DRAFT REMEDIAL ACTION PLAN FOR LEAD EXCAVATION

9400-9500 International Boulevard

Oakland, California

Case #: RO0003202

Geotracker Global ID No: T10000008353

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Submitted to:
Alameda County Environmental Health
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PROFESSIONAL CERTIFICATION AND LIMITATIONS

This Remedial Action Plan (RAP) for Lead Excavation, dated March 21, 2016, for the property located at 9400 through 9500 International Boulevard in Oakland, California, has been prepared by a California Professional Geologist. This document is based on information available to RPS Iris Environmental and current laws, policies, and regulations as of the date of this document. The information and opinions expressed in this document are based upon the information available to RPS Iris Environmental and are given in response to a limited assignment and should be considered and implemented only in light of that assignment. The services provided by RPS Iris Environmental in completing this project were consistent with normal standards of the profession. No other warranty, expressed or implied, is made.

[DRAFT]

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1.0 INTRODUCTION

RPS Iris Environmental is presenting this Remedial Action Plan (RAP) for Lead Excavation to Alameda County Environmental Health (ACEH) on behalf of Oakland International Housing Partners, L.P. (OIHP). The RAP was prepared to address the removal of surficial soils (above 3 feet below existing ground surface [bgs]) with known metal impacts (predominantly lead) from the property located at 9400-9500 International Boulevard in Oakland, California (the Site). The Site location and Plan are illustrated on Figures 1 and 2.

A regulatory case (LOC Case Number RO0003202) for the Site was created when OIHP volunteered to pursue an unrestricted site reuse scenario through the removal of on-Site shallow soils exceeding conservative residential screening-levels. Phase I and II Environmental Site Assessments (ESAs) had been conducted in 2015 by OIHP in advance of their acquisition of the Site. Site investigations identified elevated lead concentrations in shallow soils and limited low-level detections of pesticides and total petroleum hydrocarbons in the same shallow soils. The detected impacts exceed both residential human health risk-based screening levels and/or hazardous waste screening criteria in numerous samples. ACEH indicated in an email, dated January 21, 2016, that an unrestricted Site re-use classification is contingent on an appropriate mitigation strategy to return the site to a condition that is protective of future occupants and the general public.

The purpose of this RAP is to outline a preferred remedial alternative that will effectively eliminate any potential unacceptable human health risks arising from the planned land uses. The remedial action to be implemented consists of remedial measures that are specific to the residential planned use for the Site. The RAP activities will be implemented in advance of the construction phase of the development. The redeveloped Site will consist of a new 59-unit building with residential apartments and ground floor retail space. This RAP is being submitted in response to a meeting held with ACEH at ACEH offices on January 21, 2016, ACEH's email correspondence dated the same day, submittal of a DRAFT *Site Management Plan* to ACEH on February 12, 2006, a telephone conference held with ACEH on March 4, 2016 and subsequent email correspondence. Per ACEH's directives, the RAP addresses reporting and regulatory requirements to delineate lead in shallow soils and remove impacted shallow soils at the Site.

This RAP is organized into nine sections as follows:

- Section 2 presents background information and summarizes previous investigations.
- Section 3 discusses the proposed delineation sampling plan and remedial action objectives (RAOs) of this RAP.
- Section 4 presents the pre-field activities will be conducted prior to RAP implementation.
- Section 5 discusses how the proposed excavation and removal activities will be implemented including discussions including excavation locations, analytical soil sampling methods, confirmation soil sampling procedures, backfilling, and environmental control measures.

- Section 6 presents a tentative schedule to implement the RAP, once approved by ACEH, and summarizes the information that will be included in a Remedial Action Completion Report (RACR).
- Section 7 includes a list of references.

2.0 BACKGROUND

The following sections present:

- A general description of the Site;
- An overview potential impacts from historic operations;
- How historic operations might have impacted the Site;
- The proposed Site redevelopment and its future occupants;
- The results and a summary of environmental Site conditions based previous investigations; and
- Identification of the chemicals of concern identified from previous investigations.

The entailed background information will be useful when characterizing the risk to future residents and establishing Remedial Action Objectives (RAOs) to mitigate that risk.

2.1. Site Description and Historical Uses

The Site is 1.26 acres in size and composed of six contiguous properties with addresses 9400 through 9500 International Boulevard, Oakland, California. The Assessor Parcel Numbers (APNs) at this Site include: 046-5432-002-02; 046-5423-02-02; 046-5423-01-01; 046-5423-001-01; 046-5423-019; 046-5423-018-02; 046-5423-022; 046-5423-020; 046-5423-021; and 046-5423-007. The Site Location and its current Site Plan is illustrated in Figure 1 and Figure 2, respectively. Existing Site buildings are currently vacant, in the process of abatement and demolition, and the Site slated for multi-family residential housing. Observations from Sanborn maps dating back to 1896 show the Site and surrounding properties were largely vacant except for Oakland San Leandro & Hayward Electric Railway yard located on the southeast border of the Site. Between 1905 and 1946, the currently present Site buildings were constructed along with increased residential and commercial development in the area. The Oakland San Leandro & Hayward Electric Railway yard was not present by the 1939 Sanborn map.

The Site was most recently used in 2015 for mixed commercial properties including a large church in one building and a methadone clinic in another. Additional on-Site buildings were dilapidated and no longer in use by 2015. A summary of the current and historic Site building operations are provided in Table 1. The Site addresses and their respective operational history is as follows:

- 9400 International Boulevard: The property is vacant, but was most recently occupied by True Fellowship Church. It includes a large church building and asphalt parking areas on the southeast corner of International Boulevard and 94th Avenue. The church building included a sanctuary and several offices and meeting rooms. Most of the rooms are either carpeted or tile floored. Historical use of the property included a Bank of America or other bank from 1933 to 1986, Kragen Auto Parts in 1992 and 1996, and Bethlehem Christian Center in 2000.
- 9424 International Boulevard: This property is vacant and unused under its previous owner. Historical use of the property included Key System Works in 1938, locksmith in 1945, office machines in 1950, café in 1967, and residential apartments from 1998 to 2008.
- 9430 International Boulevard: This property is vacant and unused under its previous owner. Historical use of the property included a furniture shop in 1938, attorney's office in 1945 and 1950, tavern from 1967 to 1975, Apostolic Faith Church from 1980 to 1992, and a beauty salon in 2006.
- 9434 International Boulevard: This property is vacant and unused under its previous owner. Historical use of the property included a fruit market in 1920, creamery in 1925, meat sales in 1933, Pentecostal church in 1943, Gateway Radio Co. and Modern Home, Inc. in 1945, Elmhurst Cleaners & Launderette from 1950 to 1970, a Second Timothy Baptist Church in 1986, and a restaurant from 2000 to 2010.
- 9442 International Boulevard: This property is vacant, but was most recently occupied by Lifeline Treatment Services from 2003 to 2015. It included half of a large building housing a methadone clinic. This building includes waiting rooms and treatment areas. Historical use of the property includes a Barber & cigars from 1920 to 1943, Credit union from 1955 to 1975, and beauty salon in 1986; and
- 9500 International Boulevard: This property is vacant, but was most recently occupied by Lifeline Treatment Services from 2003 to 2015. It included half of a large building housing a methadone clinic. This building includes waiting rooms and treatment areas. Historical use of the property includes a Billiards hall in 1950 and 1955, furniture and carpet store in 1962 and 1967, Credit union in 1970 and 1975, motorcycle club in 1986, and Do Drop Inn in 1992.
- Surrounding Properties: Current land use surrounding the Site includes commercial buildings along International Boulevard to the northwest and residential properties to the northeast. South of the Site is a Hispanic grocery store and restaurant followed by various commercial businesses. East of the Site is residential properties. To the west is International Boulevard, followed by commercial and retail properties.

2.2. Site Redevelopment

The Site is being redeveloped into a new 59-unit multi-family building with a 20,000-square foot footprint. The building will feature residential apartments, ground-floor community and retail space(s), parking lot, and landscaped areas. The future building will front International Boulevard, and the rear of the property (east) will be surface parking and landscaping. The Site

Plan for the Site redevelopment is illustrated on Figure 3.

By the time this RAP is implemented, the current Site buildings will have been demolished and removed, so this RAP does not consider any associated demolition management. Additionally, the scope of this RAP does not include re-grading or the installation of trenches or utilities after remedial excavation.

2.3. General Geology

The Site is located in Oakland, California within the East Plain Bay of the Coast Ranges Geomorphic Province, a geologically young and seismically active region. Northwest-southeast trending ranges of low mountains and intervening valleys dominate the region (CGS 2002). According to the East Bay Plain Groundwater Basin Beneficial Use Evaluation Report from the Cal-RWQCB, June 1999, the site is located within the Oakland Sub-area of the East Bay Plain of the San Francisco Basin. The Oakland Sub-area is coastal lowland containing a sequence of alluvial fans deposited by the San Leandro and San Lorenzo Creeks. The alluvial fill thickness ranges from 300 to 700 feet deep. According to the USGS 7.5-Minute Quadrangle, San Leandro, California Map, the Property lies on a gently west southwest sloping plain approximately 2.0 miles east from the San Leandro Bay and 1.5 miles southwest from the Oakland Hills. The Site elevation is approximately 26 feet above mean sea level (msl).

According to the Soil Survey of Alameda County, Western Part, California, soils comprising the coastal lowland of the plan area in the vicinity of the Site are mainly Urban Land-Danville soils and a small strip of Urban Land-Clear Lake soils adjacent to International Boulevard. Both soils are very deep alluvium derived from sedimentary rock. The Danville soils are well drained silty clay loam, while the Clear Lake soils are poorly drained clays that are found on low terraces and alluvial fans.

Borings logs reviewed from the Site indicate that local soil types generally consist of dark brown silty clays similar in description to the Urban land-Danville soils described in the soil survey. The light brown sandy, silty clay soil observed in limited Site borings above 3 feet bgs that does not match the Danville Clear Lakes soil description, indicates that this shallow layer may be characterized as Fill (of unknown origin) previously placed on-Site decades ago. Remaining soils that compose the Site are believed to be the native soils that generally exist below the fill and at the surface where fill was not observed.

2.4. General Hydrology

Storm water runoff follows the regional topography to the west southwest where it likely enters the Oakland storm water discharge system and flows into either of the closest open water bodies; San Leandro Creek (1.3 miles to the south), Viejo Arroyo (1 mile to the northwest), or San Leandro Bay (2.25 miles to the southeast).

2.5. General Hydrogeology

The Site is located in the East Bay Plain which contains an upper aquifer system to depths of 250 feet bgs and an underlying lower aquifer system to depths of more than 650 feet bgs. There are four primary aquifers under the East Bay Plain area of the Site. They consist of Aeolian sand, alluvial sand, and gravel deposits separated by estuarine mud or fine-grained alluvial flood-plain deposits. The aquifers located beneath the Site (from shallowest to deepest) are the Newark aquifer (confined, 30-130 feet bgs), Centerville aquifer (130-220 feet bgs), Fremont aquifer (240-400 feet bgs), and Deep aquifer (500-650 feet bgs).

The first-encountered zone of saturation is encountered between approximately 8 to 12 feet bgs (RPS Iris Environmental 2015). Although the East Bay Plain area has a history of containing wells used to extract groundwater below 100 feet bgs for agricultural and development purposes, there are no pumping wells on-Site, or nearby, and groundwater beneath the Site is not a current source of drinking water for the Site or Oakland. Additionally, it is likely the shallowest saturated zone encountered during Iris's investigation is not connected to the shallow Newark aquifer which is approximated at below 30 feet bgs and confined. The observed overlying silty clay deposits likely provide a barrier to the Newark aquifer from surface recharge.

