DOCKETED

Docket Number:	07-AFC-06C
Project Title:	Carlsbad Energy Center - Compliance
TN #:	211680
Document Title:	Soil Assessment Work Plan (Work Plan)
Description:	The objective of this Work Plan is to define the site assessment work necessary to determine the lateral and vertical extent of potential soil impacts at Tanks 1, 2, and 4 resulting from on-site applications and releases of petroleum hydrocarbons. To accomplish this, soil borings will be advanced and logged and samples will be collected and analyzed. Soil data will be used to determine a recommended corrective action to be performed. Based on facility history and planned site redevelopment (California Energy Commission License [Docket No. 07-AFC-06]), soil removal is the presumptive remedial method for soil contamination
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Organization:	ERM-West, Inc. on Behalf of Cabrillo Power I LLC
Submitter Role:	Public Agency
Submission Date:	5/31/2016 1:35:01 PM
Docketed Date:	5/31/2016

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23 July 2015

Mr. James Clay,
County of San Diego
Department of Environmental Health
5500 Overland Avenue, Suite 170
San Diego, California 92123

Subject: Fuel Oil Storage Tanks 1, 2, and 4
Soil Assessment Work Plan
VAP #113941-004
Encina Power Station
Carlsbad, California

Dear Mr. Clay:

On behalf of Cabrillo Power I LLC (Cabrillo), ERM-West, Inc. (ERM) has prepared this Soil Assessment Work Plan (Work Plan) to describe proposed Tank Farm site assessment activities at the Encina Power Station (EPS) located at 4600 Carlsbad Drive, Carlsbad, California (Figure 1). This Work Plan is limited to assessment of existing aboveground fuel oil storage Tanks 1, 2, and 4 (site) and associated conveyance piping, other appurtenances at the EPS on Assessor Parcel Number (APN) 210-010-46. This Work Plan is submitted under the Voluntary Assistance Program (VAP) Case No. 113941-004 administered by the San Diego Department of Environmental Health (DEH) Site Assessment and Mitigation (SAM) Program. Under the VAP, Cabrillo will submit work plans and reports to the DEH for review and concurrence with the objective of obtaining environmental clearance for remedial actions to be undertaken in association with aboveground fuel storage tank removal and site preparation for future industrial use as a power generating facility. This Work Plan is written as an addendum to the Above Ground Fuel Oil Storage Tanks 5, 6, and 7, Soil Assessment Work Plan (The Source Group, Inc., 2014) previously approved by DEH on 17 December 2014.

The objective of this Work Plan is to define the site assessment work necessary to determine the lateral and vertical extent of potential soil impacts at Tanks 1, 2, and 4 resulting from on-site applications and

releases of petroleum hydrocarbons. To accomplish this, soil borings will be advanced and logged and samples will be collected and analyzed. Soil data will be used to determine a recommended corrective action to be performed. Based on facility history and planned site redevelopment (California Energy Commission License [Docket No. 07-AFC-06]), soil removal is the presumptive remedial method for soil contamination above the site-specific cleanup goals established for the Tanks.

SITE HISTORY

The EPS is a steam-electric power-generating station that began operation in 1954. The EPS was constructed and owned by San Diego Gas & Electric until 1999, when it was acquired by Cabrillo. Prior to construction of the power plant facilities and Tank Farm areas, the site was used as agricultural fields and the southwestern part of the property was also used as a military reservation and later as an industrial rubber plant. The Tank Farm areas west and east of the railroad were previously only used for agriculture. The EPS consists of five steam-turbine generators and one gas-turbine unit with various ancillary power generation and distribution equipment (Figure 2). Formerly seven aboveground fuel oil storage tanks and four aboveground diesel oil storage tanks existed on site.

Tanks 1 through 7 were constructed from the 1950s to the 1970's to store No. 6 fuel oil used for electric power generation. Until 1984, the EPS power plant was primarily fueled by Bunker C or No. 6 fuel oil. Since 1984, the power plant has been primarily fueled by natural gas, and the majority of the tanks are either empty or were allowed to cool, solidifying the residual fuel. Diesel oil was also present on site and used for displacing the residual oil in pipelines (to prevent the residual oil from hardening in pipelines and valves as it cooled) and as secondary fuel for the gas-turbine facility.

