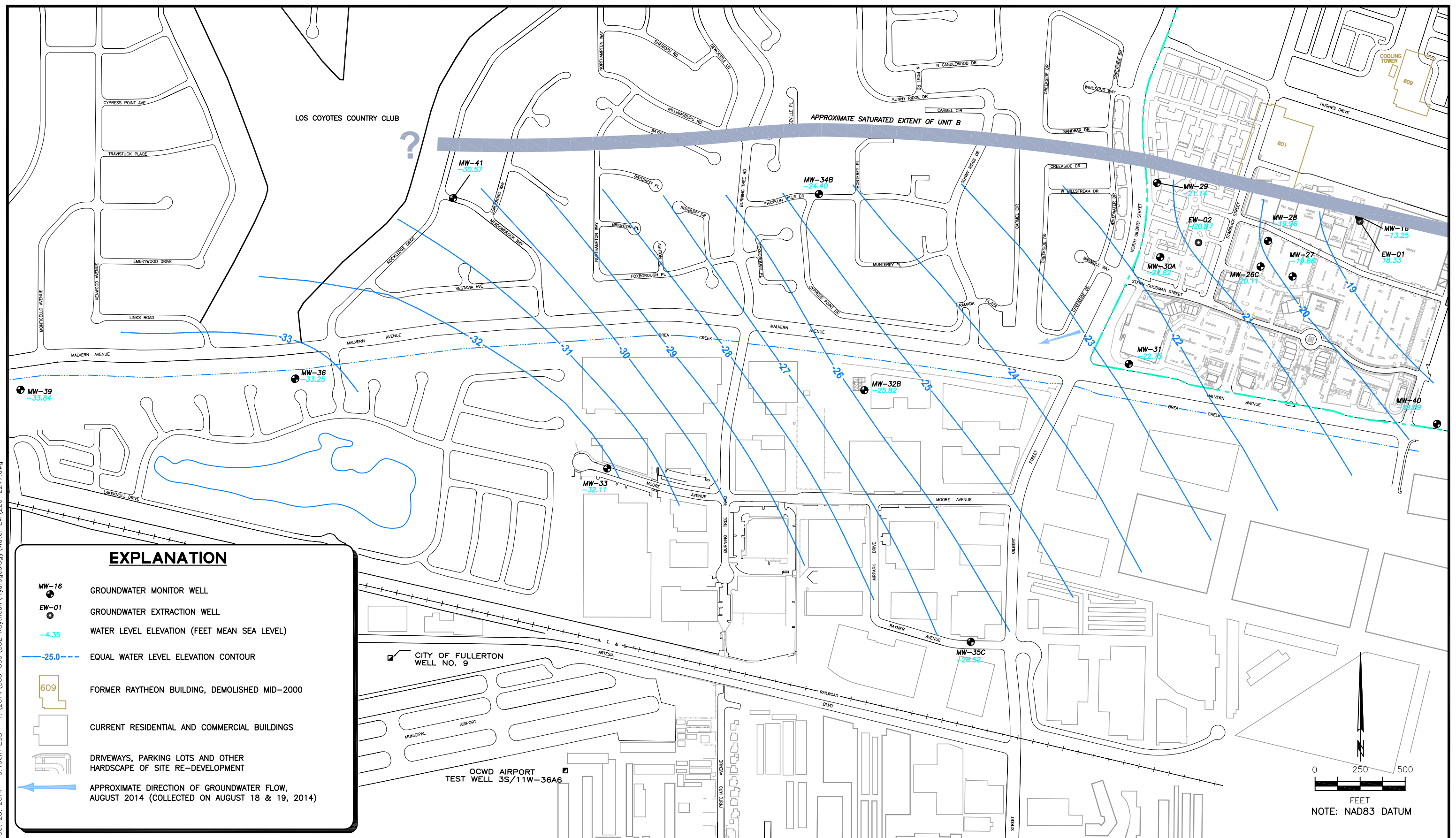


FIGURE 6.
WATER LEVEL ELEVATION TARGET ZONE (UNIT B)
AUGUST 2014

APPENDIX A
WASTE MANIFESTS

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number
NOT REQUIRED

2. Page 1 of
1

3. Emergency Response Phone
888-423-8060

4. Waste Tracking Number
0507171

5. Generator's Name and Mailing Address: **Raytheon Company**
1801 Hughes Drive Bld. 676 MSF216
Generator's Phone: **Folsom, CA 95634**

Generator's Site Address (if different than mailing address): **8820 Meadowbrook Avenue**
Stamm Park, CA

6. Transporter 1 Company Name: **American Integrated Services, Inc.** U.S. EPA ID Number: **CAR000148338**

7. Transporter 2 Company Name: U.S. EPA ID Number:

8. Designated Facility Name and Site Address: **Crosby & Overton**
1630 W. 17th Street
Facility's Phone: **Long Beach, CA 90813 (562) 432-5445**

U.S. EPA ID Number: **CAD028408019**

9. Waste Shipping Name and Description	10. Containers		11. Total Quantity	12. Unit Wt./Vol.
	No.	Type		
1. Non-Hazardous Ground Water	1	TT	3.200	G
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

Wear protective equipment while handling. Weights or volumes are approximate. 24 hour emergency number (888) 423-8060 (AIS Dispatcher)

Profile# 88928
Project# 34017-22

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: **Karl Brown** Signature: *[Signature]* Month: **08** Day: **18** Year: **14**

15. International Shipments Import to U.S. Export from U.S. Port of entry/exit: Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: **James Carter** Signature: *[Signature]* Month: **8** Day: **18** Year: **14**

Transporter 2 Printed/Typed Name: Signature: Month: Day: Year:

17. Discrepancy

17a. Discrepancy Indication Space Quantity Type Residue Partial Rejection Full Rejection

Manifest Reference Number: U.S. EPA ID Number:

17b. Alternate Facility (or Generator) Facility's Phone: U.S. EPA ID Number:

17c. Signature of Alternate Facility (or Generator) Month: Day: Year:

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Signature: Month: Day: Year:

GENERATOR

INT'L

TRANSPORTER

DESIGNATED FACILITY

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number
NOT REQUIRED

2. Page 1 of
1

3. Emergency Response Phone
888-423-8000

4. Waste Tracking Number
0507172

5. Generator's Name and Mailing Address
Raytheon Company
1801 Hughes Drive Bld. 676 MSF216
Generator's Phone: **Fallerton, CA 92634**

Generator's Site Address (if different than mailing address)
8820 Meadowbrook Avenue
Esuna Park, CA

6. Transporter 1 Company Name
American Integrated Services, Inc. U.S. EPA ID Number
CAR000148338

7. Transporter 2 Company Name U.S. EPA ID Number

8. Designated Facility Name and Site Address
Crosby & Overton U.S. EPA ID Number
1030 W. 17th Street
CAD028408019
Facility's Phone: **Long Beach, CA. 90813 (562) 432-5445**

9. Waste Shipping Name and Description	10. Containers		11. Total Quantity	12. Unit Wt./Vol.
	No.	Type		
1. Non-Hazardous Ground Water	1	TT	1,500	G
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information
Wear protective equipment while handling. Weights or volumes are approximate. 24 hour emergency number (888) 423-8000 (AIS Dispatcher)

Profile# 88928
Project# 34017-22

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name
PAUL ERKIN Signature
Month Day Year
08 18 14

15. International Shipments Import to U.S. Export from U.S. Port of entry/exit: Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name
Tommy Cantor Signature
Month Day Year
08 18 14

Transporter 2 Printed/Typed Name Signature
Month Day Year

17. Discrepancy

17a. Discrepancy Indication Space Quantity Type Residue Partial Rejection Full Rejection

17b. Alternate Facility (or Generator) Manifest Reference Number: U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name Signature Month Day Year

GENERATOR
INT'L
TRANSPORTER
DESIGNATED FACILITY

**NON-HAZARDOUS
WASTE MANIFEST**

1. Generator ID Number
NOT REQUIRED

2. Page 1 of
1

3. Emergency Response Phone
888-423-8080

4. Waste Tracking Number
0507173

5. Generator's Name and Mailing Address
Raytheon Company
1801 Hughes Drive Bld. 676 MSF216
Generator's Phone: **Fallerton, CA 92634**

Generator's Site Address (if different than mailing address)
5820 Meadowbrook Avenue
Esuna Park, CA

6. Transporter 1 Company Name
American Integrated Services, Inc.

U.S. EPA ID Number
CAR000148338

7. Transporter 2 Company Name

U.S. EPA ID Number

8. Designated Facility Name and Site Address
Crosby & Overton
1830 W. 17th Street
Facility's Phone: **Long Beach, CA. 90813 (562) 432-5445**

U.S. EPA ID Number
CAD028408019

9. Waste Shipping Name and Description	10. Containers		11. Total Quantity	12. Unit Wt./Vol.
	No.	Type		
1. Non-Hazardous Ground Water	1	TT	1600	G
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

Wear protective equipment while handling. Weights or volumes are approximate. 24 hour emergency number (888) 423-8080 (AJS Dispatcher)

Profile# 88926
Project# 34017-22

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offor's Printed/Typed Name
PAUL ELLIOTT

Signature
[Signature]

Month Day Year
10/18/14

15. International Shipments Import to U.S. Export from U.S. Port of entry/exit: _____
Date leaving U.S.: _____

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name
James C. ...

Signature
[Signature]

Month Day Year
8/19/14

Transporter 2 Printed/Typed Name

Signature

Month Day Year

17. Discrepancy

17a. Discrepancy Indication Space Quantity Type Residue Partial Rejection Full Rejection

Manifest Reference Number: _____

17b. Alternate Facility (or Generator)

U.S. EPA ID Number

Facility's Phone: _____

17c. Signature of Alternate Facility (or Generator)

Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name

Signature

Month Day Year

GENERATOR

INT'L

TRANSPORTER

DESIGNATED FACILITY

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number
NOT REQUIRED

2. Page 1 of
1

3. Emergency Response Phone
888-423-8080

4. Waste Tracking Number
0507174

5. Generator's Name and Mailing Address
Raytheon Company
1801 Hughes Drive Bld. 676 MSF216
Generator's Phone: **Fullerton, CA 92734**

Generator's Site Address (if different than mailing address)
8820 Meadowbrook Avenue
Essex Park, CA

6. Transporter 1 Company Name
American Integrated Services, Inc. U.S. EPA ID Number
CAR000148338

7. Transporter 2 Company Name U.S. EPA ID Number

8. Designated Facility Name and Site Address
Crosby & Overton U.S. EPA ID Number
1630 W. 17th Street
Long Beach, CA 90815 (562) 432-5445
Facility's Phone: **CAD028409019**

9. Waste Shipping Name and Description	10. Containers		11. Total Quantity	12. Unit Wt./Vol.
	No.	Type		
1. Non-Hazardous Ground Water	1	TT	2.500	G
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information
Wear protective equipment while handling. Weights or volumes are approximate. 24 hour emergency number (888) 423-8080 (AIS Dispatcher)
Profile# 88926
Project# 34017-22

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name
Karl Steiner Signature
Month Day Year
08 18 14

15. International Shipments Import to U.S. Export from U.S. Port of entry/exit: Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name
Bill Maresca Signature
Month Day Year
08 23 14

Transporter 2 Printed/Typed Name Signature Month Day Year

17. Discrepancy

17a. Discrepancy Indication Space Quantity Type Residue Partial Rejection Full Rejection

17b. Alternate Facility (or Generator) Manifest Reference Number: U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name Signature Month Day Year

GENERATOR

INT'L

TRANSPORTER

DESIGNATED FACILITY

**NON-HAZARDOUS
WASTE MANIFEST**

1. Generator ID Number
NOT REQUIRED

2. Page 1 of
1

3. Emergency Response Phone
888-423-8080

4. Waste Tracking Number
0507253

5. Generator's Name and Mailing Address
Raytheon Company
1801 Hughes Drive Bld. 676 MSF216
Generator's Phone: **Fallerton, CA 92634**

Generator's Site Address (if different than mailing address)
8820 Meadowbrook Avenue
Esuna Park, CA

6. Transporter 1 Company Name
American Integrated Services, Inc.

U.S. EPA ID Number
CAR000148338

7. Transporter 2 Company Name

U.S. EPA ID Number

8. Designated Facility Name and Site Address
Mu-Way
1270 Arrow Hwy, Irwindale, CA 91703
Facility's Phone: **626-306-6308**

U.S. EPA ID Number

9. Waste Shipping Name and Description	10. Containers		11. Total Quantity	12. Unit Wt./Vol.
	No.	Type		
1. Non-Hazardous Waste Solid (Soil)	1	CM		Y
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

Wear protective equipment while handling. Weights or volumes are approximate. 24 hour emergency number (800) 423-8080 (AIS Dispatcher)

Project# 34017-22
Bin# 16149

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: **Paul Stewart** Signature: *[Signature]* Month: **8** Day: **22** Year: **14**

15. International Shipments Import to U.S. Export from U.S. Port of entry/exit: _____ Date leaving U.S.: _____

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: **Silvaho Verk** Signature: *[Signature]* Month: **8** Day: **22** Year: **14**

Transporter 2 Printed/Typed Name: _____ Signature: _____ Month: _____ Day: _____ Year: _____