There are no permanent monitoring wells on-Site. RPS Iris Environmental installed two temporary monitoring wells with 5 feet of 0.01 slot screen on October 20, 2015 to evaluate if there were volatile organic compound (VOC) impacts beneath the Site from historic on-Site and off-Site operations. The temporary monitoring wells were installed under the now vacant 9434 International Boulevard building that once held a former dry cleaning facility. A saturated zone that produced water was found at 10.5 feet bgs at IE-1 and 11.5 feet bgs in IE-2. Based on topography, local groundwater flow, and groundwater observations the expected groundwater flow in the Site area is to the west at a shallow gradient.

2.6. Environmental History

The environmental history of the Site includes Phase I and Phase II ESAs conducted in 2015. A summary of current and historic Site building operations and historic borings at each Site building are provided in Table 1.

There were no records available at Alameda County Department of Environmental Health (ACEH), and while records were available at the Oakland Building and Planning, no records of significance were identified in either the online or in-person file review for the Site. Significant records searched for, but not found, included references to historic hazardous materials use, storage, or disposal – or complaints related to environmental matters (odors, emissions, etc.).

A summary of Phase I and Phase II Environmental Site Assessment reports that have been prepared for the site include:

Phase I Environmental Site Assessment, 9400-9500 International Boulevard, Oakland, California. Consulting Associates of California (CAC). June 25, 2015.

> This report was conducted to identify potential onsite and offsite sources or practices (recognized environmental conditions) that could adversely impact environmental conditions on the Property. Results of the Phase I ESA identified one potential recognized

environmental condition (REC) relative to past activities on the Property. A review of City directories indicated the presence of Elmhurst Cleaners & Laundromat at 9434 East 14th Street (currently International Boulevard) from the late 1940s to at least 1970. Potential dry cleaning solvent (Stoddard solvent or Tetrachloroethene) releases from this cleaner could have impacted soil and/or groundwater beneath the Property. A review of hazardous waste information from federal and state regional lists and a radius site profile for the project site area from Environmental Data Resources, Inc. indicate no other actual or potential RECs relative to historical activities on the Property.

The Phase I ESA indicates one possible recognized environmental condition from historical offsite properties and businesses. Historical Sanborn Maps indicate the presence of an electric train system (referenced both as the Oakland Traction Company and Key System Transit Company and the Oakland San Leandro & Haywards Electric Railway) facility just east of the Property, covering the east half of the city-block. This facility was present from at least 1896 to 1939 and included a machine shop, a repair shop, electric generation equipment, electric car barns, and cooling ponds. It is possible that a wide range of petroleum-distillate solvents, oils, and lubricants were used at this facility and may have impacted environmental conditions on the Property. No other historical businesses or activities were identified in the site vicinity which would be expected to impact environmental conditions on the Property. The historical off-Site Oakland Traction Company and Key System Transit Company layout from 1925 is provided in Figure 4.

Soil Investigation Report, 94th and International Blvd., Oakland, California. Applied Remedial Services (ARS). July 26, 2015.

This report detailed a Site-wide baseline soil assessment conducted by Applied Remedial Services, Inc. (ARS), where select samples were collected at depths ranging from 2 feet bgs to 10 feet bgs. Boring placement rational included placing borings within the future footprint of the proposed new building at the Site, and at locations with aberrations in topography, physical signs of spillage, or masses of construction debris that was discarded at the property (Figure 3). Historic boring locations and rationale are summarized in Table 1. Samples were analyzed for:

- Total Petroleum Hydrocarbons Gasoline (TPH-g), Motor Oil (TPH-mo), and Diesel (TPH-d) using United States Environmental Protection Agency (EPA) Method SW 8015B;
- CAM 17 metals using EPA Method 6020 Heavy Metals;
- Lead using EPA Method 6010B;
- Polychlorinated Biphenyls (PCBs) using EPA Method 8082; and
- VOCs using EPA Method 8260;
- Semi-Volatile Organic Compounds (SVOCs) using EPA Method 8270;
- Organochlorine Pesticides using EPA Method 8081;

- Bulk Asbestos Containing Material using EPA Method 600 PLM;
- Toxicity characteristic leaching procedure (TCLP) for lead and mercury using EPA Method 6020; and
- Waste Extraction Test (WET) for lead and chromium using EPA Method 6010B.

Step-out Soil Investigation Report, 94th and International Blvd., Oakland, California. Applied Remedial Services (ARS). September 14, 2015.

This report detailed a site-wide follow up investigation conducted by ARS to delineate lead at 2 feet bgs where residential screening-level exceedances were identified in the previous investigation. The boring location rationale was to delineate the lateral extent of lead identified in the July 26, 2015 investigation (Figure 3). Samples were collected by stepping out 10 to 25 feet in various directions from previous sampling locations. Historic boring locations and rationale are summarized in Table 1. Samples were analyzed for lead using EPA Method 6010B, TCLP for lead using EPA Method 6020, and WET for lead using EPA Method 6010B.

Report of FOIA File Review Requests and Limited Phase II Subsurface Site Investigation, 9400-9500 International Boulevard, Oakland, California. RPS Iris Environmental. November 4, 2015.

RPS Iris Environmental re-submitted a FOIA request for current and historical addresses associated with the subject site and adjacent properties. Additionally, RPS Iris Environmental collected soil, soil gas, and groundwater samples to characterize potential vapor intrusion impacts from a suspected on-Site former dry cleaning operation and the former Oakland San Leandro & Haywards Electric Railway yard historically located offsite, to the south and east of the Site. As no information was available detailing the former dry cleaner layout at 9434 International Boulevard, Iris Environmental placed sample locations across the former dry cleaner parcel for geographic coverage, and to identify potential impacts. Soil gas sample locations were also placed downgradient of the former railyard on the eastern corner of the site to evaluate possible impacts. Based on the historic layout of the former railyard (Figure 3 and 4), these sampling locations would likely contain impacts if any exist. Iris Environmental was access-limited by the former Lifeline Treatment Services building in the southern corner of the Site. Historic boring locations and rationale are summarized in Table 1. Soil and groundwater samples were analyzed for VOCs using EPA Method 8260 and soil gas was analyzed for VOCs using EPA method TO-15.

A summary of historic soil borings and subsequent soil samples collected for laboratory analysis is provided in Table 2. A summary of historic soil gas sampling points and temporary monitoring wells for groundwater sampling is provided in Table 3. This RAP focuses on compiling the results of the previous investigations and detailing an appropriate mitigation strategy to return the site to a condition that is protective of future occupants and the general public.

2.7. Contaminants of Concern

RPS Iris Environmental compiled and analyzed the results from the previous investigations to produce a summary of Contaminants of Concern (COCs) and key environmental findings for the Site. Evaluation of previous investigations indicates shallow soils on-Site have been impacted with metals (primarily lead) and other contaminants above conservative screening-level residential thresholds. An illustration of COC distribution in shallow soils is provided in Figure 5. Summaries of analytical results are provided in Table 4 (soil), Table 5 (groundwater), Table 6 (soil gas), and Table 7 (metal solubility in soils). The summary of this evaluation is detailed below.

2.7.1. Soil Results

A total of 48 soil samples were collected and analyzed from 33 borings advanced on Site by ARS and RPS Iris Environmental during the three site investigations. The purpose of the investigations were to characterize soil impacts from historic site use, potential shallow fill soils, potential offsite properties, and potential vapor intrusion impacts from a suspected on-Site former dry cleaning operation and the former Oakland San Leandro & Hayward Electric Railway yard historically located south and east of the Site.

RPS Iris Environmental compared the soil results to protective screening-levels to define COCs and their extent in soils. Protective screening-levels were taken from San Francisco Bay Regional Water Quality Control Board (RWQCB) direct exposure human health Environmental Screening Levels (ESLs) for residential shallow soils (ESLs Table S-1) (Cal/EPA 2016a, 2016b). The direct exposure ESLs consists of three land use scenarios; residential use, commercial use, and “any” land use. Although the property will be residential, there are a few instances where the “any” land use ESL is more conservative. In that case, the “any” land use ESL was applied for comparison purposes. Additionally, the Site-specific TPH screening level is based on RWQCB’s Odor Nuisance Level (ESLs Table S-4), which is less than its respective residential direct exposure ESL (ESLs Table S-1). A comparison of soil sampling results to RWQCB residential ESLs is provided in Table 4. Table 4 does not contain the results of all analyses, only the analyses where at least one exceedance above residential ESLs was reported. A summary of the soil results for each analysis is provided below.

- Various metal constituents were detected above their respective residential ESLs. Specifically, metals detected above residential ESLs included cobalt, lead, and mercury; all such elevated impacts were detected in soil samples collected at two (2) feet bgs (*i.e.*, above three [3] feet bgs). The majority of soil samples were analyzed for lead. Lead was detected above its residential ESL of 80 milligrams per kilogram (mg/kg) in 21 soil samples (out of 48 total). Exceedances were only observed at two (2) feet bgs and ranged from 90 mg/kg to 4,300 mg/kg. Samples collected from three (3) feet bgs and deeper were below the residential ESL for lead at all locations. Remaining metal constituents (cobalt and mercury) were detected above their respective residential ESL in 3 soil samples (out of 6 total). It should be noted that exceedances of arsenic in soils are attributed to naturally occurring arsenic in Bay Area soils. Therefore, arsenic is not considered a mitigation target. Refer to Section 2.7.1.1 for a more detailed explanation. An illustration of lead concentrations in shallow soils is provided in Figure 5. Geologic cross-sections of lead impacts in shallow soils are illustrated in Figures 7a, 7b, and 7c.
- The organochlorine pesticide, chlordane, was detected above its residential ESL of 0.48 mg/kg in one (1) soil sample (out of 6 total). The exceedance occurred at boring SB-1 (2 feet bgs) and is collocated with elevated lead data.
- The organochlorine pesticide, dieldrin, was detected above laboratory detection limits in one (1) soil sample out of six (6) total. The detected dieldrin concentration was below is its residential ESL of 0.0038 mg/kg. The detection was collocated with elevated lead data.
- TPH-g was detected in one (1) soil sample (out of 22 total), but no detections were above its odor threshold ESL of 100 mg/kg. It should be noted the residential ESL protective of human health for TPH-g is 770 mg/kg.
- TPH-d was detected in five (5) samples (out of 22 total), but no detections were above its odor threshold ESL of 100 mg/kg. It should be noted the residential ESL protective of human health for TPH-d is 240 mg/kg.
- TPH-mo was detected above its odor threshold ESL of 100 mg/kg in two (2) out of twenty-two (22) samples. The exceedance occurred at boring SB-1 (2 feet bgs) and SB-2 (2 feet bgs). It should be noted TPH-mo was not detected above the respective residential ESL protective of human health of 1,100 mg/kg.
- No VOC compounds were detected at concentrations above laboratory reporting limits in seven (7) soil samples.
- No SVOC compounds were detected at concentrations above laboratory reporting limits in four (4) soil samples.
- No PAH compounds were detected at concentrations above laboratory reporting limits in two (2) soil samples.
- No PCB compounds were detected at concentrations above laboratory reporting limits in four (4) soil samples.
- No asbestos was detected at concentrations above laboratory reporting limits in eight (8) soil samples.