Tanks 1 and 2 are located within the western Tank Farm, north of the current desalinization plant; and Tank 4 is located in the eastern Tank Farm, south of former Tanks 5, 6 and 7 (Figure 3).

Each tank is located within an individual tank basin. Tanks in the eastern Tank Farm are separated by earthen berms constructed at a 1.5 to 1 slope, approximately 20- to 25-feet high from the bottom of the tank basin. The western Tank Farm consists of individual basins 8 to 15 feet deep. The

ground surface across the site varies from approximately 40 feet above mean sea level (msl) in the western Tank Farm area to 55 feet above msl in the eastern Tank Farm area.

As-built design drawings provided by Cabrillo depict the Tanks constructed on top of a 6-inch-thick, oil- impregnated sand cushion surrounded by a concrete perimeter ring wall. The oil-impregnated sand cushion is comprised of No. 2 fuel oil thoroughly mixed with sand at a rate of 22 gallons of No. 2 fuel oil per cubic yard of sand (PSE, 1970).

Tanks 3, 5, 6, and 7 and the diesel tanks have been removed and assessed under VAP Case No. 113941-004. Tank 3 was removed as part of site redevelopment for the desalinization plant. Petroleum hydrocarbon-impacted soil beneath Tank 3 was mitigated by removing impacted soil and sending the soil off site for disposal. A Remediation Closure Report (Rincon, 2013) for the desalination project, which included Tank 3, Cutter Oil Tank, three diesel aboveground storage tanks and the associated aboveground fuels conveyance piping, was submitted to and approved by DEH on 31 October 2015.

Tanks 5, 6, and 7 were removed between May and July 2015. Soil beneath each tank, associated piping, and tank basin was assessed in June 2015 and a Soil Assessment Report submitted to DEH on 2 July 2015. The Soil Assessment Report concluded petroleum hydrocarbon-impacted soil exists beneath Tanks 5, 6, and 7 and recommended removing the upper 6 to 8 inches of soil with focused deeper “hot spot” removal. Remedial action is anticipated to occur between August and October 2015.

Tank 1 is 140 feet in diameter, 48 feet tall, and has a capacity of 131,500 barrels (bbl). The tank system included aboveground ancillary heating and fuel oil piping on the west side of Tank 1 and a 20-inch diameter buried fuel pipe on the east side of Tank 1. Tank 1 currently contains approximately 16 inches of oily sludge.

Tank 2 is 140 feet in diameter, 48 feet tall, and has a capacity of 131,500 bbl. The tank system included aboveground ancillary heating and fuel oil piping on the west side of Tank 2 and a 20-inch diameter buried fuel pipe on the east side of Tank 2. Tank 2 currently contains approximately 14 inches of residual water/oily sludge.

Tank 4 is 240 feet in diameter, 32 feet tall, and has a capacity of 250,000 bbl. All waste contents have been removed; a final inspection of Tank 4 has been performed; and demolition is pending final approval by the California Energy Commission.

Previous Assessments and Remediation at Tanks 1, 2, and 4

Various assessments have been conducted at EPS dating back to at least 1995. A discussion of relevant site-wide assessments is provided in the Soil Assessment Work Plan for Tanks 5, 6, and 7 (Source Group, Inc., 2014).

Within Tanks 1, 2, and 4 basins the following releases, assessments, and remedial efforts have been conducted:

- July 2001: 20 gallons of fuel oil No. 6 leaked to ground from Tank 2 caused by corrosion.
- December 2001: 15 gallons of fuel oil No. 6 leaked from Tank 2 during maintenance.
- November 2003: Approximately 219 tons of soil was removed from the area north of Tank 1, which extended to 2 feet below ground surface (bgs). Five confirmation samples collected were non-detect for total extractable hydrocarbons. Free product was not observed during the excavation (Haley & Aldrich Inc, 2004).