17. Discrepancy

17a. Discrepancy Indication Space Quantity Type Residue Partial Rejection Full Rejection

Manifest Reference Number: _____

17b. Alternate Facility (or Generator) _____ U.S. EPA ID Number _____

Facility's Phone: _____

17c. Signature of Alternate Facility (or Generator) _____ Month: _____ Day: _____ Year: _____

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: _____ Signature: _____ Month: _____ Day: _____ Year: _____

GENERATOR
INT'L
TRANSPORTER
DESIGNATED FACILITY

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number
NOT REQUIRED

2. Page 1 of
1

3. Emergency Response Phone
888-423-6060

4. Waste Tracking Number
0507175

5. Generator's Name and Mailing Address: **Raytheon Company**
1801 Hughes Drive Bld. 670 MSF210
Generator's Phone: **Folsom, CA 92634**

Generator's Site Address (if different than mailing address):
5520 Meadowbrook Avenue
Buena Park, CA

6. Transporter 1 Company Name: **American Integrated Services, Inc.** U.S. EPA ID Number: **CAR000146338**

7. Transporter 2 Company Name: U.S. EPA ID Number:

8. Designated Facility Name and Site Address: **Crosby & Overton**
1630 W. 17th Street
Facility's Phone: **Long Beach, CA 90813 (562) 432-5445**

U.S. EPA ID Number: **CAD028409019**

9. Waste Shipping Name and Description	10. Containers		11. Total Quantity	12. Unit Wt./Vol.
	No.	Type		
1. Non-Hazardous Ground Water	1 /	TT	1300	G
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

Wear protective equipment while handling. Weights or volumes are approximate. 24 hour emergency number (888) 423-6060 (AIS Dispatchers)

Profile# 88826
Project# 34017-22

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: **TAU BROWER** Signature: *[Signature]* Month Day Year: **11/18/14**

15. International Shipments Import to U.S. Export from U.S. Port of entry/exit: Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: **FRANKIE SANCHEZ** Signature: *[Signature]* Month Day Year: **03/25/14**

Transporter 2 Printed/Typed Name: Signature: Month Day Year:

17. Discrepancy

17a. Discrepancy Indication Space Quantity Type Residue Partial Rejection Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) U.S. EPA ID Number:

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) Month Day Year:

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Signature: Month Day Year:

GENERATOR

INT'L

TRANSPORTER

DESIGNATED FACILITY



HARGIS + ASSOCIATES, INC.

APPENDIX B
LITHOLOGIC LOG

MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*
 PROJECT NUMBER: 532.03

DATE DRILLED: *8/12/14 to 8/20/14* SURFACE ELEVATION: *156.02 feet msl**

BOREHOLE DIA.: *12.25 inches* TOTAL DEPTH OF BORING: *436.5 feet bbs*

LOCATION: *8820 Meadowbrook Way, Fullerton, CA*

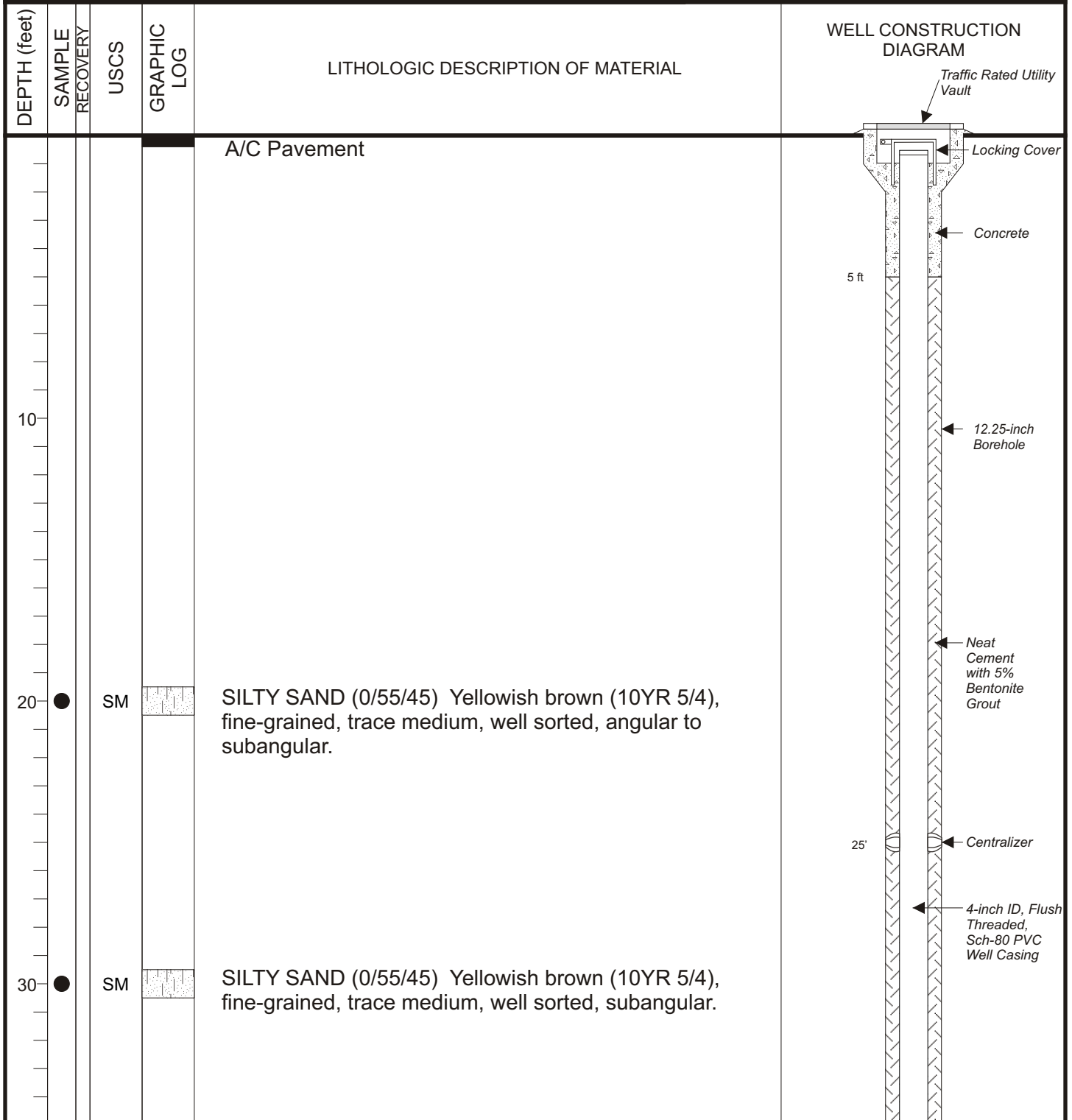
DRILLING COMPANY: *BC²* METHOD: *Mud Rotary*