2.7.2. Soil COCs

Based on the historical Site use and analytical data, the COCs beneath the Site pertaining to this redevelopment project appear limited to shallow soils and include lead, other metals (cobalt and mercury), TPH-mo, and the organochlorine pesticide chlordane. Although arsenic exceeds its residential ESL in all samples, arsenic is naturally present in Bay Area soils at concentrations above risk-based screening levels (Duvergé 2011). Cleanup of naturally-occurring chemicals to less than background concentrations is not generally required. With a detected maximum onsite concentration of 14 mg/kg, and no obvious indications of an arsenic source or distribution pattern, Iris Environmental believes arsenic to be naturally occurring, and is not considered as a mitigation target.

Lead was the most commonly identified and sampled-for COC. Detections above residential criteria for other select metals, TPH-mo, and chlordane were also above residential site reuse criteria in three locations. All three samples are collocated with elevated lead detections. As all the impacts observed onsite (other metals, TPH-mo, and chlordane) appear to be collocated with elevated lead results, the proposed mitigation activities focus on lead impacts only.

The source of soil impacts from lead and collocated chemicals are unknown; however it is likely they originate from varied historic Site use, potential shallow fill soils, and/or potential offsite properties. While the COC impacts appear well defined vertically to the shallowest 3 feet, the full horizontal extent of these impacts are not as certain, so RPS Iris Environmental proposes interim soil sampling for lead, combined with iterative field screening and confirmation sampling measures during remedial excavation to further define the impact limits. This strategy is discussed in more detail in Section 5.5. An evaluation of soil risk characterization is detailed in Section 3.1.1.

2.7.3. Groundwater Results

A total of two groundwater samples were collected and analyzed for VOCs from temporary monitoring wells IE-1 and IE-2 to characterize potential vapor intrusion impacts from a suspected on-Site former dry cleaning operation and the former Oakland San Leandro & Hayward Electric Railway yard historically located south and east of the Site. RPS Iris Environmental collected groundwater samples at depths of approximately 10.5 feet bgs in IE-1 and 11.5 feet bgs in IE-2 (RPS Iris Environmental, 2015).

RPS Iris Environmental compared the groundwater results to protective screening levels to assess potential groundwater COCs and their extent. Protective screening-levels for evaluation of direct exposure risk from residential groundwater were taken from:

- RWQCB's residential ESLs for the protection of human health from direct exposure in residential groundwater (ESLs Table W-1) (Cal/EPA 2016a, 2016b);
- DTSC's Office of Human and Ecological Risk (HERO) Human Health Risk Assessment (HHRA) Note Number 3 Screening Levels (HHRA3 SLs) were considered (Cal/EPA 2016c); and
- United States Environmental Protection Agencies (USEPA) Regional Screening Levels

(RSLs) for tap water (USEPA 2015a).

The most conservative protective screening level with respect to health risk was applied, as some screening levels are based on nuisance criteria. Protective screening-levels for evaluation of groundwater vapor intrusion human health risk for residential properties were taken from:

- RWQCB's residential ESLs for vapor intrusion risks from shallow groundwater (ESLs Table W-3) (Cal/EPA 2016a, 2016b); and
- USEPA's Office of Solid Waste and Emergency Response (OSWER) Vapor Intrusion Screening Levels (VISLs) for evaluation of target groundwater for vapor intrusion protection (USEPA 2015b).
- The most conservative protective screening level was applied. A comparison of groundwater sampling results to protective screening levels is provided in Table 5. Ethylbenzene was detected at a concentration of 1.9 µg/L, which is slightly above its residential ESL for drinking water and EPA RSL for tap water of 1.5 µg/L for both. The ethylbenzene concentration is below all screening levels protective of vapor intrusion.
- Naphthalene was detected at a concentration of 4.2 µg/L, which above the conservative residential ESL for drinking water of 0.12 µg/L. The naphthalene concentration is below all screening levels protective of vapor intrusion.
- Remaining detections above laboratory detection limits include VOC constituent's butylbenzene, cumene, methyl tert-butyl ether, and n-propylbenzene. None of these constituents were detected above their respective screening levels for vapor intrusion and drinking water concerns.

2.7.4. Groundwater COCs

A review of the limited groundwater data collected identified ethylbenzene and naphthalene as potential COCs. Protective screening levels are only recommendations based on the most conservative non-Site-specific parameters where exposure to said media is assumed. Additional Site-specific considerations are considered when identifying COCs. Since there are no wells onsite and groundwater is to be un-utilized by future site occupants for potable use, VOC constituents exceeding drinking water/direct exposure protective screening levels are not a health based risk concern. The residents all depend on City water from Sunol via Zone 7 Water district, and future plans at the site indicate that there are no wells planned onsite. Therefore, Iris Environmental does not characterize VOC constituents identified in groundwater as a concern that would require a mitigation program for the protection of future Site occupants based on Site-specific conditions. Additionally, Iris Environmental considers the human exposure pathway to groundwater through vapor intrusion to be closed due to VOC detections in groundwater below vapor intrusion protection levels. An evaluation of groundwater risk characterization is detailed in Section 3.1.2.

Soil Gas Results

A total of eight soil gas samples were collected and analyzed for VOCs from temporary soil gas points IE-1 through IE-8 to characterize potential vapor intrusion impacts from a suspected on-

Site former dry cleaning operation and the former Oakland San Leandro & Hayward Electric Railway yard historically located south and east of the Site. RPS Iris Environmental collected the soil gas samples from approximately 5 feet bgs at all locations.

RPS Iris Environmental compared the results to protective screening levels to define soil gas COCs and their extent. Protective screening levels were taken from RWQCB ESLs for the evaluation of potential vapor intrusion concerns in soil gas (ESLs Table SG-1) (Cal/EPA 2016a, 2016b). In the absence of vapor intrusion ESLs when detections were noted, protective screening levels were taken from factoring in DTSCs HHRA Note 3 sub-slab/soil gas to indoor air attenuation factor using USEPA's RSLs for residential indoor air (USEPA 201a). A comparison of soil gas sampling results to protective screening levels is provided in Table 6.

VOCs detected above laboratory detection limits include VOC constituent's acetone, benzene, carbon disulfide, cyclohexane, heptane, toluene, and 4-Methyl-2-pentanone. None of these constituents were detected above their respective vapor intrusion protective screening levels.

2.7.5. Soil Gas COCs

A review of the limited soil gas data collected did not identify any soil gas COCs. All VOCs in soil gas were below risk based screening levels that may require further action. Further, Site-wide soil sampling, and limited groundwater sampling, failed to identify any other suspected source of VOCs at the Site. RPS Iris Environmental concludes vapor intrusion mitigation measures are not warranted for the Site as no COCs were identified. An evaluation of soil gas risk characterization is detailed in Section 3.1.3.

2.7.6. Soil Solubility Results

A total of twenty (20) soil samples were collected and analyzed for select metal solubility in soils using WET and TCLP extraction methods. Solubility sampling was conducted at select soil sampling locations during ARS's July 2015 Soil Investigation and ARS's September 2015 Step-Out Soil Investigation. Solubility sampling was conducted to assess potential hazardous waste characteristics of the soils, and estimate the volume of potential hazardous waste generated during remedial excavation(s), as warranted. All TCLP and WET samples were collected at or above three feet bgs. Select soil samples were analyzed for lead and chromium solubility via WET, and lead and mercury solubility via TCLP.

A comparison of soil solubility sampling results to STLC and TCLP thresholds is provided in Table 7.

- Soluble lead via WET was detected in all twenty (20) soil samples analyzed. Twelve (12) out of the twenty samples exceed the STLC for lead of 5.0 mg/L. Exceedances were only observed at two (2) feet bgs and ranged from 5.8 mg/L to 270 mg/L. The exceedances were only observed at locations anticipated for remedial excavation, removal, and disposal. Soils with lead below the residential ESL of 80 mg/kg also demonstrated lead solubility below the STLC of 5 mg/L. Samples collected from three (3) feet bgs and deeper were below the STLC for lead.

- Soluble lead via TCLP was detected in three (3) out of five (5) soil samples submitted for analysis. Soluble lead exceeding the STLC of 5.0 mg/L was detected at a concentration of 13 mg/L at SB-2-SO-25-E. This sample location along with the other four locations is anticipated for remedial excavation, removal and disposal.
- Soluble mercury via TCLP was below method detection limits in the one (1) sample submitted for analysis. This location is poised for excavation and disposal.
- Soluble chromium via WET was detected in the two (2) samples collected for analysis. Both samples contained soluble chromium well below the respective STLC of 5 mg/L. The two sample locations are anticipated for remedial excavation, removal, and disposal.

2.7.7. Soil Solubility Conclusions

Soils generated during the course of remedial excavations are anticipated to be classified as both non-hazardous and hazardous (California and/or Federal/RCRA) based on existing data regarding solubility of metals in soil. RPS Iris Environmental was asked by ACEH to evaluate the potential for identified total metals impacts to migrate. The disparity between impacts observed at two feet bgs and impacts observed at three feet bgs and below indicate there is negligible migration of total metals in soils. Additionally, it is unlikely that storm water runoff entering on-Site drains comes in contact with impacted soils since all drain inlets are above the soil surface (i.e. within paving). The only two areas not currently paved contain no drains where surface water could come in contact with soils prior to entering the drains.

It should be noted that TCLP and WET results from the previous investigations will not be used to characterize waste toxicity for future remedial soil excavation and disposal. Waste management facilities (landfills) will require more recent (and potentially broader) sampling for waste classification. Proposed waste management practices are detailed in Section 6.3.

3.0 REMEDIAL ACTION OBJECTIVES

The objectives of this remedial action are to:

- Characterize Site risk based on background information (historic operations, redevelopment, results of previous investigations, identified COCs);
- Establish appropriate RAOs to mitigate risk and return the Site to unrestricted reuse;
- Describe the proposed RAO which involves excavation of shallow soils containing COCs above residential ESLs; and
- Describe RAO confirmation soil sampling procedures to evaluate whether near-surface source soils have been removed to the established RAOs.

3.1. Risk Characterization

Risk characterization is used to determine if a potential threat to human health and the environment exists. It is evaluated using a line-of-evidence approach that considers harm of contaminants, exposure pathways, and receptors. A complete pathway from identification of harmful contaminants to exposure route to receptors must exist for a threat to occur. The following sections characterize exposure and health risk for soil, groundwater, and vapor intrusion.

3.1.1. Potentially Harmful Contaminants in Soil

A contaminant is considered harmful when it is found in on-Site soil, groundwater, soil gas, or indoor air, and it exceeds residential ESLs for a Site residential in nature. The residential ESLs establish threshold concentrations for contaminants based on their specific properties and a target cancer risk level of 1×10^{-6} (one in a million) and/or the target chronic non-cancer hazard quotient of 1 (unity) for a resident living on the Site 24 hours per day, 350 days per year, for 26 years. Although this is a conservative risk comparison, soils with chemicals above the residential ESLs have the potential to pose a threat to human health. For this Site, lead, two other metals (cobalt and mercury), and chlordane were identified above residential ESLs in soils above three feet bgs and are considered Site specific COCs.

An exposure pathway evaluation determines if there is a potential for site specific COCs to come in contact with receptors. In this case, COCs are located in shallow soils above 3 feet bgs. This limits the exposure pathway to direct contact with, or ingestion, of impacted soils. It should be noted, the exposure pathway would be limited for future Site residents by the proposed Site plan, which calls for the coverage of a majority of the Site with asphalt and a building foundation, mitigating the exposure risk to shallow soils.

Based on the Site specific risk characterization, RPS Iris Environmental concludes that there is a low risk to human health from exposure to COCs based on proposed Site development limiting access to shallow soils impacted with COCs above residential ESLs. Although the risk is low, OIHP has elected to pursue an unrestricted site reuse scenario. The RAO for this remedial action is to abate the health risks associated with the COC impacted soils, by preventing human exposure via removal of contaminants. RAOs therefore entail completing delineation of lead in shallow soils, and removal of soils that are potentially harmful to human health from the Site. Removing soils containing COCs above residential ESLs will reduce the Site risk to future residents to negligible.