LOCAL GEOLOGY

The site is located on a coastal plain at the edge of the Peninsular Ranges (Rincon, 2013) physiographic province of Southern California. This area has been through numerous sequences of marine transgression and aggression over the previous 54 million years. As a result, the area is composed of marine and non-marine sedimentary rocks on the uplifted

and eroded high-level basement terrain. Accelerated fluvial erosion during periods of heavy rainfall, coupled with the lowering of the base sea level during the quaternary, has resulted in the rolling hills, mesas, and deeply incised valleys that are present in the area (Geo-Logic Associates, 2004). The tank sites are located on a marine terrace bluff approximately 30 to 50 feet above msl with each tank site situated in hydraulically isolated graded berm areas with fairly flat topography in the bottom. Previous geotechnical investigations performed at the site describe the soil as predominantly fine- to medium-grained sand with some silt and clay (Geo-Logic Associates, 2004). Geologic units at the site consist of Quaternary Artificially Compacted Fill, Quaternary Older Paralic deposits of mostly poorly sorted, moderately permeable, reddish-brown, interbeds of strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone, and conglomerate, and Santiago Formation (middle Eocene) consisting of buff and brownish gray, massive, coarse-grained, poorly sorted arkosic sandstone, and sandstone conglomerates. The upper 2 to 5 feet across the site consist of engineer-fill material.

HYDROGEOLGY

The site is located in the Los Monos Hydrologic Subarea 904.31 in the Agua Hedionda Hydrologic Area 904.30 within the Carlsbad Hydrologic Unit 904.00 as defined by the San Diego Regional Water Quality Control Board Basin Plan. The Aqua Hedionda Hydrologic Area is flanked by the Encinas Hydrologic Area to the south and the Buena Vista Creek Hydrologic Area to the north. The site area groundwater is listed as having beneficial uses for agricultural and industrial use; however, it is specifically exempted for use as a municipal or domestic supply. Regionally the groundwater basins discharge to the Pacific Ocean. Groundwater in the site is expected to occur at approximately 20 feet bgs in the eastern Tank Farm basins, and was measured in March 2015 (Rincon, 2015) between 29.75 to 34.52 feet below top of casing (6.92 to 4.19 feet relative to msl) in the western Tank Farm area. Groundwater flow is to the west towards the ocean and down the topographical gradient.

PROPOSED SCOPE OF WORK

The primary sources of contaminants beneath the Tanks are from the application of No. 2 diesel fuel during the construction of the Tanks as a corrosion inhibitor; below Tanks in the 6-inch thick sand cushion immediately beneath the tank bottoms; releases of No. 6 fuel oil during the operation of the Tank Farm; and the application of diesel fuel as a dust suppression agent during construction.

- Diesel fuel and No.2 fuel oil are middle distillates that contain paraffins (alkenes), cycloparaffins (cycloalkanes), aromatics, and olefins, from approximate carbon range C9 to C20.
- Aromatic compounds of concern include alkyl benzenes, toluene, naphthalene, and polycyclic aromatic hydrocarbons (PAHs).
- No. 6 fuel oil is a heavy distillate (carbon range C20 to C70), also known as Bunker C fuel, and is composed of asphaltenes, polar aromatics, naphthalene aromatics, aromatics, saturated hydrocarbons, and heteromolecules containing sulfur, oxygen, nitrogen, and metals. No. 6 fuel oil at ambient temperature is very viscous and typically requires heating for storage at 100 degrees Fahrenheit (°F) and heating to 150°F for pumping.
- Volatile organic compounds (VOCs) benzene, toluene, ethylbenzene, and xylenes (BTEX) may be present in soils.
- To a lesser extent heavy metals may be present due to fuel composition and lead based paint. The metals of concern would include nickel (Ni), vanadium (Vn), molybdenum (Mo), lead (Pb), Chromium (Cr), and cobalt (Co).

The primary source of contamination related to the site is identified as adsorbed-phase hydrocarbons in soil from either the construction of the engineered tank bottoms or releases of fuel oil from the tank systems. The secondary source of contamination is from hydrocarbons released into the underlying soil and potentially leached downward into groundwater and/or dissolved into groundwater within the tank basins. However, due to the physical properties of the petroleum hydrocarbons, and in this case diesel and fuel oil, contamination is typically limited to shallow soil and generally has limited vertical impacts.

PROPOSED SOIL SAMPLING

The environmental assessment proposed for this site will assess engineered and native soils beneath Tanks 1, 2, and 4, and beneath the ancillary equipment and piping routes; and in areas previously identified as having experienced a release, or remedial actions. The following tasks are planned for this assessment.