COMMENTS: *Lithologic description based on grab samples.*

DRILLER'S NAME: *A. Rochia* DRILL RIG: *Speedstar 50K*

Top of Sounding Tube Elevation: 155.60 ft msl
 * - City of Fullerton Datum*

LOGGED BY: *E. Hunter* CHECKED BY: *G. Cranham (P.G. #5897)*

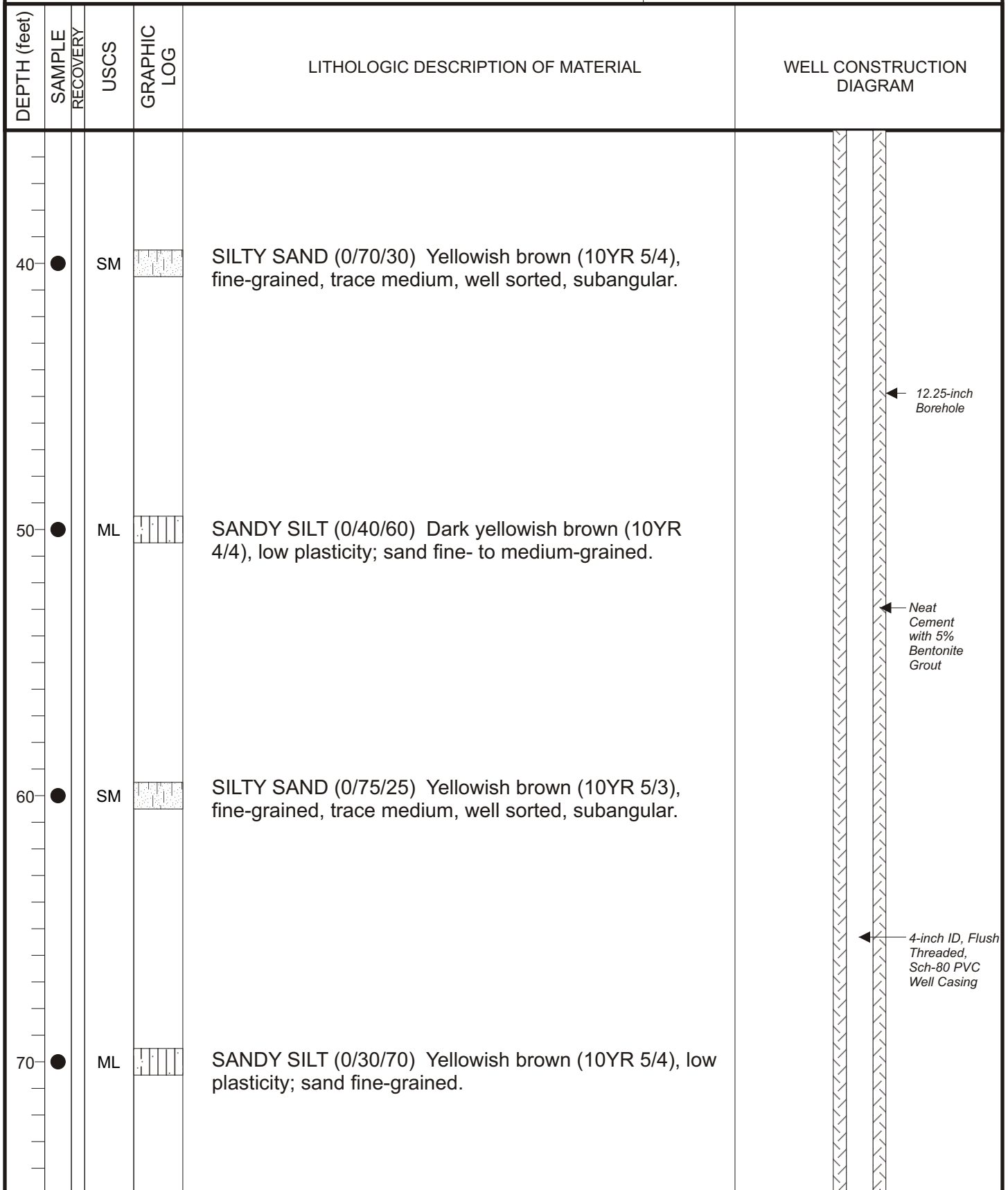


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14

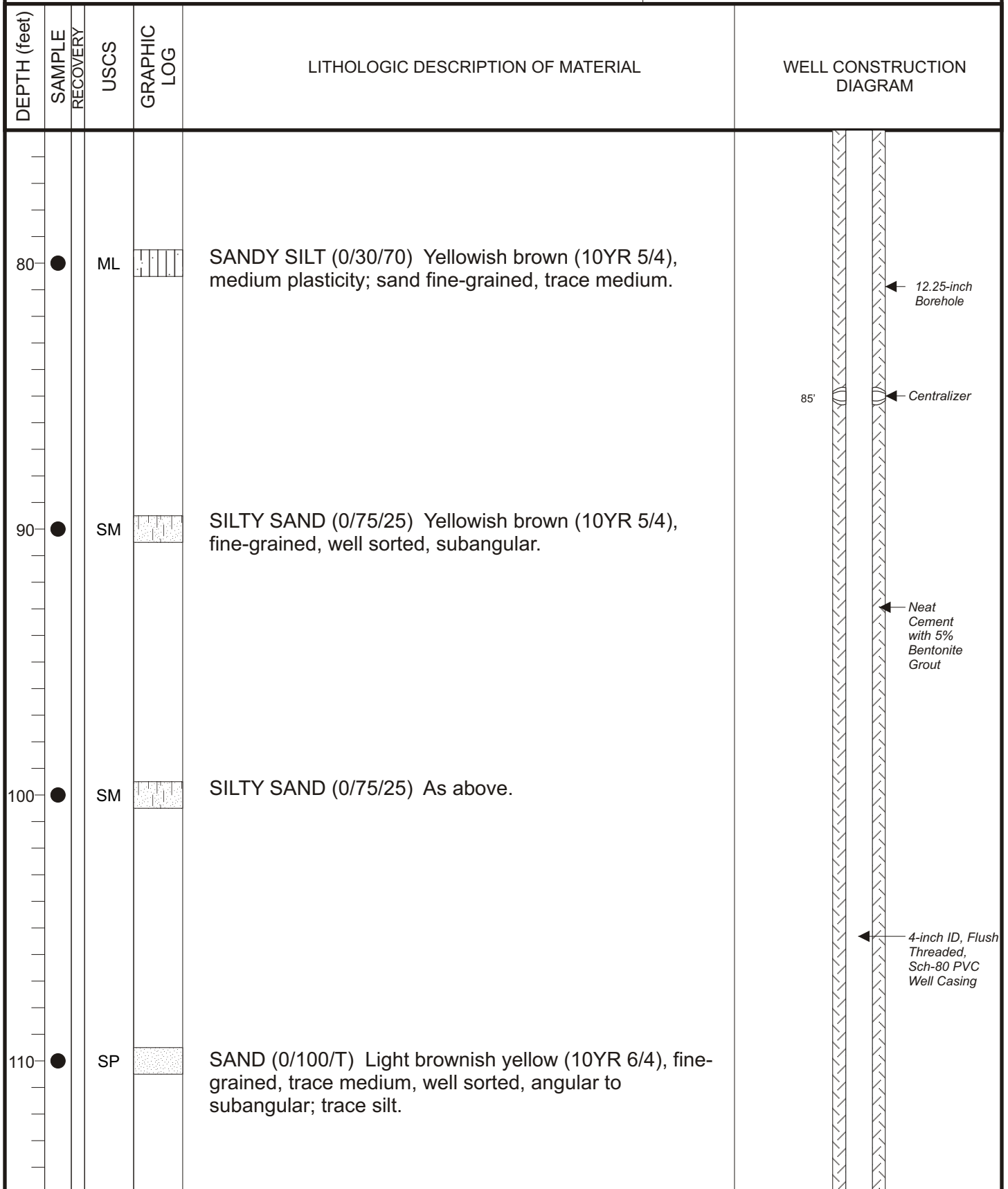


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14

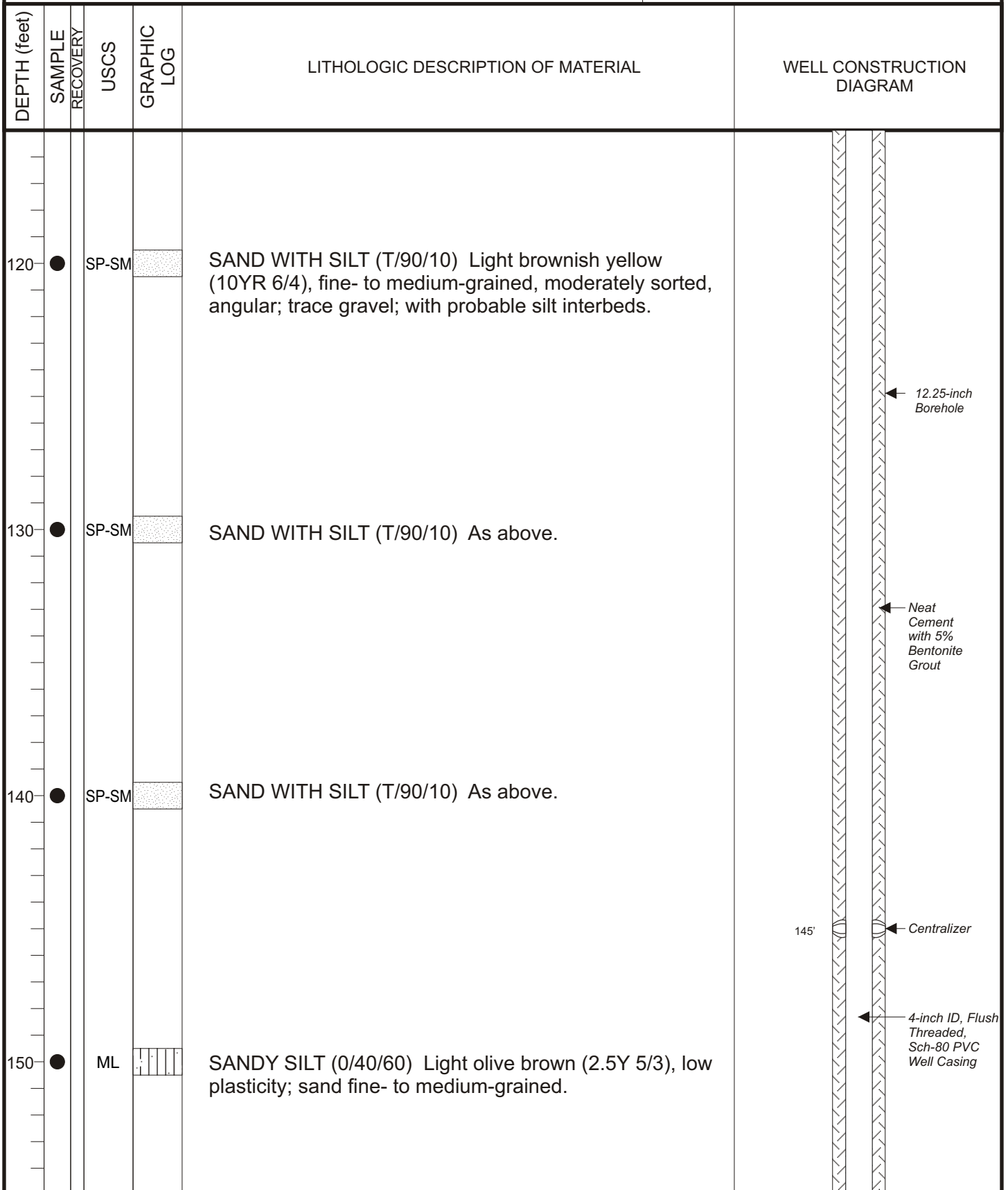


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14

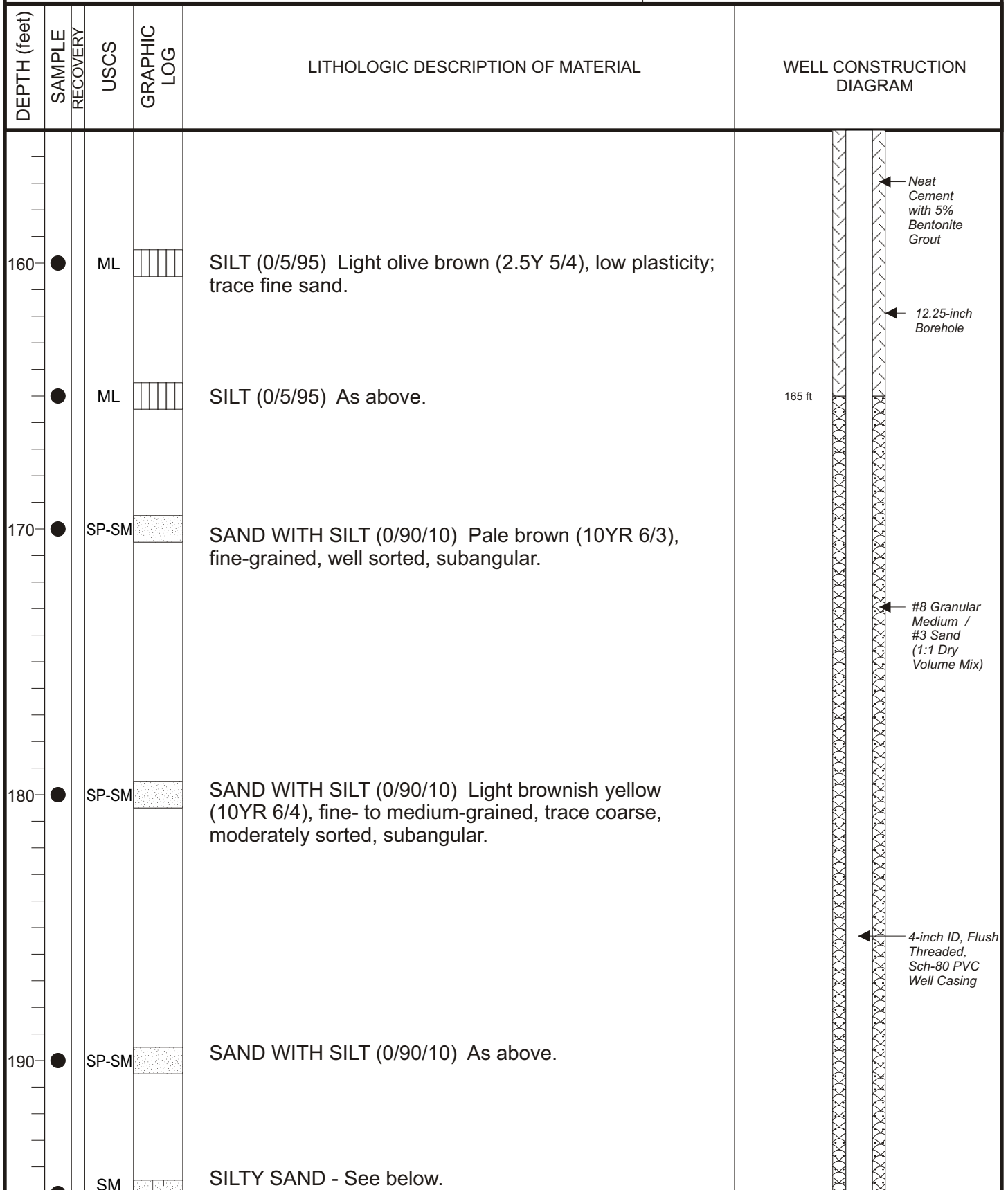


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14

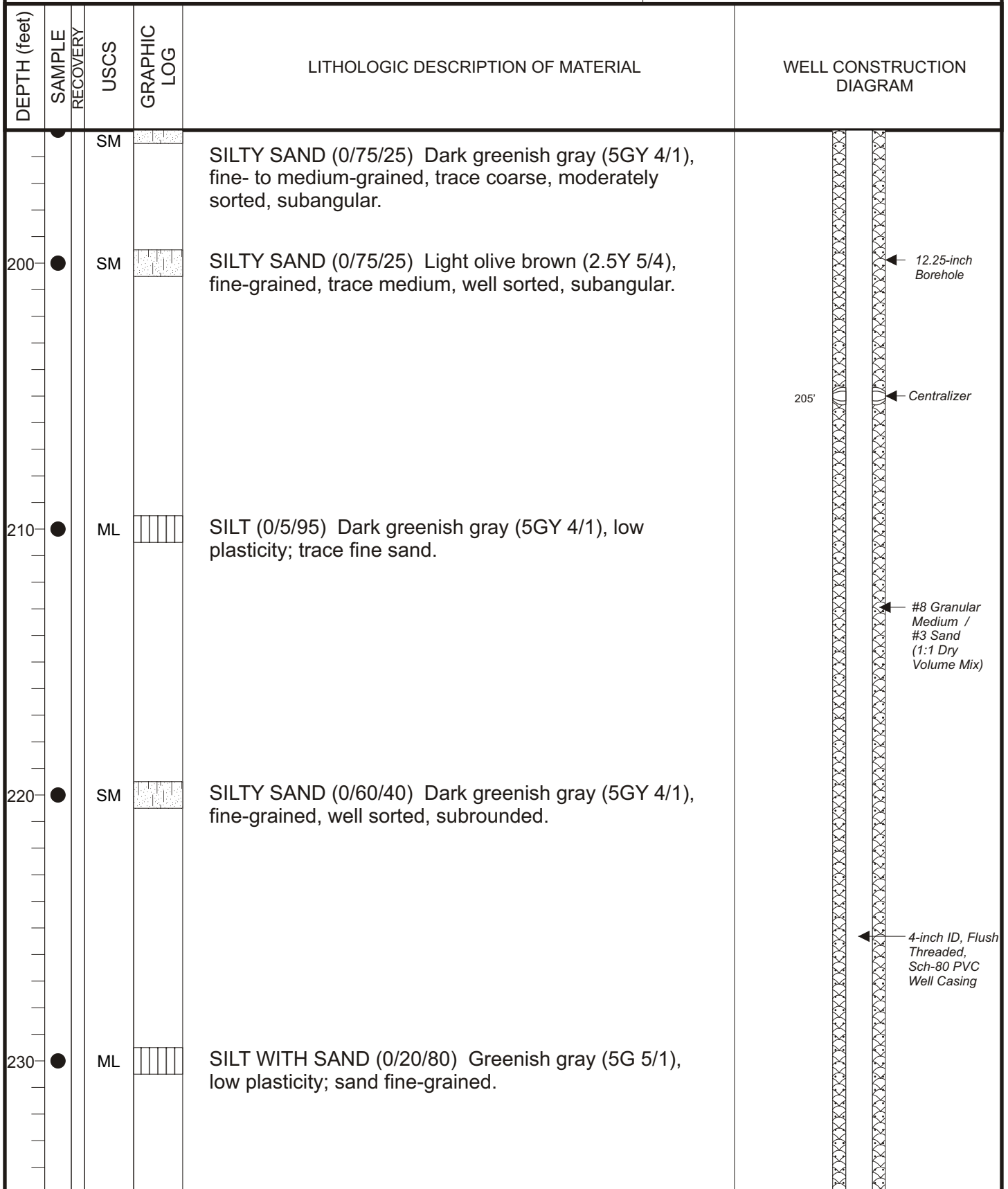


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14

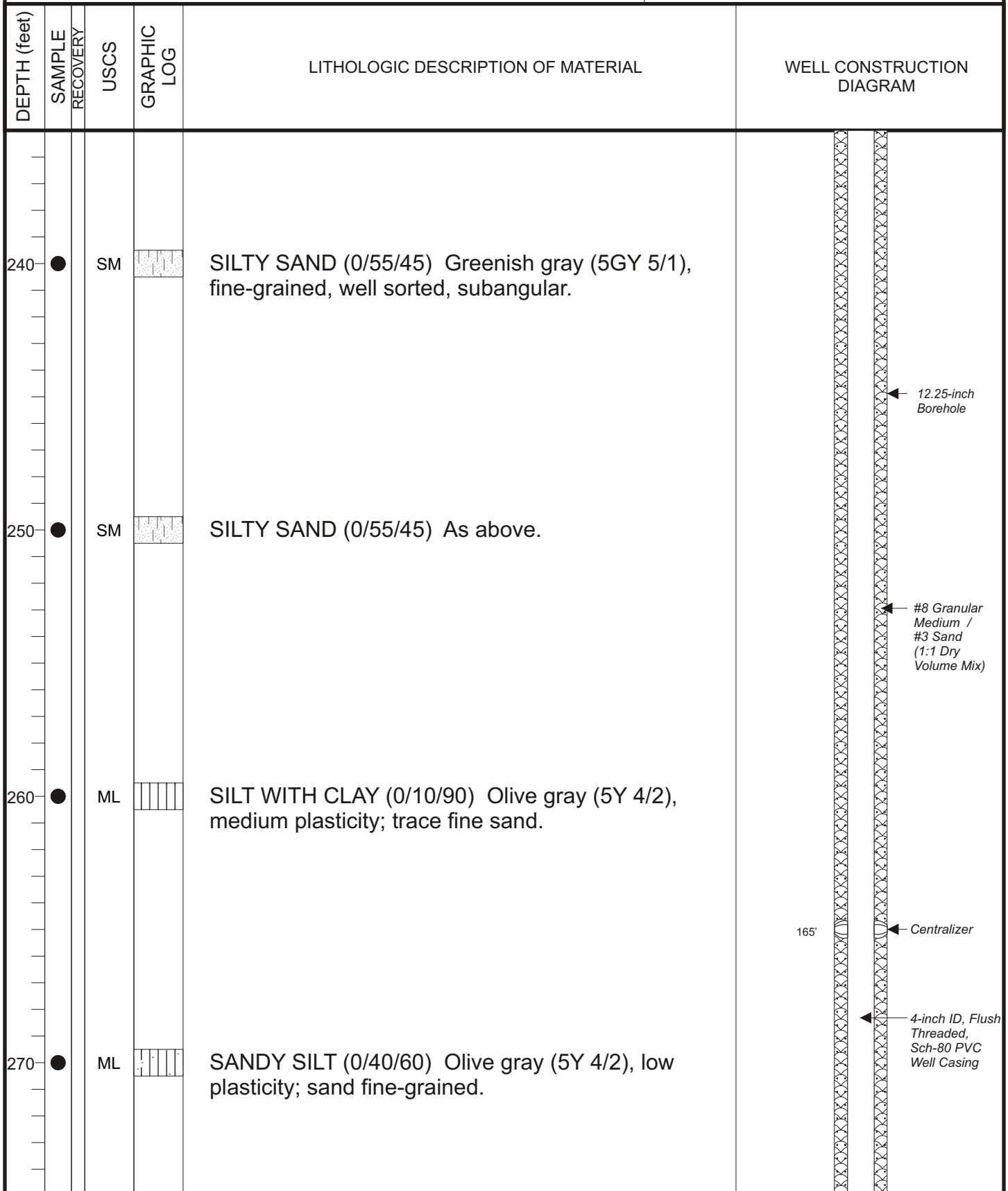


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14

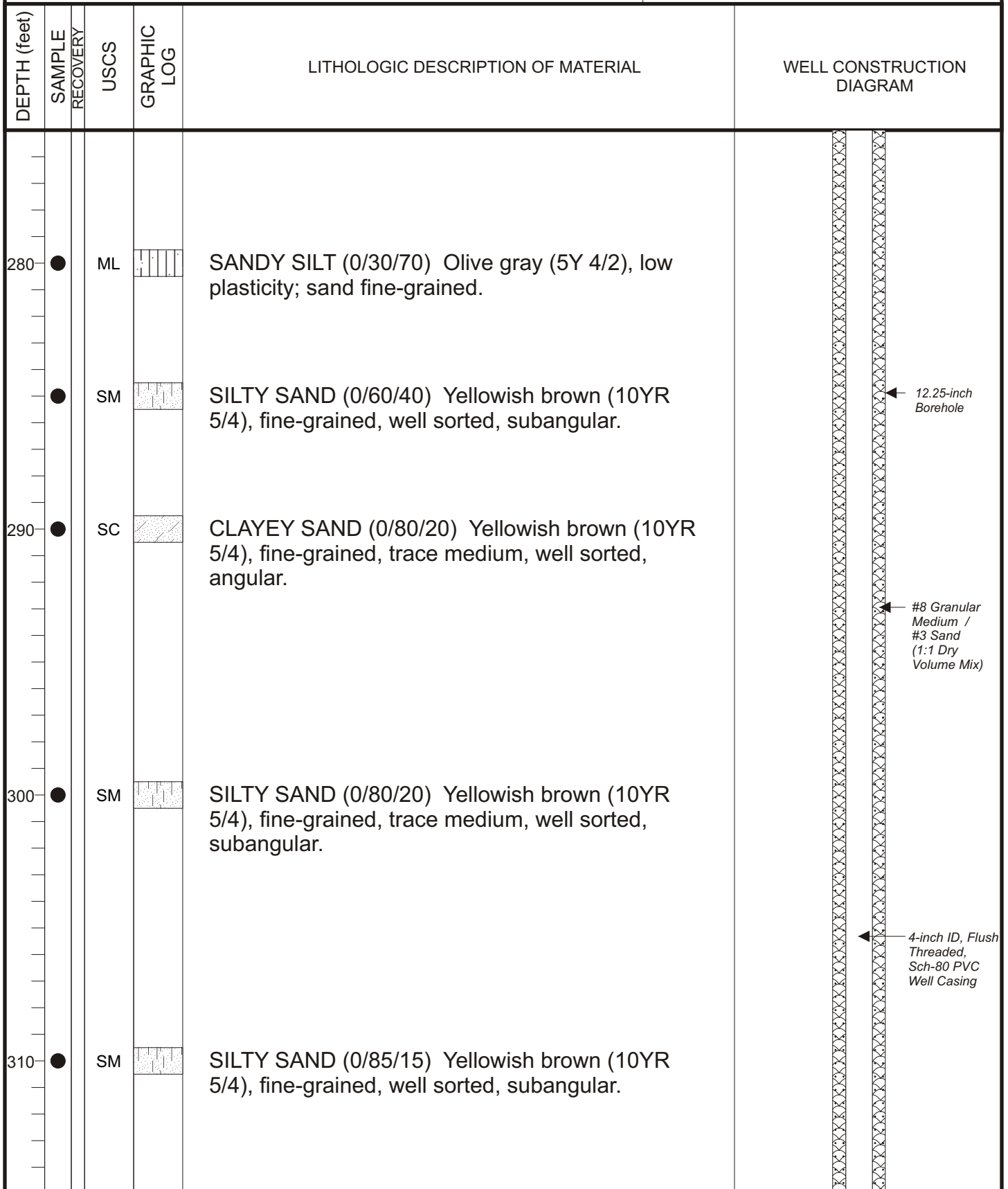


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14

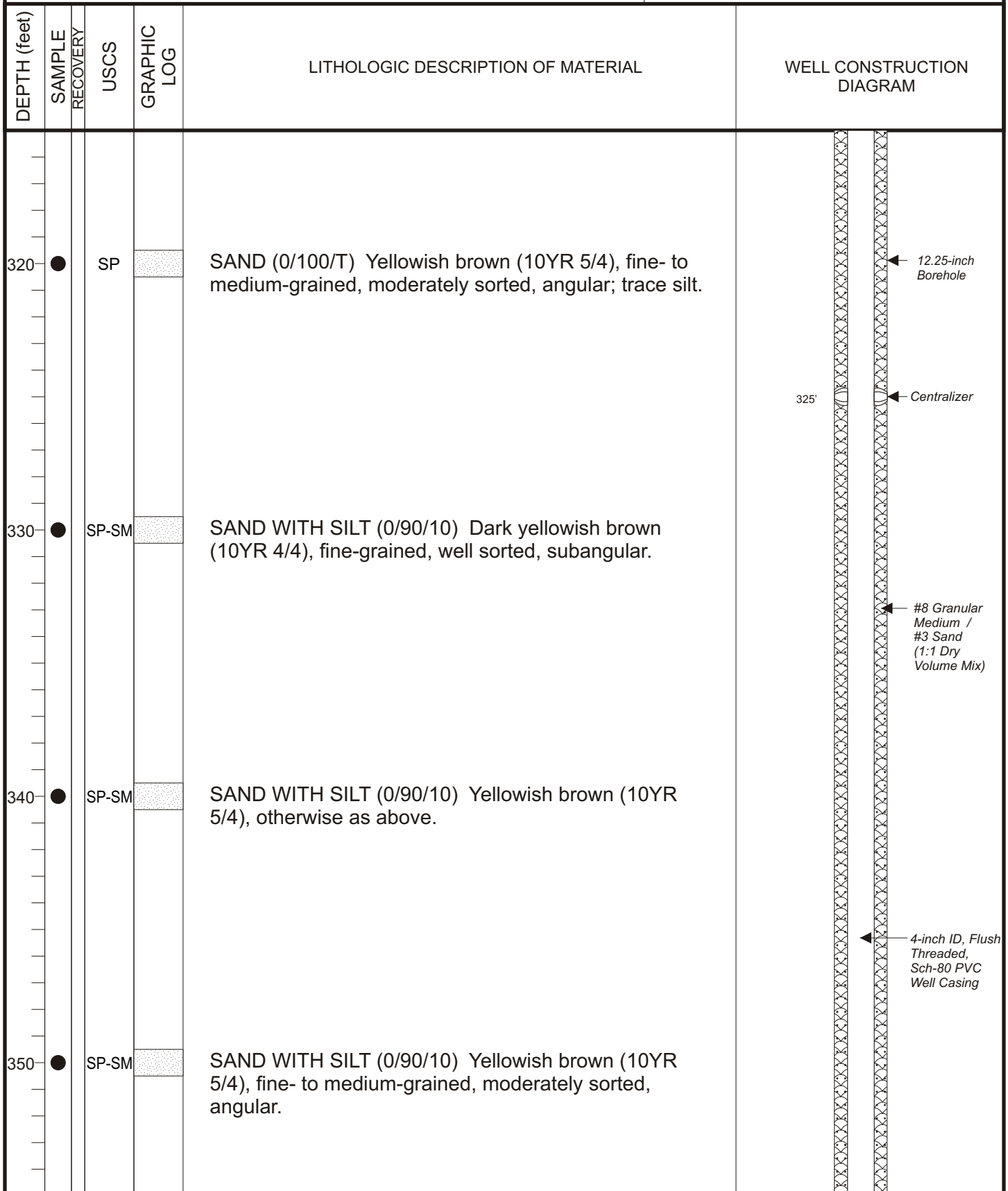


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14

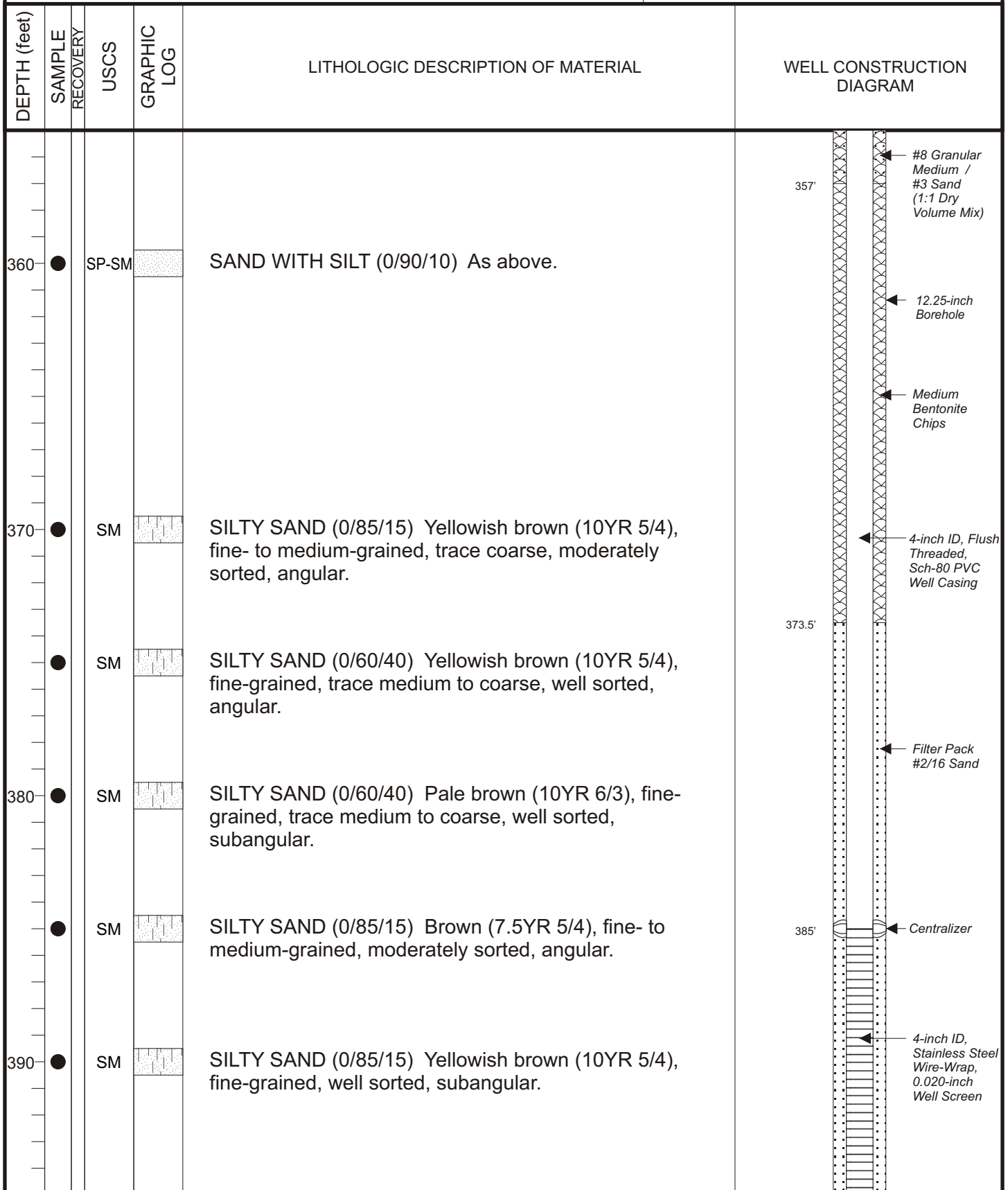


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14