3.1.2. Nuisance Contaminants in Soils

TPH constituents, TPH-g, TPH-d, and TPH-mo, were identified in shallow soils with lead impacts. Only TPH-mo exceeded its respective odor threshold ESL in two (2) soil samples; however, TPH-mo was not detected in any samples exceeding its respective residential ESL that is protective of direct exposure.

The two samples containing the highest concentrations of TPH were located on the 9400 International Boulevard property, specifically in the trash dumpster pad area (SB-1) and the parking lot (SB-2). RPS Iris Environmental reviewed the Permit/Complaint History for the Site going back to 1987, and identified numerous instances of improper storage of commercial vehicles, inoperable vehicles, trash, and debris at the 9400 property. Remaining sampling locations where TPH was detected, but below odor threshold ESLs (SB-2, SB-7, SB-8, and SB-

9), are similar in that they are within or adjacent to access roads or parking lots where decades of vehicle use has likely contributed to shallow soil impacts. This is not uncommon as a New England study has demonstrated a 95% upper confidence level of 373 mg/kg for TPH in urban non-industrial soils (Bradley 1996). Sampling locations where TPH was below laboratory detection limits were either collected from three feet bgs or lower or beneath a building away from parking lots or access roads (SB-5). Therefore RPS Iris Environmental believes the source for TPH impacts is likely a result of normal historic operations from decades of vehicle use. Detections at the 9400 property may also be from small-quantity hazardous material storage and disposal practices.

The potential for an overlooked TPH source at the Site is not likely since soil samples were collected from locations with staining during ARS's July 2015 Soil Investigation. This leads to reasonably assume TPH concentrations in SB-1 and SB-2 may represent the Site-specific worst case conditions. Additionally, TPH impacts are limited to above three feet bgs. The data supports that the source for low-level TPH in shallow soils is likely historic operations at the Site through decades of vehicle use. Iris Environmental concludes TPH is collocated with lead impacts and remediation of lead impacted soil will remove the TPH nuisance. No harmful contaminants were identified in groundwater that could be exposed to an on-Site receptor based on conservative protective screening levels and Site-specific conditions. The majority of low-level VOCs were detected in IE-2 located adjacent to the eastern wall of the former dry cleaners. This is presumably upgradient from IE-1. Expected shallow groundwater flow at the Site is to the west.

It is unknown whether PCE solvent or Stoddard solvent was used at the former dry cleaner. Stoddard solvent is a mixture of middle-end hydrocarbons (C_7-C_{12}) derived by refining crude oil. Stoddard Solvent mixture typically contains less than 1% of each VOC constituent's benzenes, naphthalenes, and toluenes. There is no substantial evidence of solvent release from the former dry cleaners due to lack of TPH in soils below three feet bgs and VOCs below laboratory detection limits or below protective screening levels in soil, groundwater, and soil gas. Additionally, VOCs in groundwater would likely be expected in downgradient groundwater sample IE-1 if a release occurred. Low-level VOCs in groundwater are likely reflective of residual stable impacts originating from an off-Site source. The former Oakland San Leandro & Hayward Electric Railway yard can be assumed as the most likely source, since no other RECs were reported in the Phase I within a 1-mile radius. It should be noted the observed impacts are more indicative that potential historic impacts from the railyard have either attenuated or were not significant due to the minor Site impacts observed and the close proximity of the Site to the former railyard. Additionally, the risk from VOC impacts in groundwater is considered negligible since VOCs in groundwater are below vapor intrusion protective screening levels, no apparent connection between groundwater and soil gas, and no connection between groundwater and human exposure.

Iris Environmental concludes there is no indication that groundwater remediation or mitigation for the protection of future residential Site occupants is necessary. This is based on identification of no harmful contaminants in groundwater and an incomplete pathway between receptor and direct contact with groundwater.

3.1.3. Vapor Intrusion

No harmful contaminants were identified in soil gas based on the most conservative residential ESLs protective of human health. Although limited soil gas samples did exhibit low-level detections of a few VOCs, a pathway from VOC source to soil gas is considered incomplete due to no observable source area, soil gas concentrations either below laboratory detection limits or below residential ESLs, and inconsistencies between VOCs detected in groundwater and VOCs detected in soil gas.

The most likely possible source for VOCs in soil gas at the Site would be groundwater migration from an off-Site source. Section 3.1.2 describes there is no indication of a release from the former dry cleaners, and Section 2.7.2 describes that VOCs were not identified as a COC in shallow soils. The most likely source would be from off-Site impacted groundwater migrating to the Site and diffusion of VOCs from groundwater to soil gas. This is considered incomplete as not only were all VOCs in groundwater and soil gas below residential ESLs for vapor intrusion; the few VOCs detected in groundwater were not detected in soil gas samples. This connection would be required as soil gas chemicals are derived from VOCs in groundwater unless a soil source was discovered, which there was not. Although the soil gas sample result from IE-7 indicated naphthalene below method detection limits, that method detection limit was above the residential ESL of 41 µg/L. Iris Environmental considers this a function of laboratory and media variability, and considers the surrounding soil gas samples IE-5, IE-6, and IE-8 representative of unrestricted site re-use soil gas conditions where naphthalene results were below method detection limits, and its protective screening level. Finally, the protective screening levels assumes the most conservative parameters when determining its level for vapor intrusion protection. A Site-specific screening level for vapor intrusion protection would most likely be higher than 41 µg/L, as the most conservative assumptions would not apply for the Site (i.e. soil composition, sample depth, slab condition). Iris Environmental concludes there are no indications for vapor intrusion, and additional soil gas sampling is not warranted.

Recognizing the focus of the investigation was on a suspect prior dry-cleaning facility and the former adjacent Oakland San Leandro & Hayward Electric Railway yard (RPS Iris Environmental 2015), RPS Iris Environmental adhered to California's DTSC Vapor Intrusion Guidance (Cal/EPA October 2011) (2011 VIG). The 2011 VIG recommends:

- A sampling density of one sample per one-eighth or one-quarter acre collected as close as possible to buildings and at depths below the respective building foundation;
- Samples collected no less than five feet below ground surface; and
- Sampling conducted in accordance with Site-specific conditions.

This approach has been demonstrated to confidently characterize vapor intrusion conditions (2011 VIG). The approximate area of the Site is 1.26 acres, and Site-specific conditions dictated vapor intrusion impacts are most likely at the former dry cleaners and in the eastern corner of the Site adjacent to former railyard buildings. Therefore guidance suggests adequate coverage equates to between 5 and 10 soil gas samples, adjacent to Site-specific building foundations, no less than five feet bgs. The completed soil gas sampling plan has met all those objectives. Requirements for additional soil gas samples are dictated by delineating identified contaminants to a 100-foot buffer zone beyond the extent of a plume (2011 VIG). Since no contaminants were detected, there is no requirement for additional sampling.

In addition to the future residential apartment complex, Iris Environmental evaluated the vapor intrusion exposure risk to adjacent residential properties. A desktop review of adjacent properties using Google Maps Street View® was conducted to evaluate the foundations of nearby residential structures for vapor intrusion consideration. Cripple walls were identified at ground level in most if not all of the residential properties. Cripple walls are typically less than full story height. They occur between the first floor and the foundations, creating a crawlspace underneath the first floor. Crawlspaces and basements are considered at higher risk for vapor intrusion than an on-grade foundation since they are openings to the subsurface and could flood with potentially impacted groundwater. A desktop assessment for evaluating vapor intrusion at off-Site residential properties includes identifying an on-Site vapor source, evaluating on-Site soil gas and groundwater results, and evaluating if Site conditions warrant further vapor intrusion investigations. There is no evidence indicating vapor intrusion issues at adjacent residential properties based on lack of VOCs in soil, groundwater, and soil gas. It should be noted this opinion is based on evidence collected under the scope of this RAP. The scope of work has never included identifying sources outside the Site's property boundary or characterizing off-Site properties. Any findings that indicate a vapor intrusion risk to off-Site properties is likely the result of an off-Site source that is not the responsibility of current Site owners.

Iris Environmental concludes there is no indication that vapor intrusion remediation or mitigation for the protection of future residential Site occupants is necessary. This is based on no harmful contaminants were identified in soil gas and no apparent source area.

3.2. Proposed Additional Delineation of Lead in Soils

Iris Environmental proposes to conduct delineation sampling around the current proposed excavation area. The proposed sampling plan will delineate the lateral extent of lead in shallow soils to a reasonable degree prior to excavation and simultaneously characterize direct exposure risk in future exposed areas (i.e. storm water treatment and landscaped areas).

3.2.1. Scope of Work

RPS Iris Environmental proposes to collect nineteen (19) soil samples from nineteen (19) borings (IE-9 through IE-27) advanced to a depth of approximately two (2) feet bgs. The borings are located in a grid-like pattern around the proposed excavation area with approximately 30-feet to 50-feet of lateral separation between proposed and existing borings. An additional consideration for sample placement includes targeting areas that will be exposed after redevelopment to assess lead leachability and direct exposure risks. The nineteen soil sampling locations are shown in Figure 8 and a summary of proposed borings and their rationale is provided in Table 1.

Prior to work start, RPS Iris Environmental will mark proposed boring locations in white paint for Underground Services Alert (USA) North, and notify USA North at least 48 hours prior to conducting intrusive fieldwork. Utility locate activities will also be conducted before or the day of work start. It is expected that a drilling permit will not be required by Alameda County Public Works Agency-Water Resources since the vertical extent of borings is limited to two (2) feet bgs.

Drilling will be conducted by a California certified Geoprobe® operator under the supervision of an RPS Iris Environmental field geologist or scientist. Soil samples will be collected in a 6-to-2 inch section of acetate liner. From that liner, RPS Iris Environmental will collect samples for lead analysis using USEPA Preparatory Method 6010B. Samples will be labeled and stored in iced coolers for transport under chain-of-custody protocol. Samples will be sent to Curtis & Thompkins Ltd. Analytical Laboratories in Berkeley, California with RUSH laboratory analytical turn-around time, as warranted. Following receipt of analytical results, RPS Iris Environmental will tabulate the results and compare to RWQCB's residential ESL of 80 mg/kg for the protection of human health from direct exposure in residential shallow soils (ESLs Table S-1) (Cal/EPA 2016a, 2016b). Sampling locations containing lead above residential ESLs will be proposed for excavation in addition to the current excavation area. This strategy will remediate soils that exceed residential ESLs protective of direct exposure and leachability of metals in soil. Site-specific empirical data suggest soils with lead below the residential ESL will also be below STLC and TCLP solubility regulatory levels. Changes to the RAP based on sampling results will be submitted to ACEH as a letter report or an addendum to this RAP. Any investigation-derived waste will be stored on-Site in secure drums and included with the future excavated soil waste.

As a final note, RPS Iris Environmental proposes the confirmation field screening and sampling procedure outlined in Section 5.5 be used to iteratively determine the final excavation limits. Additional concerns regarding impact extent can be addressed during confirmation field screening and sampling where the quick response and adaptability of the field screening methods matches the same quick response and resolution requirements needed to ensure complete removal of impacts.