- Advance nine soil borings below the bottom of each tank's footprint (27 total) to a depth of 15 feet below grade. Collect soil samples at 0.5-, 3-, 5-, 10-, and 15-foot intervals for laboratory analysis.
- Advance one soil boring beneath ancillary equipment and one soil boring below former fuel pipelines west of each tank location to a depth of 5- feet below grade; and one soil boring beneath ancillary equipment and one soil boring below former fuel pipelines east of each tank location to a depth of 15- feet below grade. Collect soil samples at 0.5-, 3- and 5-, 10-, and 15- foot intervals for laboratory analysis.
- Advance four soil borings in each tank basin (exterior to the tank footprint) to a depth of 15 feet below grade. Borings will be located in the northwest, northeast, southwest, and southeast quadrant of each tank. Borings will be moved to target previous remedial actions, if one exists, in the quadrant. Collect soil samples at 0.5-, 3-, 5-, 10- and 15-foot intervals for laboratory analysis.
- Borings will be advanced to planned depths, unless evidence of contamination is observed (discoloration, odor, VOC detection by photoionization detector [PID]), then borings will be advanced until visibly clean soil is encountered. Samples below planned depths will be collected every 2-feet until total depth is achieved. If groundwater is encountered in any boring, or if the depth extends beyond 20 feet below grade, DEH will be notified and a retroactive permit obtained.
- ERM will prepare a report summarizing the site assessment, findings, and provide recommendations on remedial actions, as necessary.

Soil borings will be advanced using a hollow-stem auger drill rig operated by a state-licensed well drilling contractor, (C57 license) in accordance with Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120, and 40-hour trained field crew. Soil samples will be collected from each borehole for visual field inspection at prescribed intervals in stainless steel or brass sleeves or

glass jars (shallow samples). Soil samples will be inspected for lithologic description using the Unified Soil Classification System. In addition, field VOC headspace readings will be taken using a field PID calibrated to 100 parts per million by volume of isobutylene calibration gas.

Sampling equipment will be steam cleaned or cleaned with a dilute trisodium phosphate solution; double rinsed in clear tap water; and then final rinsed in distilled water prior to its use and between sampling locations.

Groundwater is not anticipated to be encountered during soil boring advancement. Per the San Diego County Site Assessment Manual (SAM), Section 5, II, A, 3, boring permits will not be required for these borings. Additional soil sample collection may be warranted based on field observations.

Analytical Methods

Soil samples will be collected from all borings at 2- to 5-foot intervals. All samples will be analyzed by the analytical methods per SAM guidance. All samples will be submitted to the laboratory for analysis per Table 1. Samples will be collected in glass jars, or stainless steel sleeves. The sample sleeves will be covered on both ends with Teflon™ sheeting and sealed with plastic end caps. Each soil sample will be labeled and placed on ice in a thermally insulated cooler pending transport to a state-certified laboratory (following strict chain-of-custody procedures).

Soil samples will be analyzed by the following methods:

- Total petroleum hydrocarbon as diesel (TPH-d) and TPH as oil (TPH-o) by U.S. Environmental Protection Agency (USEPA) Method 8015M (all samples),
- VOC chemicals BTEX by USEPA Method 8260B (all samples);
- PAHs by USEPA Method 8270C (two samples per tank area); and
- Heavy metals (specifically Ni, Vn, Mo, Pb, total Cr, and Co) by USEPA Method 6010B (two samples per tank area).

Samples will be collected in accordance with USEPA Method 5035 for all soil VOC analysis. All other analytical test methods will follow those specified in Table 1 and will be performed in accordance with USEPA

Methods per the SAM guidance, Section 5.IV. All laboratory analysis reports will be provided in Level II data packages.

STORM WATER POLLUTION PREVENTION

Sampling activities will be covered under the existing EPS Construction Storm Water Pollution Prevention Plan. The SWPPP was revised on 30 June 2015 to include Tanks 1 ,2 and 4.

WASTE MANAGEMENT

All investigation-derived waste (soil cuttings, used personal protective equipment, and decontamination rinseate) will be placed in Department of Transportation-approved 55-gallon drums and stored on site pending characterization for disposal. All drummed waste will be characterized per the SAM guidance, Section 5, XI, B. A label will be placed on each drum to indicate its contents, date generated, site address, and consultant's name and telephone number.