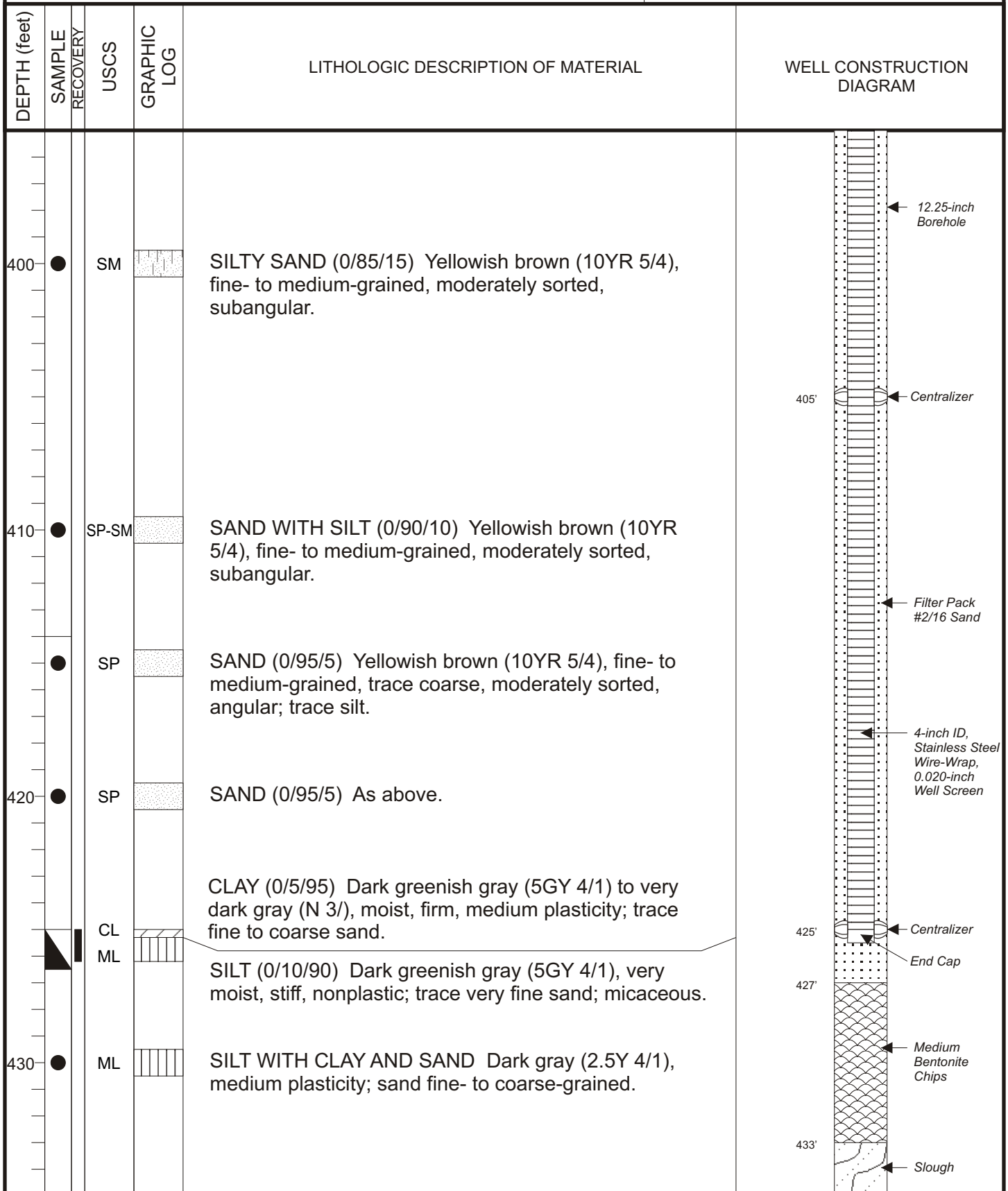


MONITOR WELL MW-41

PROJECT NAME: *Raytheon - Fullerton*

PROJECT NUMBER: 532.03

DATE DRILLED: 8/12/14 to 8/20/14



APPENDIX C
GEOPHYSICAL LOGS

Job No. 18585
 Company HARGIS & ASSOCIATES
 Well MW-41
 Field BUENA PARK
 County ORANGE State CA

Location: 8820 MEADOWBROOK WAY
 GPS: N 33o 52.818' W 117o 58.710'
 Sec. Twp. Rge. Other Services: GR/LL3 ELOG

	G.L.	0'	Elevation above perm. datum	Elevation K.B. D.F. G.L.
Permanent Datum	G.L.			
Log Measured From	G.L.	0'		
Drilling Measured From	G.L.			
Date		08-14-2014		
Run Number		ONE		
Depth Driller		425'		
Depth Logger		425'		
Bottom Logged Interval		423'		
Top Log Interval		0'		
Casing Driller		13" @ 10'		
Casing Logger		10'		
Bit Size		12.25"		
Type Fluid in Hole		BENTONITE		
Density / Viscosity		N/A		
pH / Fluid Loss		N/A		
Source of Sample		PIT		
Rm @ Meas. Temp		8.64 @ 90.2F		
Rmf @ Meas. Temp		8.51 @ 90.2F		
Rmc @ Meas. Temp		N/A		
Source of Rmf / Rmc		MEASURE		
Rm @ BHT		N/A		
Time Circulation Stopped		1530		
Time Logger on Bottom		1700		
Max. Recorded Temperature		N/A		
Equipment Number		PS-5		
Location		LA		
Recorded By		SCHUMACHER		