3.3. Proposed Remedial Action Objectives

Based on the current understanding of Site specific risk and the need to remove potential harmful contaminants, the preferred remedial technology is excavation and off-site disposal of contaminated soils. Several soil remediation technologies are available to adequately clean up contaminated soils at this site such as capping the Site, and preventing future exposures via Agency-approved engineering, and operations and maintenance approaches. This requires long term operations and monitoring and likely land-use controls. Based on OIHP's request to return the Site to an unrestricted reuse scenario and time constraints of construction schedules for this site, the excavation and off-site disposal plan is the most feasible option.

The preferred remedial approach for the Site will be the excavation of shallow soils containing lead exceeding its direct exposure residential ESL of 80 mg/kg. The residential ESL is from the RWQCB ESLs for shallow soils under residential/unrestricted land use where groundwater is not a drinking water source (ESLs Table S-1) (Cal/EPA 2016a, 2016b). The residential ESLs are based upon conservative default toxicological and model inputs. The RAO focus on lead is appropriate, as previously mentioned, as the other identified COCs in soil are collocated with lead, and removing soils with lead exceedances equates to removing the other COCs. The area proposed for excavation is illustrated in Figure 6 in relation to the proposed redevelopment. This is subject to change pending the results of the proposed delineation investigation. Depths of excavation will be approximately 3 feet bgs. The depths of excavation based on residential ESLs are illustrated in the geologic cross-section Figures 7a, 7b, and 7c. A combination of field screening for lead and confirmation sampling for offsite laboratory analysis will be conducted to define impact boundaries, and ensure the RAO has been completed. Soils removed from the excavation will be profiled and appropriately disposed of in a licensed landfill.

4.0 PRE-FIELD ACTIVITIES

The pre-field activities include a description of planning and organizational aspects of the proposed excavation required for excavation to begin.

4.1. Site Security and Access

During remedial activities, the Site will be secured to provide protection and safety to on-Site personnel and equipment, and to prevent unauthorized access to areas of remedial activity. A 6-foot high chain link fence will be constructed around the perimeter of the Site and will enclose the staging area and the work zones (*i.e.*, any exclusion, decontamination, and support zones). During non-working hours, the fencing will be fully closed and locked. During remedial activities, access will be restricted to authorized personnel only.

4.2. Traffic Control

Caution will be exercised during entrance and exiting of the work area to ensure safe and uninterrupted traffic flow. Entrance into and departure from the Site by trucks will be facilitated by a flagman, or comparable contractor personnel, as necessary. Once trucks have left the Site, they will follow specific haul routes to disposal facilities as described in the Transportation Plan, Section 5.3.5.

4.3. Excavation Permit

All necessary permits for removal activities, transportation, and/or air quality will be obtained prior to remediation. The permits will be kept on-Site and made available for inspection during working hours.

The procedures proposed for remediation activities will comply with federal, State and local rules and regulations, regardless of whether permit documents are required.

4.4. Health and Safety Plan

A Site-specific health and safety plan (HASP) will be prepared for the remedial excavation activities. The HASP will establish the minimum requirements, policies, and procedures adequate to protect Site workers, the public, and the environment from the predicted Site hazards. All remediation contractors involved in removal, transport, and handling of impacted material will be required to abide by these minimum requirements in their own contractor-specific HASP. In the event that unanticipated conditions occur at the Site, the plan will be modified accordingly.

All work at the Site will be performed in accordance with applicable State and Federal occupational health and safety standards. The HASP will be developed as a stand-alone document containing the following elements:

- A general description of the Site, including its location and Site map;
- Work objectives at the Site;
- A hazard evaluation, which includes the characteristics of the potential hazards to be found at the Site;
- Name of key personnel and alternates responsible for Site health and safety, including the appointment of a Site health and safety coordinator;
- Site personnel training requirements as specified by 29 CFR 1910.120 and medical surveillance requirements;
- PPE to be used by Site personnel in addition to action levels and decision criteria for upgrading the levels of PPE;
- The frequency and types of personal and area air monitoring, and environmental sampling techniques and instrumentation to be used for health and safety purposes;
- Site control measures, including the designation of work zones (*i.e.*, exclusion zone, contamination reduction zone, and support zone);
- Decontamination procedures for personnel and equipment;
- Noise control procedures and action levels;
- Dust control procedures and action levels;
- Procedures to perform safe work;
- Contingency plans for emergencies including contact names and telephone numbers;
- Location of nearest medical facility for emergency medical care, as well as a map showing the route from the Site to the medical facility; and
- Site safety plan consent agreement.

4.5. Contractor Qualifications

Workers that directly come into contact with contaminated soil and/or groundwater at the Site are required to conduct the work in accordance with California Occupational Safety and Health Administration (Cal/OSHA) training and worker protection rules and regulations. Cal/OSHA is the state agency responsible for monitoring compliance with worker health and safety laws and requirements. Compliance with standard Cal/OSHA regulations is important to prepare workers for the types of hazards that may be encountered during such activities. Earthwork activities conducted at the Site must be in compliance with applicable laws, including current Cal/OSHA rules and regulations. Construction contractors shall assume direct responsibility for the health and safety of its own employees and shall prepare a Site-specific HASP that meets the provisions and guidelines presented in this RAP. The HASP is specific to workers who may handle or contact hazardous wastes, hazardous materials, or contaminated soil or groundwater at the Site as part of subsurface work.

To the extent that construction activities at the Site may constitute "clean-up operations" or "hazardous substance removal work" as defined in the Cal/OSHA standards for Hazardous Waste Operations and Emergency Response (HAZWOPER), contractors will assure that all workers engaged in such activities have had training and are subject to medical surveillance, in accordance with Cal/OSHA standards (HAZWOPER-trained personnel). Soil that is visibly stained, discolored, shiny, or oily or has a noticeable solvent-like or hydrocarbon odor should be handled only by HAZWOPER-trained personnel until it is determined that such soil does not warrant such precautions.

4.6. Notifications and Utility Clearance

Iris Environmental will notify the BAAQMD of excavation activities at least five days prior to implementation. In addition, we will also notify ACEH of our tentative schedule at least five days prior to commencing work. The proposed excavation areas will be marked in white paint prior to contacting Underground Service Alert (USA) at least 48 hours prior to excavating, as required by law. A private utility locating service will be contracted prior to conducting the field activities to mark and/or clear proposed excavation locations relative to the presence and/or marked locations of potential subsurface utilities.

5.0 EXCAVATION ACTIVITIES

This section describes the soil excavation and backfill (as warranted) activities associated with the excavation work. Before excavation begins, the soil removal areas will be measured and clearly marked on the ground. The associated excavation activities proposed in the sections below are to be completed during business hours (7:00 AM to 5:00 PM) Monday to Friday.

The RAO will include the excavation of shallow lead-impacted soil to remove the direct contact threat to human health and the environment beneath the Site, in an attempt to provide a permanent solution that reduces the toxicity, mobility and volume of contaminated media. The proposed remedial action will target areas where COC concentrations in shallow soil exceed residential ESLs.

5.1. Project Mobilization

Before excavation activities, the Site will be prepared by conducting the following activities:

- Removal and relocation or disposal of miscellaneous items such as trash bins and other miscellaneous items;
- Locate underground utilities using a private utility locate contractor and by contacting Underground Service Alert (USA) so that each utility is conspicuously marked;

- Erecting temporary barricades, cones, and/or caution tape around the perimeter of the remedial excavation area;
- Mark the soil removal areas;
- Decommission any utilities or overhead light poles that lie with the excavation zone;
- Provide an external water source for dust control;
- Set up access and egress paths for equipment;
- Temporary facilities and utilities, such as portable toilets, hand washing stations, electrical and telephone services, and office trailers will be installed as needed;
- Health and safety equipment and supplies will be positioned for use when needed;
- Work zones will be identified and clearly marked. Work zones may include the exclusion, decontamination, and support zones. The exclusion zone will include all areas of excavation, contaminated soil staging area, and the truck loading area. The decontamination zone will be located immediately adjacent to the exclusion zone for the purposes of decontaminating personnel, equipment, and vehicles as they exit the exclusion zone, as warranted. The support zone will be located within the designated work area, but outside of the exclusion and decontamination zone. The support zone will be used to temporarily store equipment, vehicles, clean soil, and personnel;
- The staging area for impacted soils will be identified and marked;
- Other Site-specific precautionary measures, including but not limited to provisions against dust, odor, and storm water run-off will be implemented as necessary.

5.2. Soil Excavation

Excavations will be limited to soils identified as impacted with lead exceeding residential ESLs. Based on the information reviewed, the lead impacts exist above 3 feet bgs vertically and the proposed area of excavation is approximately 0.4 acres (Figure 6). Existing boring logs for the Site (ARS Inc.) show a majority of the excavation area is capped by approximately 1.0 feet of hardscape (*i.e.*, asphalt paving, building foundations) and baserock overlying Site soils. RPS Iris Environmental assumes the hardscaping and baserock layers will be recycled. RPS Iris Environmental estimates the minimum volume of soil requiring excavation and disposal comprises approximately 0.4 acres from 1.0 to 3.0 feet bgs, resulting in approximately 1,300 cubic yards (roughly equivalent to 1,950 tons). Actual yardage/tonnage will depend on results of interim soil sampling for lead, and field screening and confirmation soil sampling during remedial excavation. Excavation may be constrained in some areas by the presence of utilities, encountered material, or Site borders.

5.2.1. Equipment

Excavation and backfill activities may require a combination of the following equipment:

- Front-end loaders and/or bulldozers for excavation, loading, and backfilling;
- Excavators and/or backhoes for excavation and loading;

- A sheepsfoot compactor (roller) for compaction of backfilled soil;
- A water truck for dust suppression and soil compaction efforts;
- Dump trucks for exporting impacted soil and import of clean backfill soil; and
- Other equipment may be used on an as-needed basis, such as jackhammers or handheld compactors for areas where larger equipment access is not possible.

5.2.2. General Excavation Procedure

The excavation procedure will be conducted in the following general sequence:

- Develop staging areas, access paths for equipment, work zones, and decontamination areas for use during remediation to reduce the potential of tracking waste off-Site;
- Identify locations of perimeter air monitoring stations, as necessary, and begin monitoring to comply with Bay Area Air Quality Management District (BAAQMD) regulations, and the health and safety plan;
- Subsurface concrete, if encountered, will be extricated, cleaned, broken into manageable sizes, and disposed or recycled off Site. Crushed concrete may be reused on-Site;
- Excavate contaminated soil from the soil removal areas shown on Figure 6, up to the depths indicated in Section 5.0 above. The excavation sidewalls will be sloped no steeper than 1.5H/1V.
- Soils will be "batched" into 100-, 250-, or 500-cubic yard piles for individual stockpiling, sampling, and profiling. Stockpiled soil will be located a minimum of 10 feet away from the top of excavation. Stockpiled soil will be characterized in accordance with landfill acceptance criteria. Depending on the results of characterization sampling, soils will be disposed to an appropriate off-Site licensed landfill facility.
- After the soil removal area has been excavated to the specified depth and horizontal extent, field screening for lead will be conducted to assist in determining if the RAO has been achieved. Field screening samples will be collected from the side walls and floor of the excavation pit as described in Section 5.5 to determine if remediation goals have been achieved. If field screening detects lead in soil above 80 mg/kg then the excavation limits will be stepped-out as described in Section 5.5. Once field screening concentrations are below the lead residential ESL, or the excavation limit has reached the Site property, confirmation samples will be collected from limited field screening locations. Confirmation samples will be analyzed on an expedited basis. If COCs exceed the remediation goals, then additional soil will be excavated as described in Section 5.5.1.
- Once confirmation sampling indicates that the soil remediation goals have been attained, backfill operations will be initiated, as warranted.