As appropriate, the respective waste streams will be characterized through the collection and analysis of various waste characterization samples. Following receipt of the analytical results, from a state-certified analytical laboratory, the wastes will be profiled for disposal under a manifest or bill-of-lading prepared and signed by a Cabrillo representative. All wastes will be profiled according to California Code of Regulations, Title 22, Division 4.5, Chapters 10 through 32, and federal Resource Conservation and Recovery Act (RCRA) regulations.

DISPOSAL

Following characterization and profiling, the respective waste streams will be manifested (or bill-of-lading) for off-site disposal or recycling, as appropriate. The waste will either be sent off site for disposal in drums or included as a waste in the remedial action for the respective tank. The waste disposal facility will be identified and contact information will be provided to DEH at that time. The disposal of wastes, or recycling of such wastes, will occur only at U.S. Environmental Protection Agency (USEPA)-approved and state-licensed facilities. A Cabrillo representative will sign all manifests and/or bills-of-lading as generator.

DOCUMENTATION AND REPORTING

Field data will be reviewed in the field to determine the need for possible additional sampling to ensure complete delineation. Upon completion of the field activities and receipt of the analytical laboratory reports, a Site Assessment Report will be prepared and submitted to DEH. The report will provide recommendations for additional subsurface assessment to delineate the horizontal and vertical extent of impacted soil, if necessary, and waste management. The Site Assessment Report will be signed and stamped by the Professional Geologist overseeing the project.

HEALTH AND SAFETY

A site-specific Health and Safety Plan (HASP) will be prepared and submitted under separate cover. The HASP will be specifically prepared for the site assessment of the Tank Farm area at the EPS facility; will apply to the site assessment work crew; and only addresses the potential environmental and physical hazards of the field investigation. The HASP will contain, at a minimum, the following information and procedures:

- Project and emergency contact information defining the lines of communication.
- Prior to beginning on-site work, the Project Manager will ensure all employee training and medical clearances are confirmed, including subcontractors. Utility clearances will be verified.
- The Site Health and Safety Officer (SHSO) will ensure air monitoring equipment is available and calibrated; monitoring logs are kept current; a daily health and safety briefing is held; all field personnel and subcontractors agree to and sign the HASP; and an acknowledgement and agreement form for the first day of on-site work.
- The SHSO will oversee the overall HASP. SHSO has the authority to stop work or prohibit any personnel from working on the site at any time for not complying with any aspect of the HASP.
- All subcontractor field supervisors are responsible for implementing this HASP with their employees.

- Each person on the site has responsibility for their own health and safety, as well as assisting others in carrying out the HASP. Any person observed to be in violation of the HASP should be assisted in complying with the HASP, or reported to the SHSO or subcontractor field supervisor.
- Any site personnel may shut down field activities if there is a real or perceived immediate danger to life or health.

Minimum training, respirator fit-testing, and medical surveillance requirements for site personnel (for all field people working with any hazardous materials) including:

- 40-hour Hazardous Waste Operations Training (HAZWOPER) 29 CFR 1910.120;
- 8-hour Annual HAZWOPER Refresher Training; and
- Annual Medical Clearance and Respirator Clearance by a physician.

All site work will be performed in accordance with EPS' health and safety program.

COMMUNITY HEALTH AND SAFETY PLAN

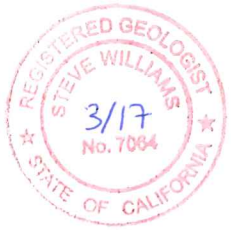
As discussed with DEH on 29 May 2015, a Community Health and Safety Plan (CHASP) will not be required for site assessment activities. A CHASP will be prepared, however, prior to remedial activities with the intent of public distribution to promote a safe and healthy environment for the public in areas where soils and other materials contaminated with hazardous substances are excavated, removed, or handled. The goal of the CHASP is to identify and address potential environmental exposures and hazards posed by the remediation work. The CHASP will address all the requirements of a CHASP as defined in the SAM guidance, Section 4, IV.