Witnessed By		G. CRANHAM		

<<< Fold Here >>>

All interpretations are opinions based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule.

Comments

Calibration Report

Database File 18585.db
 Dataset Pathname CAL/CAL1
 Dataset Creation Thu Aug 14 18:34:54 2014

Temperature Calibration Report

Serial Number: GRPH_SHORT
 Tool Model: GRPH_CAL
 Performed: Tue Jan 21 14:11:28 2014

	Reference		Reading
Low Reference:	4.00 degF		2417.00cps
High Reference:	8.00 degF		5700.00cps
Gain:	0.00		
Offset:	1.06		
Delta Spacing	1		

XY Caliper Calibration Report

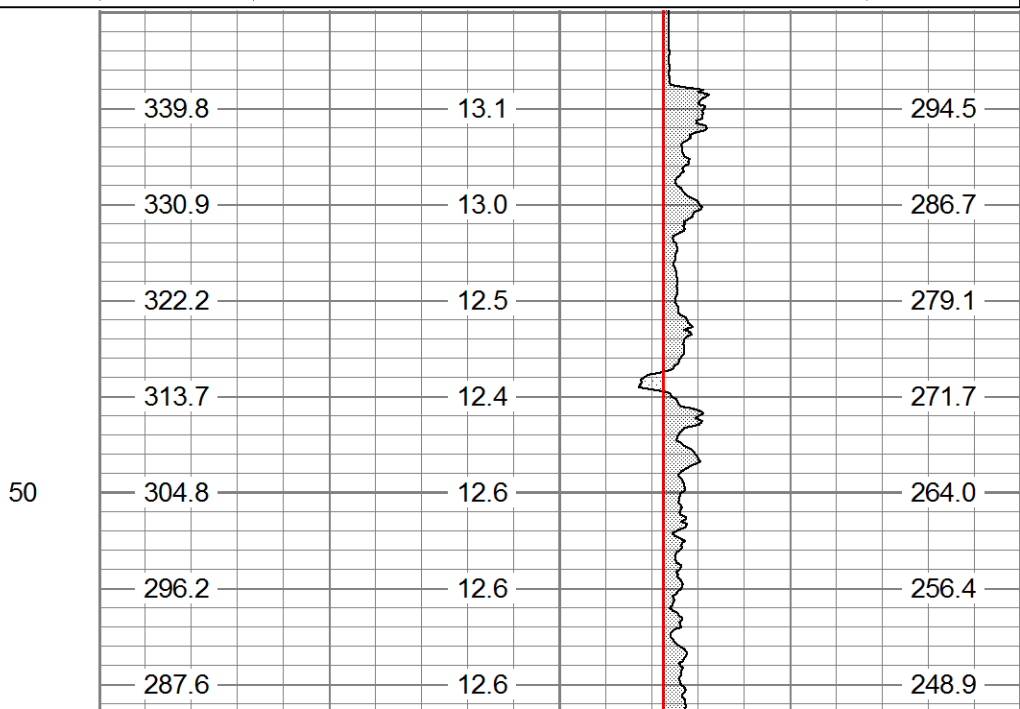
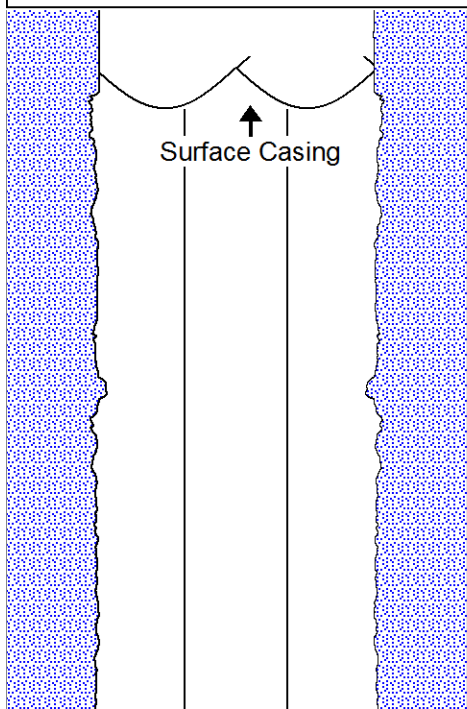
Serial Number/Model: Short-Comprobe
 Performed: Sat Aug 09 16:17:59 2014

	Ring		X Caliper		Y Caliper	
1:	4	in	1000.32	cps	1000.32	cps
2:	6	in	1609.48	cps	1609.48	cps
3:	8	in	2417.53	cps	2417.53	cps
4:	10	in	3266.45	cps	3266.46	cps
5:	16	in	5700	cps	5700	cps
6:	24	in	9014.71	cps	9014.71	cps
7:		in		cps		cps
8:		in		cps		cps
9:		in		cps		cps
10:		in		cps		cps

Database File 18585.db
 Dataset Pathname CAL/CAL1
 Presentation Format xyc_gph
 Dataset Creation Thu Aug 14 18:34:54 2014
 Charted by Depth in Feet scaled 1:240