5.2.3. Excavation Backfill

The Site will not be backfilled as a component of the remedial excavation. Grades on the Site will need to come down to for redevelopment purposes. The redevelopment contractor will backfill/grade in accordance with the redevelopment design requirements. Imported soils utilized for backfill would have to meet unrestricted residential Site reuse standards.

5.3. Waste Management

This section describes how waste generated by soil remediation activities will be managed and includes a description of the types of waste anticipated to be generated, soil waste profiling, the transportation plan, and the spill response plan. The following four types of waste are anticipated to be generated at the Site:

- Recyclable construction debris, including concrete rubble and rock. The recyclable construction debris will be transported to a local recycling facility via dump trucks (end dumps). Some crushed concrete may be recycled for reuse on-Site.
- Non-recyclable construction debris including weeds, trash, and discarded personal protective equipment (PPE). The non-recyclable construction debris will be transported and disposed at an offsite landfill via dump trucks or individual drums.
- Soil contaminated with COCs will be transported to the appropriate offsite landfill for disposal via covered dump trucks. Soil impacted with COCs may require additional characterization prior to offsite disposal. If soil is classified as hazardous waste by State and Federal standards, it will be disposed of at the Class I Kettleman Hills Landfill in Kettleman City, California, a licensed and approved facility. If soil is classified as non-hazardous waste by State and Federal standards, it will likely be disposed of at a Class II licensed landfill facility such as:
    - Waste Management's Altamont Landfill in Livermore, California,
    - Republic Services' Vasco Road Landfill in Livermore, California, or
    - Allied Waste's Forward Landfill in Manteca, California.
- Wastewater generated during remediation, such as decontamination liquids, will be temporarily stored onsite. Wastewater may be used to moisten contaminated soil for dust suppression. Any remaining decontamination water will be profiled and transported to an appropriate disposal or recycling facility.

5.3.1. Soil Management Protocols

Iris Environmental estimates the minimum volume of soil waste generated to be approximately 1,300 cubic yards (roughly equivalent to 1,950 tons) based on identified impacts. Actual yardage/tonnage will depend on results of interim soil sampling, and field screening and confirmation soil sampling during remedial excavation. The excavated soils generated during the excavation will be temporarily stockpiled on-Site and appropriately analyzed for offsite disposal purposes. Soil excavated from the Site will need to be stockpiled before it can be transported off-Site for disposal. In consultation with the General Contractor and potential landfill sites, soils will be "batched" into 100, 250, or 500 cubic yard piles for individual stockpiling, sampling, and profiling. The stockpiles will be kept on existing concrete slabs or on plastic liners, and covered with Visqueen-type sheeting to prevent migration of contaminants via airborne dust or storm water runoff. Soil stockpiles will be inspected regularly for integrity and continued effectiveness of implemented control measures.

5.3.2. Groundwater Management Protocols

The potential for groundwater to be encountered at the site is minimal. It is documented that groundwater is past 8 feet bgs, and it is not expected that soils will need to be removed past 3 feet. However, if a saturated zone is encountered during earthwork activities that produces accumulated water it will be temporarily containerized on-Site within portable aboveground industrial holding tanks. Holding tanks should be staged on the existing hardscape (i.e. concrete or asphalt) where feasible.

Containerized groundwater will most likely be non-hazardous. Collected groundwater will be transferred into a vacuum truck or 55-gallon steel drums for off-Site transportation and disposal.

5.3.3. Soil Waste Profiling

Concurrent with the completion of excavation and confirmation sampling, batched stockpiles of excavated soil will be sampled by four-point composite sampling. Each stockpile will be demarcated into quarters, with a single sample collected from each quadrant. The analytical laboratory will composite the four subsamples into a single stockpile sample prior to analyses. Soil stockpiles will be tested for known Site contaminants of concern that may affect soil disposition, specifically:

- Title 22 metals, including lead, by USEPA Method 6010/7470;
- Total petroleum hydrocarbons as diesel and motor oil by Method 8015M;
- Pesticides by USEPA Method 8081; and
- Volatile organic compounds by USEPA Method 8260.

In the event very elevated data are found in a four-point composite sample, RPS Iris Environmental may elect, in consultation with the Client, to have the four individual subsamples run for that specific compound in an attempt to isolate the soils containing the worst impacts for disposal.

5.3.4. Documentation of Soil Waste Management and Disposal Activities

Prior to transporting the excavated soil off-Site, each waste manifest will be signed by the generator or an agent on behalf of the generator. The Contractor will maintain copies of waste manifests (if applicable) and keep an accurate log of the trucks receiving loads for offsite transportation. At a minimum, this form will include the following information:

- Generator name and address;
- Transportation company;
- Accepting facility name and address;
- Waste shipping name and description; and

- Quantity shipped.

Each truck driver will be instructed to use the freeway Call Box System (if available), a cellular telephone, and/or their radio dispatch system to call for roadside assistance and report roadside emergencies.

Permitted disposal facilities operate a certified weight station at their facility. As such, each truck will be weighed before off-loading its payload. Weight tickets or bills of lading will be provided to the removal action contractor after the soil has been shipped off-Site.

5.3.5. Transportation Plan

All transportation activities will be performed in strict compliance with all regulations and ordinances. Some of the impacted soil and waste material is anticipated to be classified as California or Federal hazardous waste. The hauling contractor(s) used to transport non-hazardous or hazardous waste will be fully licensed and permitted by the State of California. For hazardous waste haulers, the selected transportation company will be certified by the State of California as a hazardous waste hauler, and appropriately permitted to haul contaminated waste material. All Department of Transportation (DOT) and California Highway Patrol (CHP) safety regulations will be strictly followed by both hazardous and non-hazardous waste haulers.

Transportation equipment will be chosen to safely transport the expected volumes of soil, taking into consideration the types of roads to be traveled and their loading capacity. Routine truck maintenance and repairs will be performed at the contractor's premises prior to picking up loads of waste material from the Site.

Non-hazardous and hazardous material could be expected to be generated during remediation procedures. Material that is classified as non-hazardous will be transported to one of the three landfills above. Material that is classified as hazardous waste will be transported to the Waste Management, Inc., Kettleman Hills Landfill located at 35251 Old Skyline Road, Kettleman City, California, or approved alternative.

A detailed log of the loads hauled from the Site will be maintained. The log will include, at a minimum, the date and the time trucks were loaded and off-loaded, the destination, size (volume and weight) of the load, description of contents, name and signature of the hauler, and name and signature of the contractor's representative. The waste will be off-loaded for treatment or disposal in a manner consistent with current Federal, State, and local regulations. Shipments of hazardous waste will be tracked with the appropriate hazardous waste manifests.

During loading, dust and odor emissions will be monitored and mitigated as necessary. During transportation, the hauling trucks will be equipped to fully cover all soil and debris, such as with a heavy tarpaulin.

5.3.6. Spill Response Plan

In the event of a spill, the remediation contractor will be responsible and prepared to respond in a safe and efficient manner, specific to the particular spill situation. Standards will be set and consistent procedures will be used for handling of spills, whether they are on-Site spills or spills occurring during transportation. Haulers will have an Emergency Spill Contingency Plan (ESCP, a uniform reporting procedure) to ensure that all drivers and dispatchers know their responsibilities in the unlikely event that an accidental spill occurs while transporting contaminated material off-site. The drivers and dispatchers will be required to know the procedures for emergency spill response. The ESCP will meet or exceed all Federal, State, and County regulations currently in effect. The provisions of the ESCP will be strictly adhered to, in order to ensure continued protection of the public safety and the environment. The project specific health and safety plan will address the handling of on-Site spills.

5.4. Environmental Controls

This section describes how certain environmental factors will be controlled and consists of a description of noise, dust and fugitive emissions, odor and vapor emissions, decontamination procedures, storm water management plan, and supplemental environmental controls.

5.4.1. Noise

The purpose of the noise monitoring and control plan is to identify noise sources, receptors, and monitoring methods, and to reduce the noise level during the remediation activities via engineering mitigation measures. Potential noise receptors consist of on-Site workers, oversight personnel, general public, and nearby residents and workers. Expected sources of noise during remediation may include typical construction equipment such as heavy earth moving vehicles and machinery, and generator operation. To reduce the noise level during remediation activities, the following practices will be followed during the remediation:

- Equipment operation shall be restricted to hours compliant with City of Oakland requirements; and
- In general, the excavation equipment to be used at the Site is not exceedingly large and will be properly and routinely maintained to keep noise levels relatively low.

As warranted, a noise level meter may be used to monitor the noise at the perimeter of the remediation activities during each stage. If monitoring of noise indicates that the levels are above 85 dBA at the perimeter of the Site, then appropriate measures will be taken to implement additional engineering controls to reduce the noise levels. These measures may include the following:

- Mufflers may be used on equipment;
- Sound barriers may be installed to deflect sound from sensitive areas;
- Alternate equipment may be considered; and
- Staggering of equipment operation may be implemented.

5.4.2. Dust Emissions

To comply with the BAAQMD rules, standard dust control measures (including water spray application) will be followed during the remediation. Successful dust mitigation will accomplish the following goals:

- Reduce the potential for health impacts to workers;
- Reduce the potential for health impacts to facility neighbors;
- Prevent violations of ambient air quality standards;
- Minimize nuisance dust complaints from facility neighbors; and
- Minimize the migration of contaminants adhered to fugitive dust particles outside the Site.

On-Site monitoring of dust levels will be implemented as required. Dust levels will be monitored during excavation activities directly outside the excavation area, as well as at the Site perimeters. If the monitoring data at the Site perimeters indicates dust levels are beyond the limits established by BAAQMD (Regulation 6, Particulate Matter and Visible Emissions) or California Ambient Air Quality Standards (CAAQS), then additional engineering control measures, such as foam spray, will be implemented to reduce the dust levels. RPS Iris Environmental has confirmed the BAAQMD and CAAQS dust thresholds are protective of neighboring receptors, using DTSC's LeadSpread 8 model. A site-specific calculation, considering the dust inhalation pathway only (no soil ingestion or dermal contact), and a calculated lead 95% UCL of 1,315 mg/kg in the excavation area yields a calculated airborne dust concentration over 320 $\mu g/m^3$ would be needed to hit California EPA's benchmark blood level. The Lead Risk Assessment Spreadsheet that includes the calculation for maximum allowable dust concentrations is provided in Appendix A. RPS Iris Environmental recommends setting a conservative dust action level at 50 $\mu g/m^3$ for a daily average, and 250 $\mu g/m^3$ for a 15-minute average. In the event that active stockpiles of contaminated soil or surface excavations are left overnight, the exposed portions will be properly covered with plastic to reduce dust emissions.

5.4.3. Odor and Vapor Emissions

While not expected, the primary potential sources of odor and vapor emissions at the Site will be from the isolated, and low-level, TPH-impacted soil, which may emit petroleum-like odors.

By controlling the dust as described in Section 5.4.2, the emission of odor and vapors will be reduced to levels that likely will not pose a risk to the health of the public and remediation personnel. The water spray used to control dust will also significantly reduce the emissions of any potential volatiles that may be present in the soil. The selective loading and transportation of impacted soils could minimize the use of soil stockpiling, further reducing potential emissions of volatiles. Any active stockpile of contaminated soil or exposed excavation left overnight at the Site will be properly covered with plastic so emissions of volatiles will be minimized.