SCHEDULE

Field work will commence upon DEH approval of this Work Plan. Field activities will commence in Tank 4 in July 2015; Tanks 1 and 2 will be assessed at a later date to be determined, likely September or October

2015. Final validated laboratory results are expected within 4 weeks of completion of field activities. A Site Assessment Report will be submitted to the DEH for Tank 4 within 4 weeks of completion of the final validated laboratory results. A separate Site Assessment Report will be submitted for Tanks 1 and 2.

Sincerely,



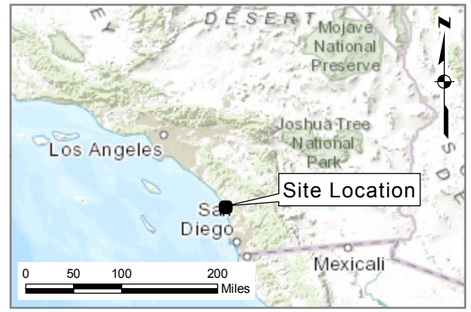
Steve Williams, P.G., CHG
Partner

SD/MD/SW/taa

Figures and Table attached as noted.

Figures

Project: 0300536
Date: 7/9/2015
Created By: Austin Phelps



Legend

Project Boundary

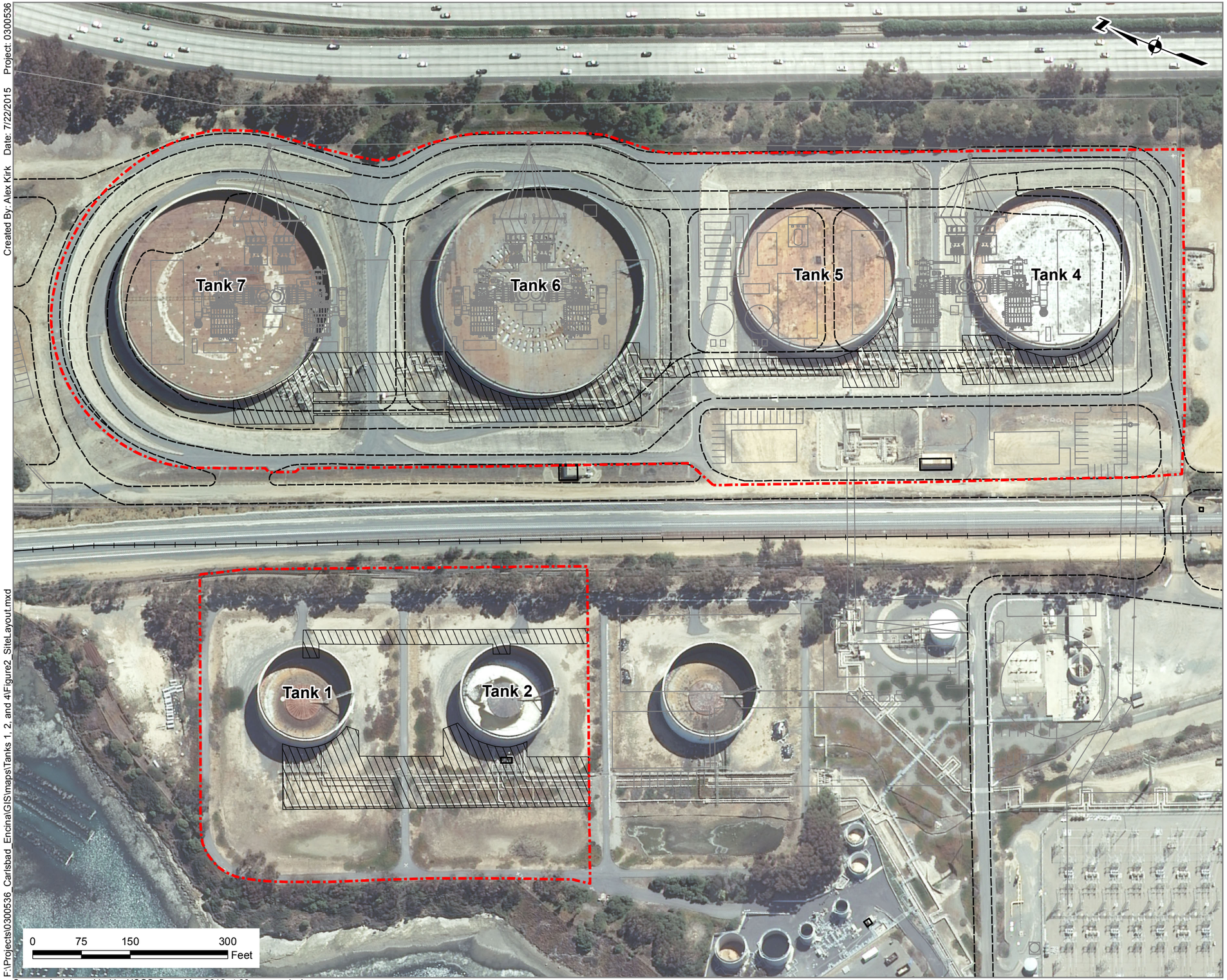
F:\Projects\0300536_Carlsbad_Encina\GIS\maps\Tanks 1, 2, and 4\Figure1_Site_Location.mxd