CSG SCHEDULE
 Pipe(s) proportional to Hole Size

0	Caliper (in)	20
0	Bit Size (in)	20
Total BHV ft ³ (ft3)	Caliper (in)	Annular Vol ft ³ (ft3)



← 4" PVC Casing

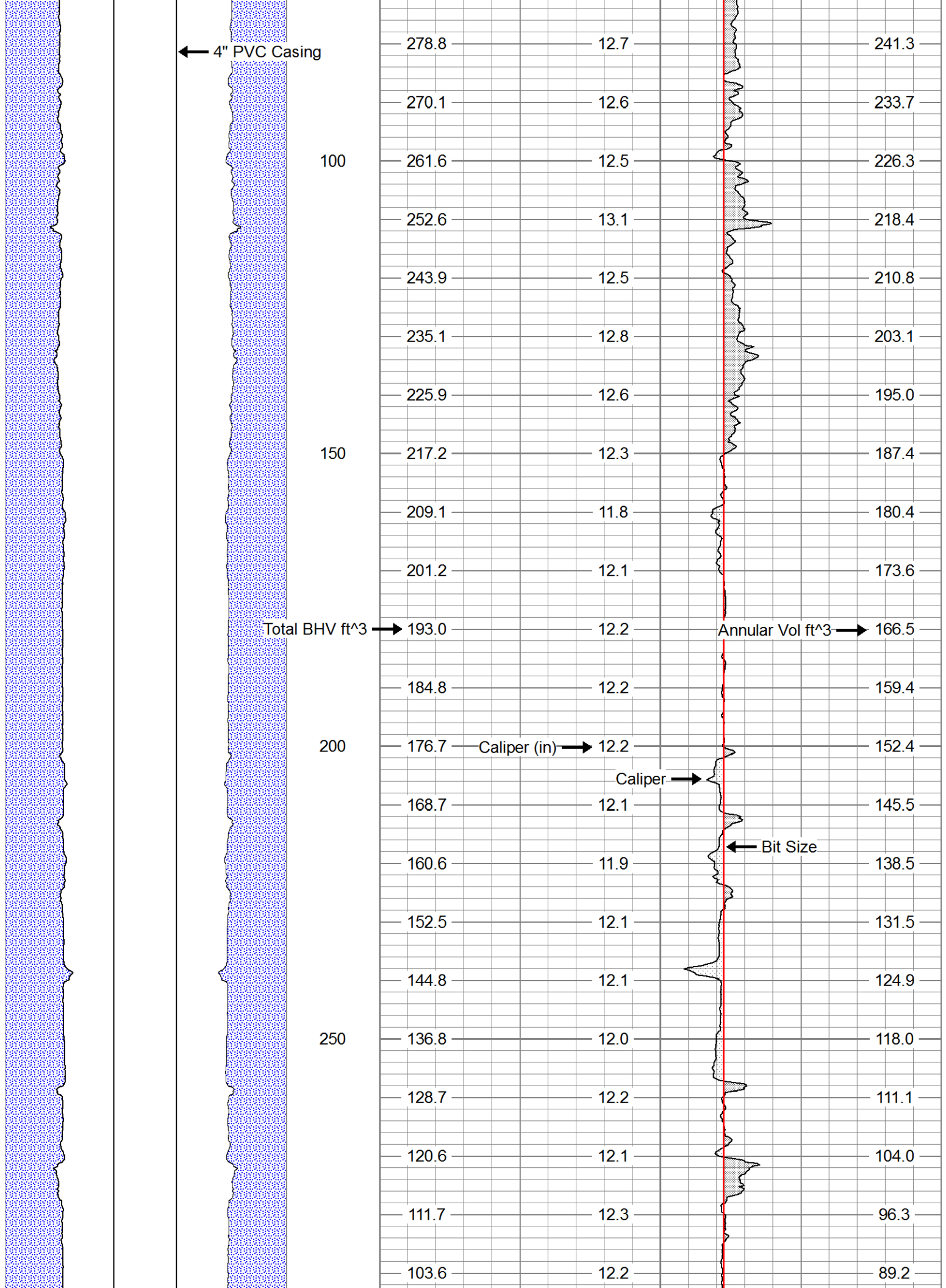
Total BHV ft³ → 193.0

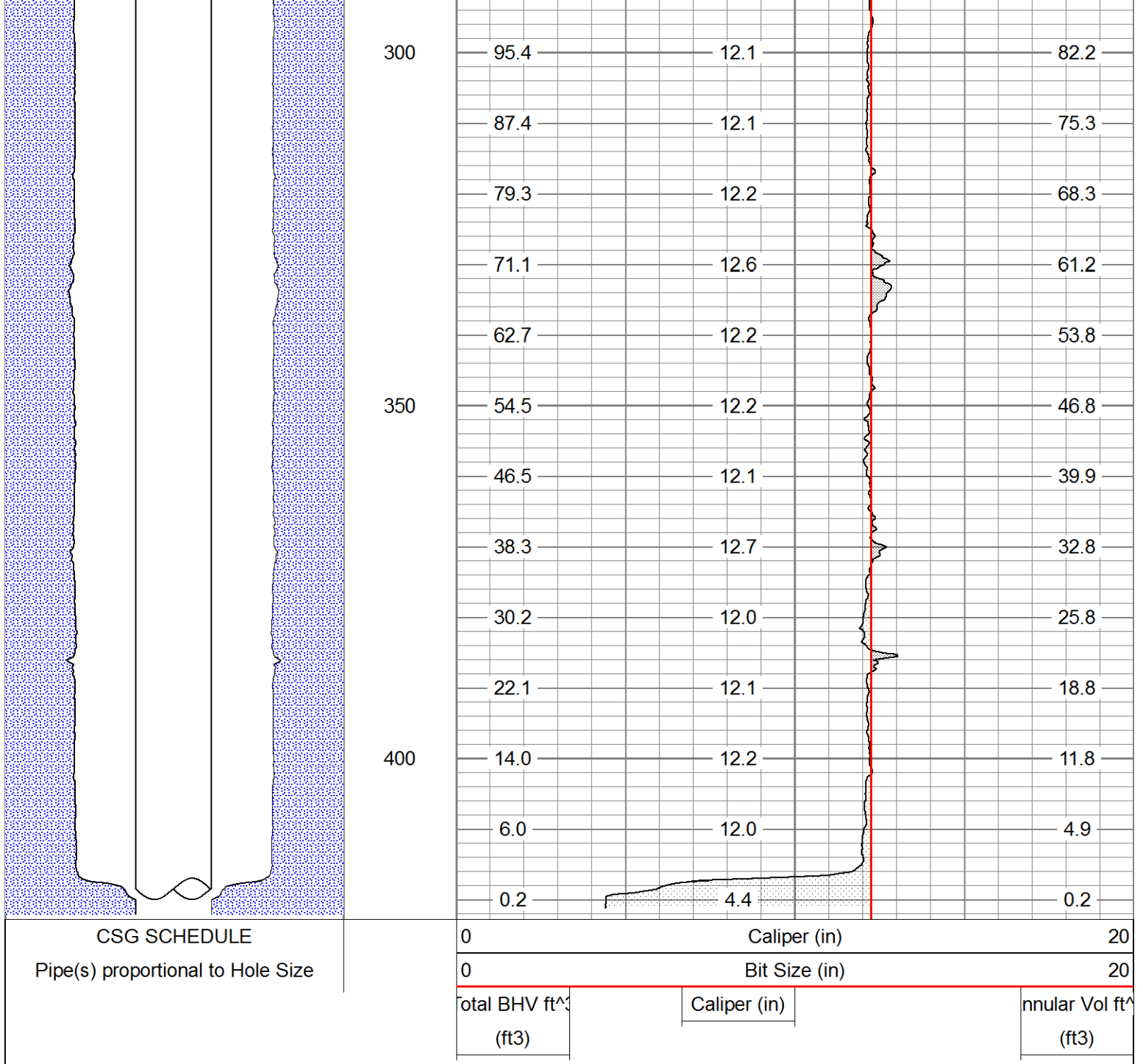
Annular Vol ft³ → 166.5

Caliper (in) → 12.2

Caliper →

← Bit Size





CSG SCHEDULE

Pipe(s) proportional to Hole Size

Caliper (in)

20

Bit Size (in)

20

Total BHV ft³
(ft3)

Caliper (in)

Annular Vol ft³
(ft3)

Job No. 18585
 Company HARGIS & ASSOCIATES
 Well MW-41
 Field BUENA PARK
 County ORANGE State CA
 File No.

Location: 8820 MEADOWBROOK WAY
 GPS: N 33o 52.818' W 117o 58.710'
 Sec. Twp. Rge. Other Services: GRILL3 CALIPER

	G.L.	0'	Elevation above perm. datum	Elevation
Date	08-14-2014			K.B. D.F. G.L.
Run Number	ONE			
Depth Driller	425'			
Depth Logger	425'			
Bottom Logged Interval	425'			
Top Log Interval	0'			
Casing Driller	13" @ 10'			
Casing Logger	10'			
Bit Size	12.25"			
Type Fluid in Hole	BENTONITE			
Density / Viscosity	N/A			
pH / Fluid Loss	N/A			
Source of Sample	PIT			
Rm @ Meas. Temp	8.64 @ 90.2F			
Rmf @ Meas. Temp	8.51 @ 90.2F			
Rmc @ Meas. Temp	N/A			
Source of Rmf / Rmc	MEASURE			
Rm @ BHT	N/A			
Time Circulation Stopped	1530			
Time Logger on Bottom	1700			
Max. Recorded Temperature	N/A			
Equipment Number	PS-5			
Location	LA			
Recorded By	SCHUMACHER			
Witnessed By	G. CRANHAM			

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All interpretations are opinions based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule.

Comments

Calibration Report

Database File 18585.db
 Dataset Pathname elog
 Dataset Creation Thu Aug 14 17:01:51 2014

Serial: D4
 Model: DTQ

Shop Calibration Performed: Thu May 22 10:37:59 2014
 Before Survey Verification Performed: Sat Sep 14 11:11:53 2013
 After Survey Verification Performed: Sat Sep 14 11:11:58 2013

Shop Calibration

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	9.446	101.290		10.200	102.200	Ohm-m	1.002	0.738
Long	9.440	98.766		10.200	102.200	Ohm-m	1.030	-17.000
IEE	29469.859	29471.061	counts	32.252	32.253	A		
VSN	1824.000	1824.020	counts	34.791	34.791	V		
VLN	8175.680	8176.080	counts	155.941	155.949	V		

Before Survey Verification

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	178.827	100.801		295.888	100.783	Ohm-m	2.501	-151.272
Long	934.011	103.172		103.094	103.094	Ohm-m	0.483	53.212
IEE	74.460	6115.720	counts	0.081	6.693	A		
VSN	149.600	6926.100	counts	2.853	132.107	V		
VLN	195.340	1772.260	counts	3.726	33.804	V		

After Survey Verification

	Readings			References			Results	
	Zero	Cal		Zero	Cal		Gain	Offset
Short	40.270	101.200		40.249	101.201	Ohm-m	1.000	-0.035
Long	142.491	102.843		102.842	102.842	Ohm-m	1.004	-0.383
IEE	213.380	7077.580	counts	0.234	7.746	A		
VSN	96.540	8047.160	counts	1.841	153.490	V		
VLN	85.400	2044.440	counts	1.629	38.995	V		

After Survey Verification compared to Before Survey Calibration

	Zero			Cal		
	Before	After		Before	After	
Short	295.888	40.249	Ohm-m	100.783	101.201	Ohm-m
Long	504.790	142.638	Ohm-m	103.094	102.842	Ohm-m