If odor is excessive and vapor emissions are detected, some or all of the following mitigation procedures may be implemented:

- Use of chemical suppressants mixed with water and applied using various applications such as spray or mist;
- Use of plastic sheeting to cover the sidewalls of the trench during non-active remedial activities will minimize the migration of VOCs and odors;
- Alternative work sequencing, such that excavation of soil with potential odor during mid-day or afternoon (during hot weather) is avoided;
- Any highly odorous soil could be segregated and placed inside a roll-off bin equipped with a lid. This will minimize the amount of highly odorous soil during loading; and
- Balancing the excavation with transportation so that the need for large stockpiles is reduced.

Other emissions include exhaust from remediation equipment. The equipment proposed for the Site remediation will be maintained properly so that exhaust emissions will be within acceptable standards.

5.4.4. Decontamination Procedures

In order to prevent residual contamination from leaving the Site by construction equipment and personnel, decontamination procedures have been developed. These procedures are outlined as follows:

- Prior to loading excavated materials into trucks, plastic sheeting will be placed on the ground such that any spilled material will be prevented from contacting the ground surface. Upon completion of loading, any debris will be placed in the transportation vessel and the plastic sheeting will be reused, or disposed.
- As necessary, all equipment wheels/tires will be cleaned over plastic sheeting by means of shovels and stiff-bristled brooms or brushes until they are fully cleaned. Upon completion of cleaning, any debris will be placed in the appropriate transportation vessel and the plastic sheeting will be folded and disposed.
- Personal protective equipment, such as disposable coveralls, will be removed and discarded in the contamination reduction zone. In order to decontaminate reusable items such as work boots, a two-stage decontamination process will be used. This process will include washing in a detergent solution with a stiff-bristled brush and rinsing in clean water. The rinsate water will be distributed over contaminated soil (to be exported) for dust control purposes.

5.4.5. Storm Water Management Plan

Other environmental controls may be required in the event that anticipated conditions at the Site change. In the event that the remediation activities occur during the rainy season, then water management procedures will be implemented in addition to probable modifications of other plans, such as the Health and Safety Plan. The following procedures will be implemented at the Site during the rainy season:

- The weather forecast will be monitored. During the days heavy rain is forecasted, remediation activities may be stopped;
- The boundary of the remediation area will be properly bermed to prevent storm water from entering or leaving the remediation area;
- Storm water entering the remediation area from non-impacted areas and storm water originating within the excavated area will be pumped to settlement tanks and treated prior to discharge under permit;
- The excavation will be conducted in small sections so the exposed excavated area can be covered immediately if heavy rains occur;
- Procedures will be used to prevent wet soil from sticking to the tires of trucks used to haul soil off Site. These procedures may include plastic sheeting at the loading area, a tire wash at Site egress paths, and/or a stabilized gravel construction entrance; and
- Plastic sheeting will be used extensively to cover the area of excavation during non-working hours.

In general, the excavation will be kept as dry as possible in order to minimize the waste generated and the backfilling (as necessary) of the excavation can be conducted promptly. A SWPPP will be prepared for the Site and a Notice of Intent (NOI) for discharging storm water under the terms of the general permit for construction activity will be submitted to the SFRWQCB. The NOI will be submitted before remediation activities expose soil at the Site.

5.5. Sampling and Analysis Plan

The objective of the sampling and analysis plan is to set the protocols for field screening and collection of soil samples to document that the RAOs were achieved after completion of the soil removal. The remediation goal is to remove soils with elevated concentrations of COCs to the point where remaining soils contain COCs below their respective residential direct exposure ESLs. Confirmation samples will be collected following excavation and field screening. A comprehensive analysis of field screening and confirmation sampling will be used to determine if the excavation has reached the RAO. Specifically, sampling will not be conducted at every field screening location. Soil sampling results will be conducted at select field screening locations and the results from both will be compared. Based on available literature on the field screening method proposed, RPS Iris Environmental expects the field screening results to have the capability to identify the excavation limits. Select field screening locations will be subjected to confirmation sampling to confirm the excavation limits and that the RAO has been achieved.

5.5.1. Field Screening

To reduce the extent uncertainty of soil impacts, and expedite remediation in case additional impacts are observed, soils will be field screened for lead utilizing an x-ray fluorescence (XRF) analyzer to help determine the excavation limits. An XRF analyzer is capable of measuring real-time lead concentrations in soils. RPS Iris Environmental proposes to use a Thermo Scientific Niton XL2 GOLDD Series Environmental Analyzer, or equivalent. This XRF model is reported to have a lower lead detection limit between 7 and 12 mg/kg depending on soil composition.

These specifications are provided in Appendix B. There is precedence in the San Francisco Bay Region to use XRF technology ancillary to confirmation soil sampling for excavation of lead impacted soil to assist in confirmation sampling for lead excavation (Harding 2002) and an Oregon based study has shown excellent correlations for lead (Clark 1999). Additional XRF references include an initiative to identify lead impacts in Berkeley City homes using XRF's (Ridley 2015), screening for toxic metals in packaging recognized by DTSC, screening for lead in soils recognized by the California Department of Public Health (CDPH) (State of California 2016). The reported detection limit is well below the residential ESL of 80 mg/kg for lead. This will provide immediate approximations for lead in soils during excavation, and lend confidence that the RAO has been accomplished before laboratory confirmation sampling results are returned. The approach is designed to avoid or minimize iterative RUSH sampling and analysis events (and corresponding iterative over-excavations) that delay redevelopment activities.

After the proposed area illustrated in Figure 6 is excavated to 3 feet bgs, field screening will be conducted along the sidewall every 25 linear feet at approximately 1.5 to 2.0 feet bgs. Additionally, field screening will be conducted every 500 square feet from the floor (approximately 3.0 feet bgs) of the excavation area. If field screening indicates that lead in the excavation limits is above residential ESLs then the excavator will step out in the direction where exceedances are noted. Specifically, if field screening indicates an exceedance in the side wall, the horizontal limits will be extended an additional 5 feet in the direction of the side wall, and limited to the distance between the two closest side wall field screening locations. In the event field screening indicates a floor sample exceeds residential ESLs the vertical limits will be extended 0.5 feet bgs and limited to the nearest vertical screening locations where clean soil was observed. An illustration of the projected number of field screening locations based on the current proposed excavation area is provided in Figure 7. This would be expected to change if additional impacts are identified.

Field screening will be conducted in accordance with the methodology provided by the manufacturer of the XRF analyzer.

5.5.2. Confirmation Sampling

After field screening indicates that the remedial goal has most likely been reached, soil samples will be collected from the sidewalls of the excavation using a systematic approach. To represent the chemical concentration of the sidewalls of the excavation cell, confirmation samples will be collected from the "passing" field screening locations (those with lead measured at less than 80 mg/kg). The number of confirmation samples proposed is 50% the number of samples collected for field screening where samples were indicated to be below 80 mg/kg. The confirmation samples will be collected from all four excavation side walls equidistant from each other, and from the excavation floor in a predetermined grid based on the final number of field screened locations. An illustration of the projected number of confirmation sampling locations based on the current proposed excavation area is provided in Figure 9. This confirmation approach would result in approximately 37 field sampling locations and 18 confirmation soil samples. The sampling and analysis plan is expected to change if additional impacts are identified. Specifically, Iris Environmental may recommend a Site-specific confirmation sampling plan that considers historic sampling, future redevelopment features, and Site environmental risks when proposing sampling locations and density.

Sidewall samples will be collected in 3- to 6-inch stainless steel sleeves or glass jars. Before sampling, any loose soil will be brushed off the excavation surface to expose undisturbed soil for collection. Soil samples will be collected in stainless steel sleeves using a manual slide hammer, or placed into glass jars using a stainless steel trowel. Sleeves will be filled fully with soil and capped with Teflon sheets, covered with plastic end caps attached with silicone tape. Samples will be labeled, placed in re-sealable plastic bags, and stored on ice in a cooler until delivered under chain-of-custody to the laboratory. Samples will be stored in a freezer at the laboratory pending results. Each confirmation sample will have a unique identification number that will describe the location and depth of the sample.

5.5.3. Confirmation Sampling Laboratory Analyses

Confirmation samples will be analyzed for lead by USEPA Method 6010. Laboratory reporting limits or detection limits will be sufficient to compare the results to the residential ESL for lead. Samples will be analyzed during excavation activities by a California-certified laboratory, likely on an expedited turnaround time. Analytical results will be reviewed to ensure adequate quality assurance/quality control and used to determine if additional excavation is needed. Quality assurance and quality control review will include an assessment of the laboratory's performance criteria (including surrogates, spikes, and laboratory control samples) as well as a review of equipment blanks. Equipment blanks will be collected at a frequency of one per 20 soil samples.

Results of confirmation sampling will be evaluated to determine if additional excavation and confirmation sampling are necessary. To achieve this, analytical results will be compared to the residential ESL for lead. For both sidewall and bottom confirmation samples, if analytical results exceed remediation goals, then additional over-excavation will occur.

5.6. Documentation of Remedial Excavation Activities

Prior to remedial excavation activities, photo-documentation of the Site will be performed. The photographs will show the condition of the Site prior to work activities. Photographs will be taken with a digital camera. The anticipated excavation limits will be marked and documented.

During excavation, the Contractor will be responsible for maintaining a field logbook, which will serve to document observations, personnel on site, equipment arrival and departure times, and other important project information. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. Specifically the contractor will maintain daily logs that, at a minimum, will include:

- Sign-in and sign-out of all personnel at the Site;
- Activities conducted;
- Excavation material types and quantities. The remediation contractor will be responsible for detailing the excavation material quantities and types;
- Materials hauled to the Site, material used, and excess material hauled off Site;

- Equipment used;
- Demarcated excavation area boundaries;
- Field monitoring equipment readings and calibration;
- A record of all formal Site meetings such as health and safety meetings, daily tailgate meetings, and agency meetings;
- Entries will be legible, written in black or blue ink, and signed by the author;
- Language will be factual and objective;
- If an error is made, corrections will be made by crossing a line through the error and entering the correct information; and
- Corrections will be dated and initialed.

5.7. Discovery of Unexpected Underground Structures

Redevelopment activities may reveal unexpected conditions such as previously unidentified areas of contamination or underground structures. Contingency protocols to be followed in this situation are described in this section.

5.7.1. Discovery of Unexpected Underground Structures

While not expected, during excavation and construction, it is possible that unexpected USTs, hoists, sumps, maintenance pits, pipelines, or other underground structures may be discovered. USTs may be identified during grading and Site excavation activities by the presence of vent pipes that extend above the ground surface, product distribution piping that leads to the UST, fill pipes, backfill materials, or the underground structure itself. Other buried structures may not have features that extend above ground surface, and could be discovered only after contact with construction equipment.

The following section outlines the measures that govern identification and removal of USTs, and appropriate measures for addressing other underground structures identified during development. In the event of such discoveries, a qualified environmental professional will be contacted immediately to assess the appropriate course of action.

5.7.2. Removal of USTs

ACEH is the Local Oversight Program (LOP) responsible for overseeing removal of USTs at the Site. In the event that USTs or product lines are encountered during redevelopment, the County Certified Unified Program Agency (CUPA) inspector from ACEH shall be notified. The current CUPA contact information is presented in Section 6.2. Other pertinent state/local agencies (*i.e.*, Oakland Fire Department) may be notified and engaged, in the event USTs or apparent piping are discovered during redevelopment activities at the Site.

Per Chapter 6.7 of the California Health and Safety Code, which contains specific requirements for removing and remediating contamination associated with a leaking UST, removal activities will be conducted to prevent potential damage to the UST and/or a release to the subsurface. Environmental investigations and responses required following removal of the UST will also be conducted in accordance with the specific provisions delineated in Chapter 6.7 and under the direction of the applicable regulatory agency.