Source: Bing Hybrid Web Mapping Service, flown Nov. 2014

Figure 1
Site Location
Encina Power Plant
Carlsbad, CA

Environmental Resources Management
2875 Michelle Drive, Suite 200
Irvine, California 92606

Created By: Alex Kirk Date: 7/22/2015 Project: 0300536



F:\Projects\0300536_Carlsbad_Encina\GIS\maps\Tanks 1, 2, and 4\Figure2_SiteLayout.mxd

Source: Aerial provided by USGS, flown May 2012 at 30 cm per pixel

Legend

- Project Boundary
- Building
- Fence Line
- New Infrastructure
- New Roadway
- Railroad
- Piping and Ancillary Equipment Coridor

Figure 2
Site Layout
Encina Power Plant
Carlsbad, CA

Environmental Resources Management
2875 Michelle Drive, Suite 200
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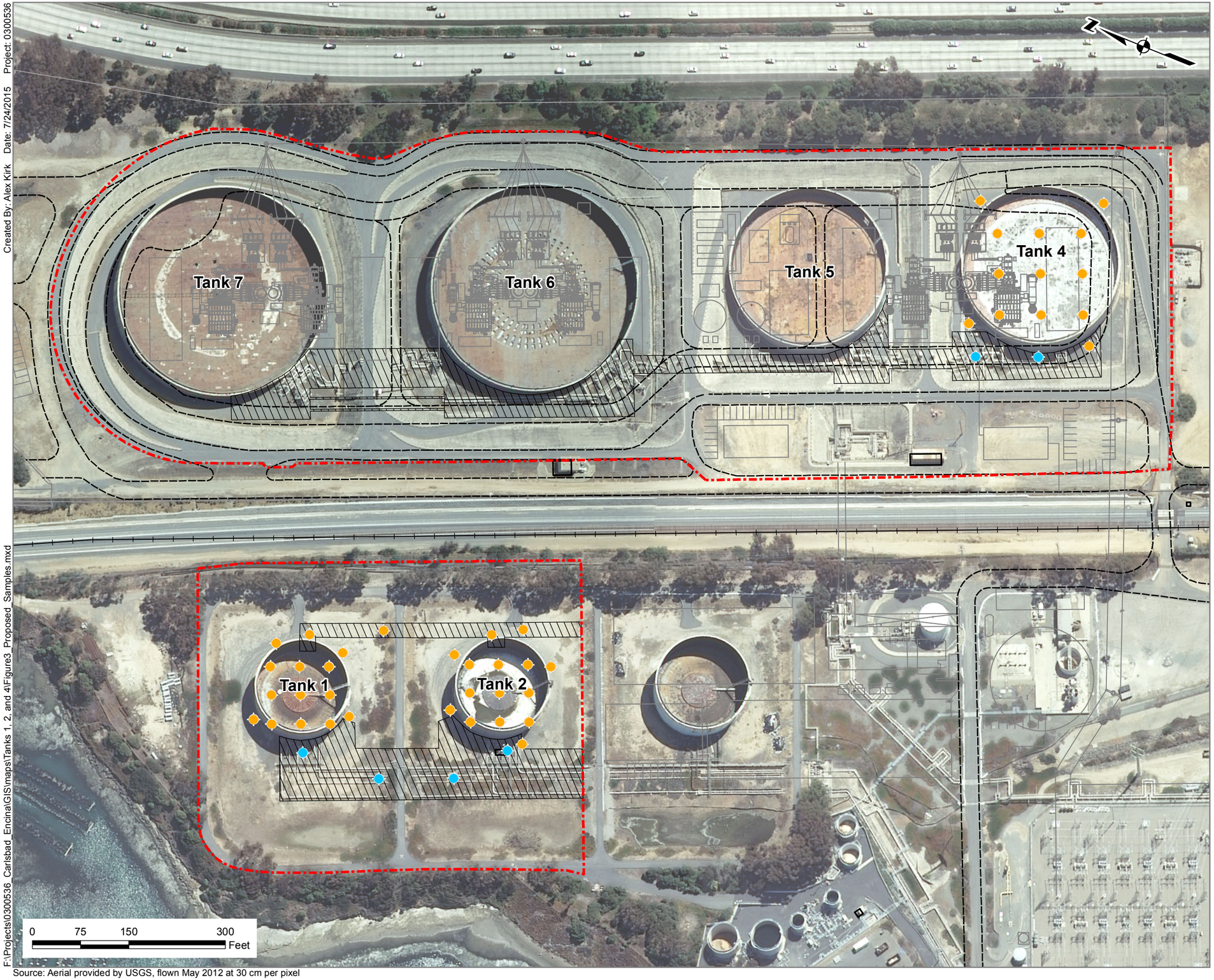
F:\Projects\0300536_Carlsbad_Encina\GIS\maps\Tanks 1, 2, and 4\Figure3_Proposed_Samples.mxd