Gamma Ray Calibration Report

Serial Number: D4
 Tool Model: ELOG
 Performed: Tue Jun 10 10:58:27 2014

Calibrator Value: 162.0 GAPI

Background Reading: 111.8 cps
 Calibrator Reading: 338.8 cps

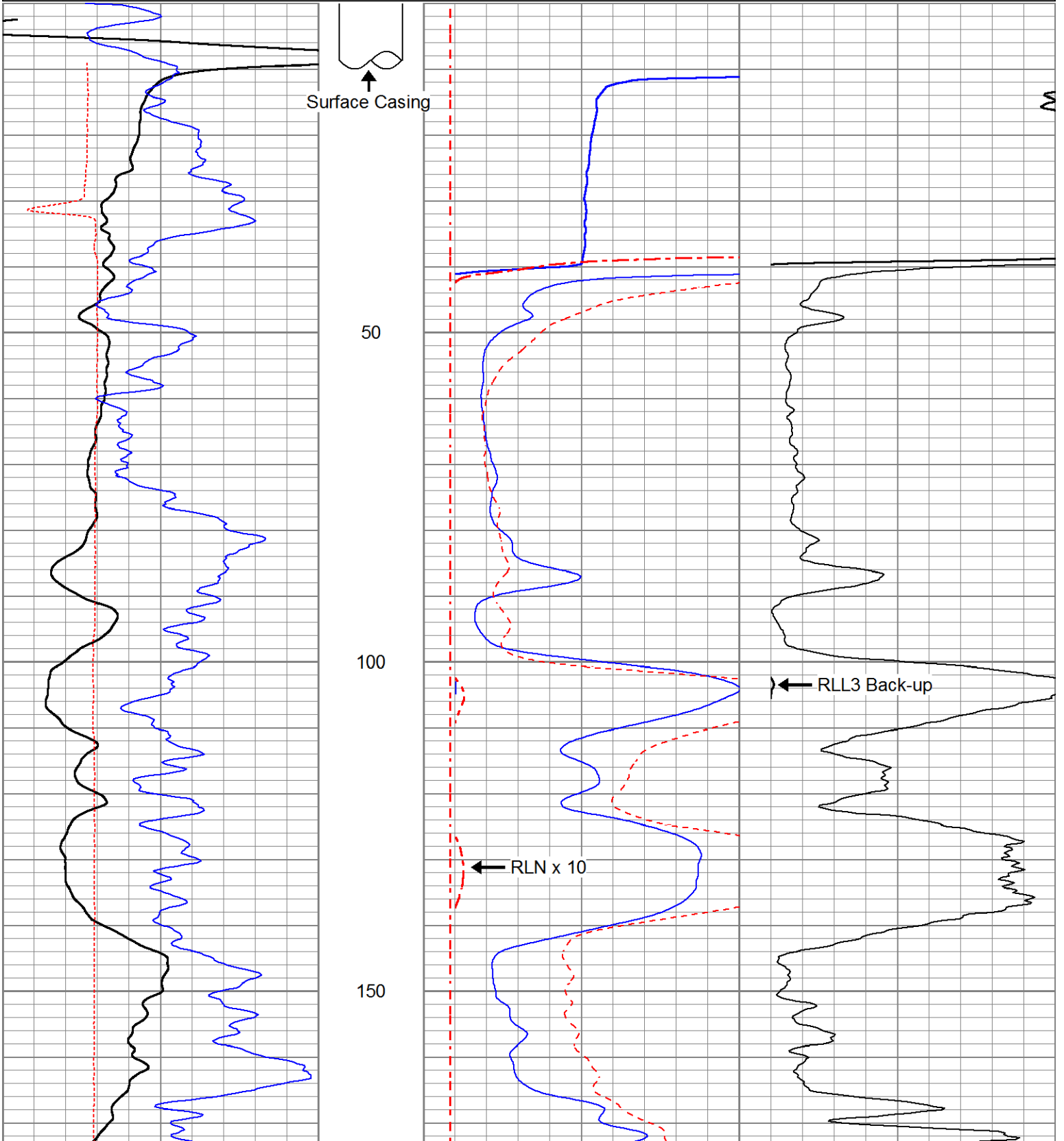
Sensitivity: 0.7136 GAPI/cps

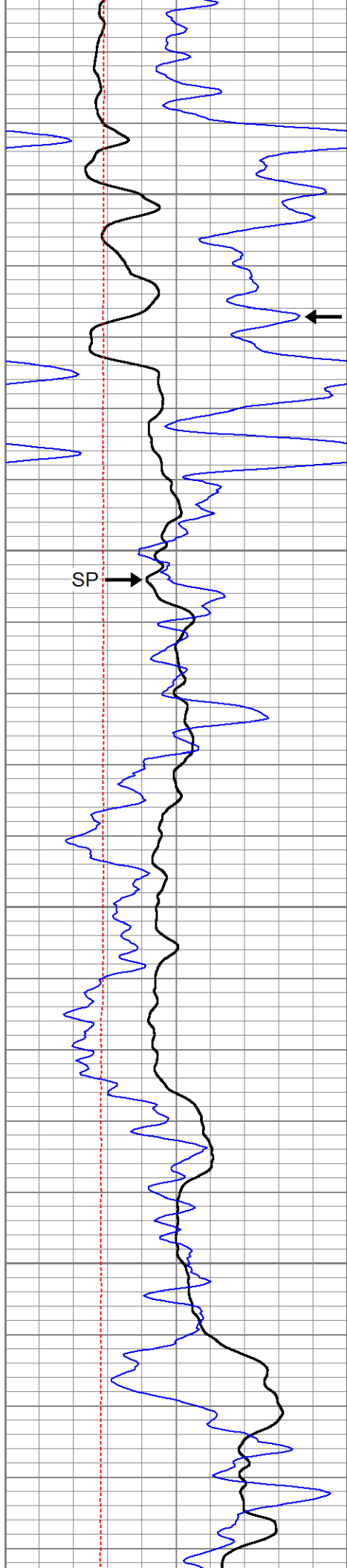
Database File 18585.db
 Dataset Pathname elog
 Presentation Format elog
 Dataset Creation Thu Aug 14 17:01:51 2014
 Charted by Depth in Feet scaled 1:240

-50	SP (mV)	50
0	Line Speed (ft/min)	100
60	Gamma-Ray (GAPI)	160

0	RSN (Ohm-m)	100
0	RLN (Ohm-m)	100
0	RMF (Ohm-m)	100
100	RSN x 10 (Ohm-m)	1000
100	RLN x 10 (Ohm-m)	1000

0	RLL3 (Ohm-m)	100
100	RLL3 Back-up (Ohm-m)	1000





200

Gamma-Ray

SP

250

300

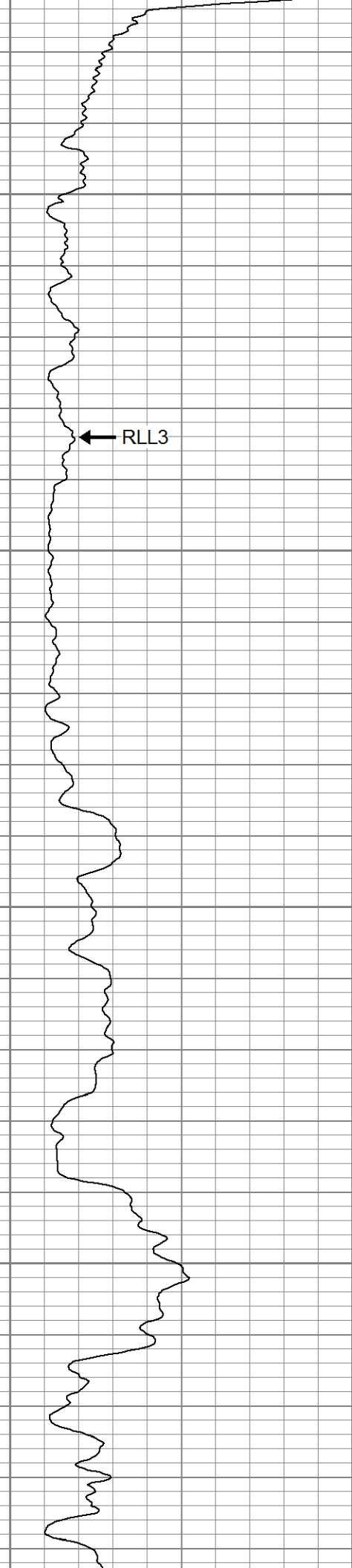
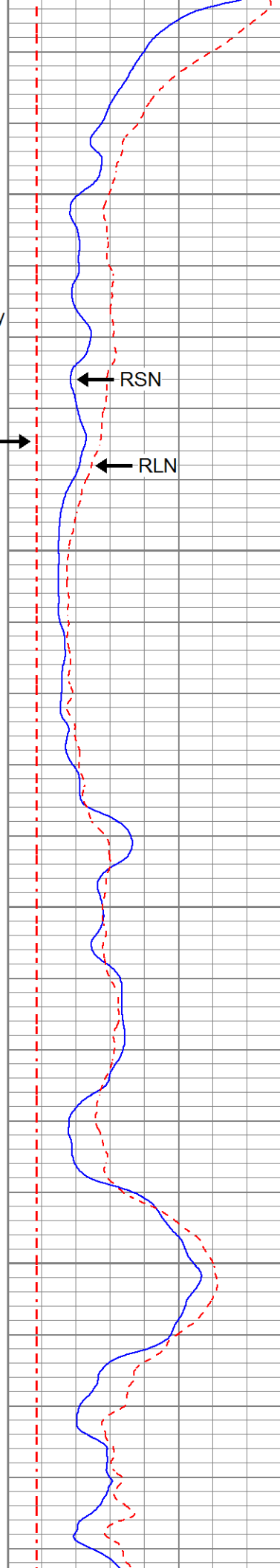
350

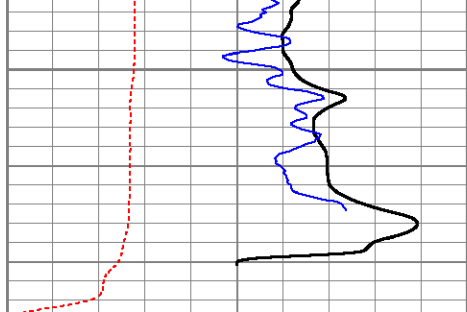
RMF

RSN

RLN

RLL3





400



-50	SP (mV)	50
0	Line Speed (ft/min)	100
60	Gamma-Ray (GAPI)	160

0	RSN (Ohm-m)	100
0	RLN (Ohm-m)	100
0	RMF (Ohm-m)	100
100	RSN x 10 (Ohm-m)	1000
100	RLN x 10 (Ohm-m)	1000

0	RLL3 (Ohm-m)	100
100	RLL3 Back-up (Ohm-m)	1000

Job No. 18585
 Company HARGIS & ASSOCIATES
 Well MW-41
 Field BUENA PARK
 County ORANGE State CA
 File No.

Location: 8820 MEADOWBROOK WAY
 GPS: N 33o 52.818' W 117o 58.710'
 Sec. Twp. Rge. Other Services: ELOG CALIPER

	G.L.	0'	Elevation above perm. datum	Elevation K.B. D.F. G.L.
Permanent Datum	G.L.			
Log Measured From	G.L.	0'		
Drilling Measured From	G.L.			
Date		08-14-2014		
Run Number		ONE		
Depth Driller		425'		
Depth Logger		425'		
Bottom Logged Interval		425'		
Top Log Interval		0'		
Casing Driller		13" @ 10'		
Casing Logger		10'		
Bit Size		12.25"		
Type Fluid in Hole		BENTONITE		
Density / Viscosity		N/A		
pH / Fluid Loss		N/A		
Source of Sample		PIT		
Rm @ Meas. Temp		8.64 @ 90.2F		
Rmf @ Meas. Temp		8.51 @ 90.2F		
Rmc @ Meas. Temp		N/A		
Source of Rmf / Rmc		MEASURE		
Rm @ BHT		N/A		
Time Circulation Stopped		1530		
Time Logger on Bottom		1700		
Max. Recorded Temperature		N/A		
Equipment Number		PS-5		
Location		LA		
Recorded By		SCHUMACHER		
Witnessed By		G. CRANHAM		

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Comments

Calibration Report

Database File 18585.db
 Dataset Pathname LL3
 Dataset Creation Thu Aug 14 17:32:16 2014

Serial Number: 12
 Tool Model: GROH
 Performed: Wed Jan 02 12:20:51 2013

 Calibrator Value: 162.0 GAPI

 Background Reading: 54.1
 Calibrator Reading: 193.3

 Sensitivity: 1.1641 GAPI/

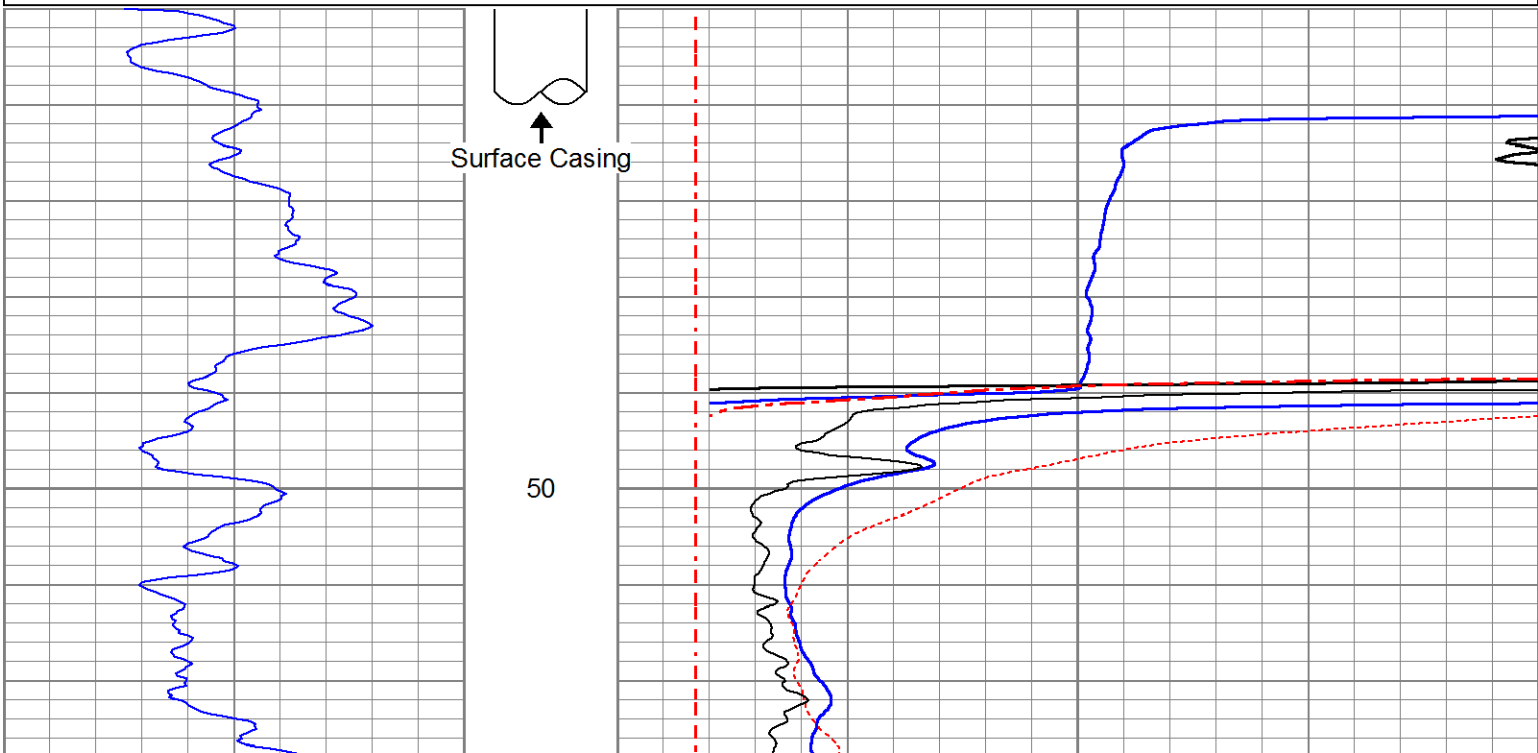
RLL3 (Resistivity Laterolog 3) Calibration Report:

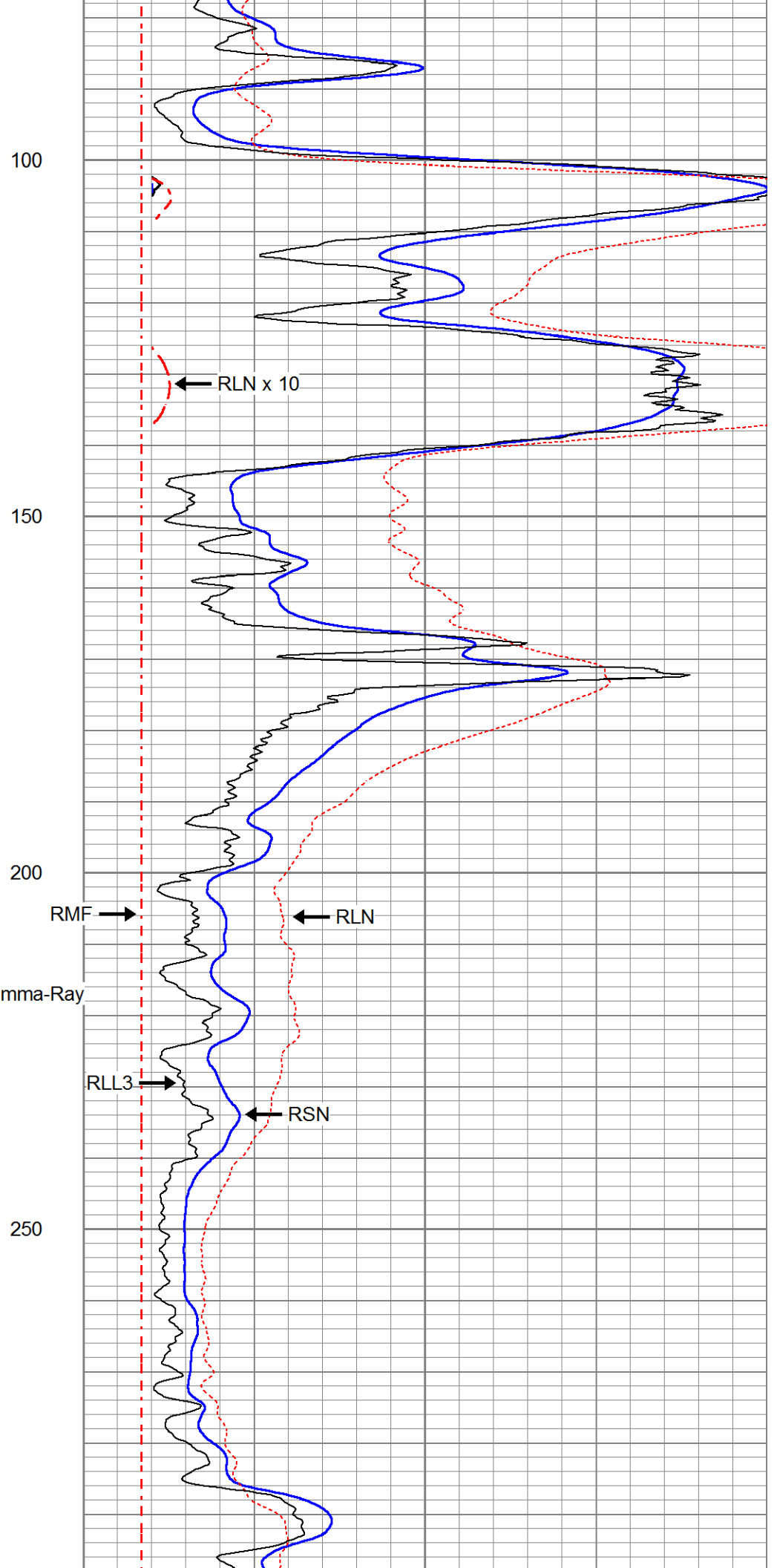
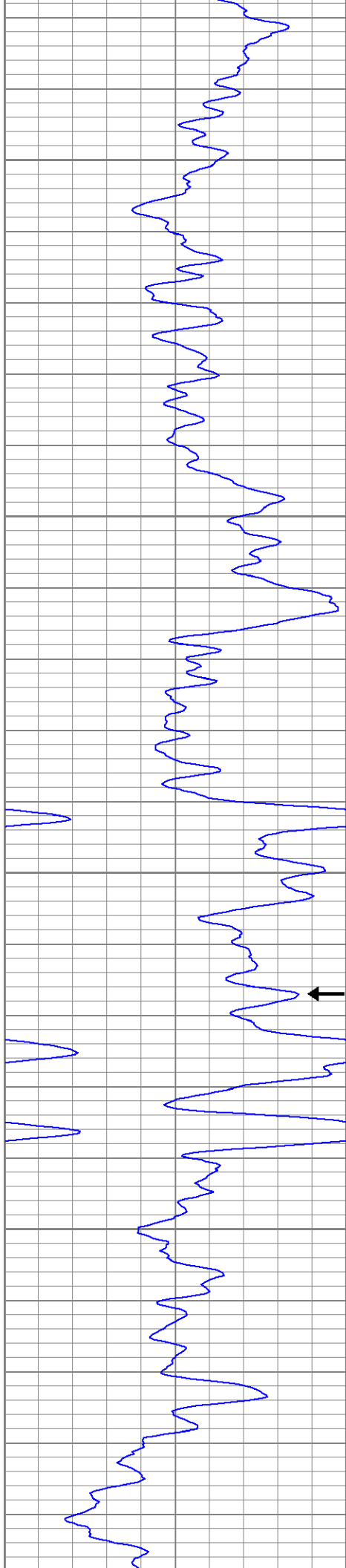
Serial Number: 130
 Tool Model: M&W
 Performed: Sat Feb 01 01:20:28 2014

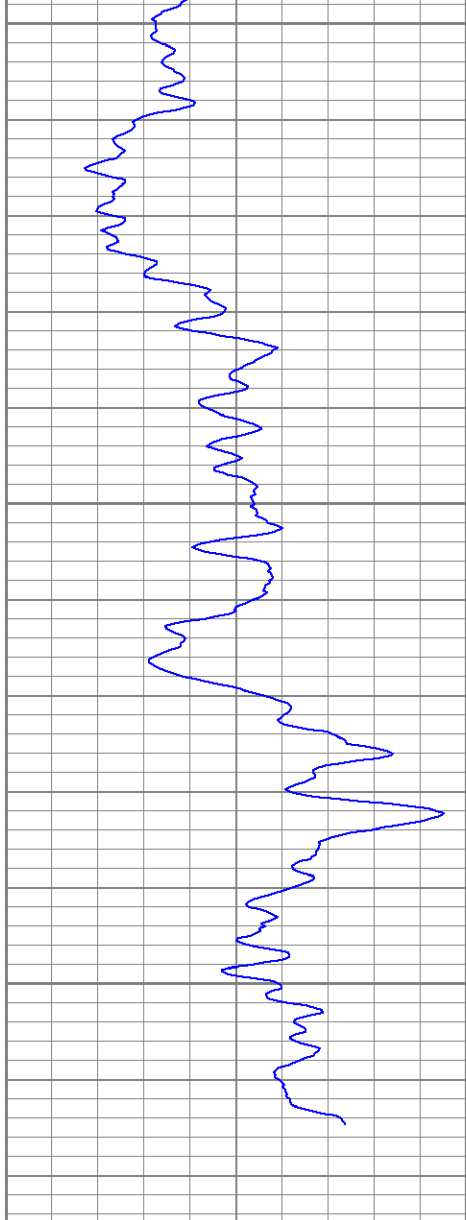
System Reading	Calibration Reference
0.003	2.500 Ohm-m
0.007	5.000
0.068	50.000
0.358	250.000
0.707	500.000

Database File 18585.db
 Dataset Pathname LL3
 Presentation Format guard
 Dataset Creation Thu Aug 14 17:32:16 2014
 Charted by Depth in Feet scaled 1:240

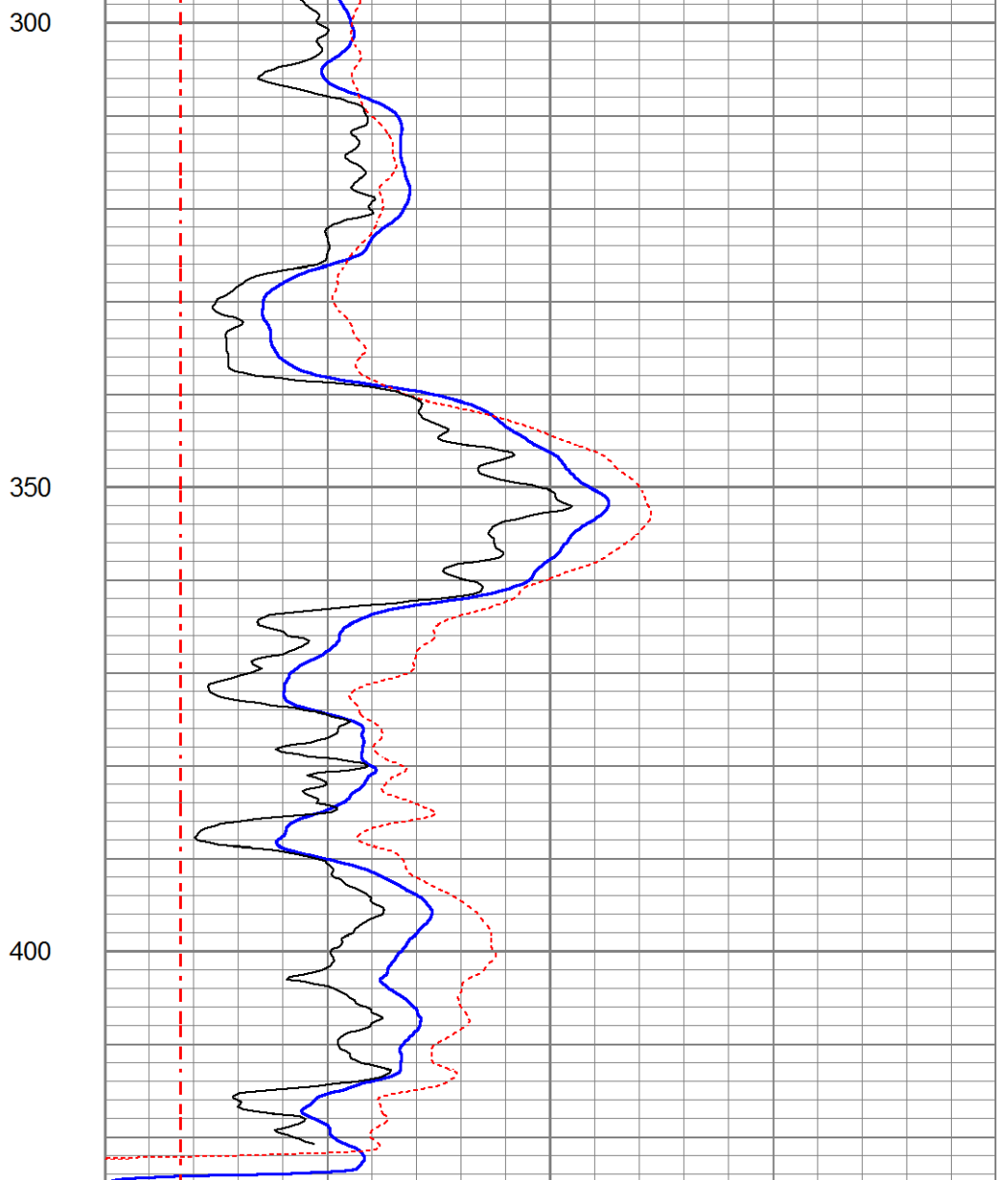
60	Gamma-Ray (GAPI)	160	0	RSN (Ohm-m)	100
			0	RLN (Ohm-m)	100
			0	RMF (Ohm-m)	100
			0	RLL3 (Ohm-m)	100
			100	RLL3 x 10 (Ohm-m)	1000
			100	RSN x 10 (Ohm-m)	1000
			100	RLN x 10 (Ohm-m)	1000







60 Gamma-Ray (GAPI) 160



0	RSN (Ohm-m)	100
0	RLN (Ohm-m)	100
0	RMF (Ohm-m)	100
0	RLL3 (Ohm-m)	100
100	RLL3 x 10 (Ohm-m)	1000
100	RSN x 10 (Ohm-m)	1000
100	RLN x 10 (Ohm-m)	1000