Source: Aerial provided by USGS, flown May 2012 at 30 cm per pixel

Legend

- Proposed 15 ft. Sample
- Proposed 5 ft. Sample
- Project Boundary
- Building
- Fence Line
- New Infrastructure
- New Roadway
- Railroad
- Piping and Ancillary Equipment Coridor

Figure 3
Proposed Sample Locations
Encina Power Plant
Carlsbad, CA

Environmental Resources Management
2875 Michelle Drive, Suite 200
Irvine, California 92606

ERM

Table

Table 1 ***Sampling and Analysis Plan***
Encina Power Station, Tanks 1, 2, and 4
Carlsbad, California

Analysis:			USEPA Method 8015B	USEPA Method 8260B	USEPA Method 8270C	USEPA Methods 6010B/7471A
Area	Sample Locations	Depth Intervals (ft bgs)	TPH-d & TPH-o	BTEX	PAHs	Metals (Ni, Vn, Mo, Pb, Cr, Co)
Tank 1 Bottom [1]	9	0.5, 3, 5, 10, and 15	45	45	1	1
Tank 1 Basin	4	0.5, 3, 5, 10, and 15	20	20	1	1
Tank 1 Piping East [2]	2	0.5, 3, 5, 10, and 15	10	10	--	--
Tank 1 Piping West[2]	2	0.5, 3 and 5	6	6	--	--
Tank 2 Bottom [1]	9	0.5, 3, 5, 10, and 15	45	45	1	1
Tank 2 Basin	4	0.5, 3, 5, 10, and 15	20	20	1	1
Tank 2 Piping East [2]	2	0.5, 3, 5, 10, and 15	10	10	--	--
Tank 2 Piping West [2]	2	0.5, 3 and 5	6	6	--	--
Tank 4 Bottom [1]	9	0.5, 3, 5, 10, and 15	45	45	1	1
Tank 4 Basin	4	0.5, 3, 5, 10, and 15	20	20	1	1
Tank 4 Piping [2]	2	0.5, 3 and 5	6	6	--	--

Notes:

-- = Not applicable

[1] Sample locations based on a maximum 100-x-100-foot grid.

[2] Sample locations based on 1 sample every 100 linear feet of pipe run.

Abbreviations:

BTEX = Benzene, toluene, ethylbenzene, and xylenes

Co = Cobalt

Cr = Chromium

ft bgs = Feet below ground surface

Mo = Molybdenum

Ni = Nickel

PAHs = Polynuclear aromatic hydrocarbons

Pb = Lead

TPH-d = Total petroleum hydrocarbons as diesel

TPH-o = Total petroleum hydrocarbons as motor oil

USEPA = U.S. Environmental Protection Agency

Vn = Vanadium