5.7.3. Removal of Other Subsurface Structures

If subsurface structures other than USTs are discovered during construction activities, such as underground vaults, hoists, sumps, and associated piping, they should be inspected to assess whether chemical residuals or free liquids other than water are present. This assessment will be made by a qualified environmental professional relying on visual observations, detection of chemical odors, and field PID measurements.

If there is no indication that chemicals are or were present within the structure, then removal of the structure is not necessary for environmental reasons.

If a sump or vault contains residues (liquids or solids) that appear to be chemical-containing based on field observations (visual, odor, or PID readings), the following steps will be implemented:

- Contain and protect liquids to avoid spills to the subsurface.
- Characterize chemical-containing residues and/or soils, and assess the appropriate response action. Chemical-containing substances will be sampled for profiling purposes, followed by proper removal and disposal under the direction of the qualified environmental professional (as previously defined). The appropriate regulatory agency will be notified and engaged prior to the selection of an appropriate response.
- Inspect the structure for cracks and holes once the residues and/or chemical-containing soils are removed.
    - If, based on the opinion of the qualified environmental professional, it is assessed that the structure is intact, that subsurface releases of the chemicals to the underlying soils likely did not occur, and no free-phase liquids or chemical residues remain inside, removal of the structure is not required for environmental reasons.
    - If the physical inspection of the structure suggests that chemicals may have been released to the underlying soils:
        - Conduct additional environmental investigations of the underlying soils to assess whether a release sufficient to warrant removal has occurred. If, based on the opinion of the qualified environmental professional, it is assessed that such a release, has not occurred, then removal of the structure is not required for environmental reasons; or,
        - Remove the structure under the guidance of the qualified environmental professional.

5.8. Post-Construction and Long-Term Risk Management Measures

In accordance with the objectives of this RAP, future precautions or mitigation measures will not be necessary for the long-term management of risks to human health and the environment for Site specific COCs. This RAP outlines a RAO through excavation of shallow soils that will achieve the specified objective to return the Site to an unrestricted re-use scenario. Land-use or long term engineering controls will not be required. If there are any indications otherwise throughout project lifespan the Owner and ACEH will be notified appropriately.

6.0 REMEDIAL ACTION PLAN FOR LEAD EXCAVATION REPORTING AND SCHEDULE

6.1. Modifications

If an alternate design or mitigative measure other than referenced in this RAP, the proposed design should demonstrate how the alternative design or mitigative measure would be protective of human health and the environment should be developed. The proposed alternate design or mitigative measures should be included in a design report prepared by the contractor proposing such changes and submitted to the then-current owner/project developer for review and approval before implementation.

6.2. Site Contact List

In the event of encountering a condition that requires notification, the pertinent contacts are as follows:

- Mr. Colby Northridge, Oakland International Housing Partners L.P. (415) 677-9000, cnorthridge@related.com
- Mr. Nicholas Loizeaux, P.G., RPS Iris Environmental, 510.834.4747 x14, nloizeaux@irisenv.com
- Mr. Mark Detterman, P.G., CEG, Alameda County Environmental Health, 510.567.6876, mark.detterman@acgov.org
- ACEH CUPA, 510-567-6700, dehalamedacers@acgov.org

6.3. Schedule

RPS Iris Environmental will initiate the proposed remedial actions upon approval of this RAP. In the interim, RPS Iris Environmental proposes additional shallow soil sampling for lead. The proposed remedial activities presented in this RAP will be effective in removing soil containing COCs above Site-specific RAOs to the extent practical. Due to the time sensitive nature to complete this work and begin redevelopment activities, we respectfully request expeditious review and approval of this RAP. The following tentative schedule is proposed:

March 21, 2016 Submit RAP for ACEH approval

March 23, 2016	Deliver Neighborhood Notices/Begin 30-day Review Period
March/April 2016	Implement interim soil sampling for lead
April 22, 2016	30-day Review period ends
April 25, 2016	Implement proposed RAP activities

6.4. Reporting

Upon completion of the excavation activities and receipt of the laboratory analyses, Iris Environmental will prepare a Remedial Action Completion Report (RACR) documenting the scope of work conducted and associated findings. The RACR will include a description of the Site, summary of remedial methodologies, summary tables of the analytical data, figures, findings, conclusions and recommendations, as appropriate. Appendices will also be provided, which will include field forms, certified analytical reports, and copies of truck weight tickets and/or bills of lading. A request for closure with NFA status and unrestricted site reuse classification will be submitted to ACEH with the RACR.

7.0 REFERENCES

Applied Remedial Services. 2015. *Soil Investigation Report, 94th and International Blvd., Oakland, California*. July 26.

Applied Remedial Services. 2015. *Step-out Soil Investigation Report, 94th and International Blvd., Oakland, California*. September 14.

Cal/EPA Department of Toxic Substances Control (DTSC). 2011. *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (2011 VIG)*. Final. October.

Cal/EPA. 2016a. *February 2016 Update to Environmental Screening Levels*. California Regional Water Quality Control Board (RWQCB). San Francisco Bay Region. February 22.

Cal/EPA. 2016b. *User's Guide: Derivation and Application of Environmental Screening Levels (ESLs).* California Regional Water Quality Control Board (RWQCB). San Francisco Bay Region. Interim Final. February.

California Environmental Protection Agency (Cal/EPA). 2016c. *DTSC/Office of Human and Ecological Risk (HERO) Human Health Risk Assessment (HHRA) Note Number 3.* DTSC Recommended Methodology for Use of U.S. EPA Regional Screening Levels (RSLs) in Human Health Risk Assessment Process at Hazardous Waste Sites and Permitted Facilities. Department of Toxic Substances Control. January.

Clark S, Menrath W, Chen M, Roda S, Succop P: *Use of a field portable X-Ray Fluorescence analyzer to determine the concentration of lead and other metals in soil samples*. Ann Agric Environ Med 1999, **6**, 27–32.

Consulting Associates of California. 2015. *Phase I Environmental Site Assessment, 9400-9500 International Boulevard, Oakland, California*. June 25.

Duvergé, D.J. 2011. *Establishing Background Arsenic in Soil of the Urbanized San Francisco Bay Region*. A thesis submitted to the faculty of San Francisco State University, In partial fulfillment of The Requirements for The Degree, Master of Science in Geosciences. December.

D. Williams-Ridley. 2015. *Berkeley Lead Poison Prevention and Control*. Planning and Development Department. Berkeley, California. October 13.

G. Lieberman and D. Cover. 2002. *Lead Impacted Soil Summary Report and Sampling and Removal Action Workplan NASA Research Park*. Harding ESE. Moffett Field, California. Final. July 24.

RPS Iris Environmental. 2015. *Report of FOIA File Review Requests and Limited Phase II Subsurface Site Investigation, 9400-9500 International Boulevard, Oakland, California*. November 4.

L. J. N. Bradley, B. H. Magee, and S. L. Allen. 1994. *Background Levels of Polycyclic Aromatic Hydrocarbons (PAH) and Selected Metals in New England Urban Soils*. Journal of Soil Contamination, 3(4): 1994

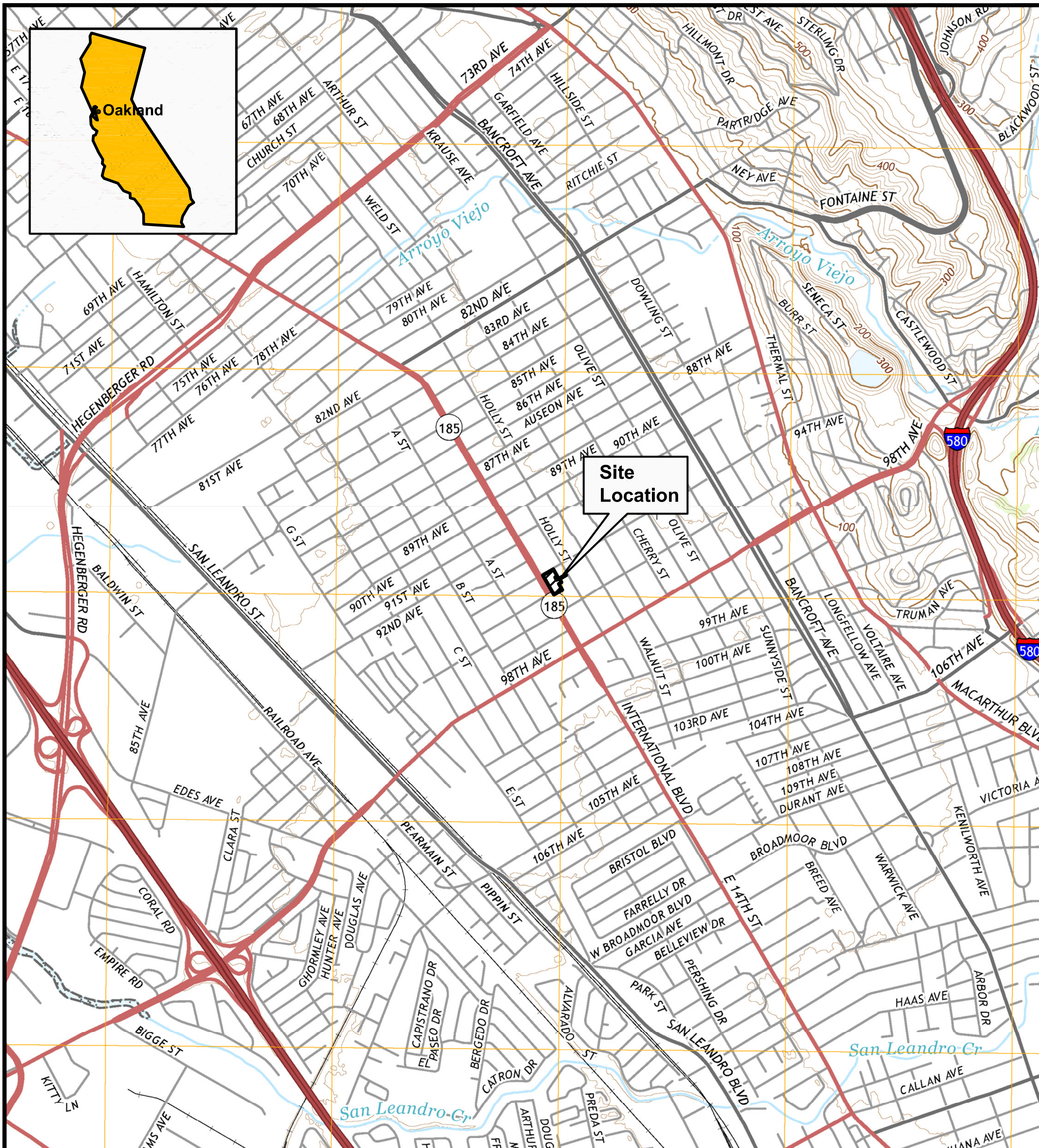
San Francisco Regional Water Quality Control Board (RWQCB). 2007. *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater*. Interim Final. November.

Toxics in Packaging Clearinghouse. 2012. *An Assessment of Heavy Metals in Packaging: A Focus on Flexible PVC from Discount Retail Chain Stores.* Northeast Recycling Council, Inc. June 28.

USEPA. 2015a. Regional Screening Levels (RSLs) - Generic Tables. November 2015. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015.

USEPA. 2015b. Vapor Intrusion. June. Available at: https://www.epa.gov/vaporintrusion

Figures



Source: USGS 7.5' Quadrangle, San Leandro/Oakland East, California, 2015

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Site Location Map
9400-9500 International Boulevard
Oakland, California

Figure
1

Drafter: EC
Date: 02/08/16
Contract Number: 15-1325A

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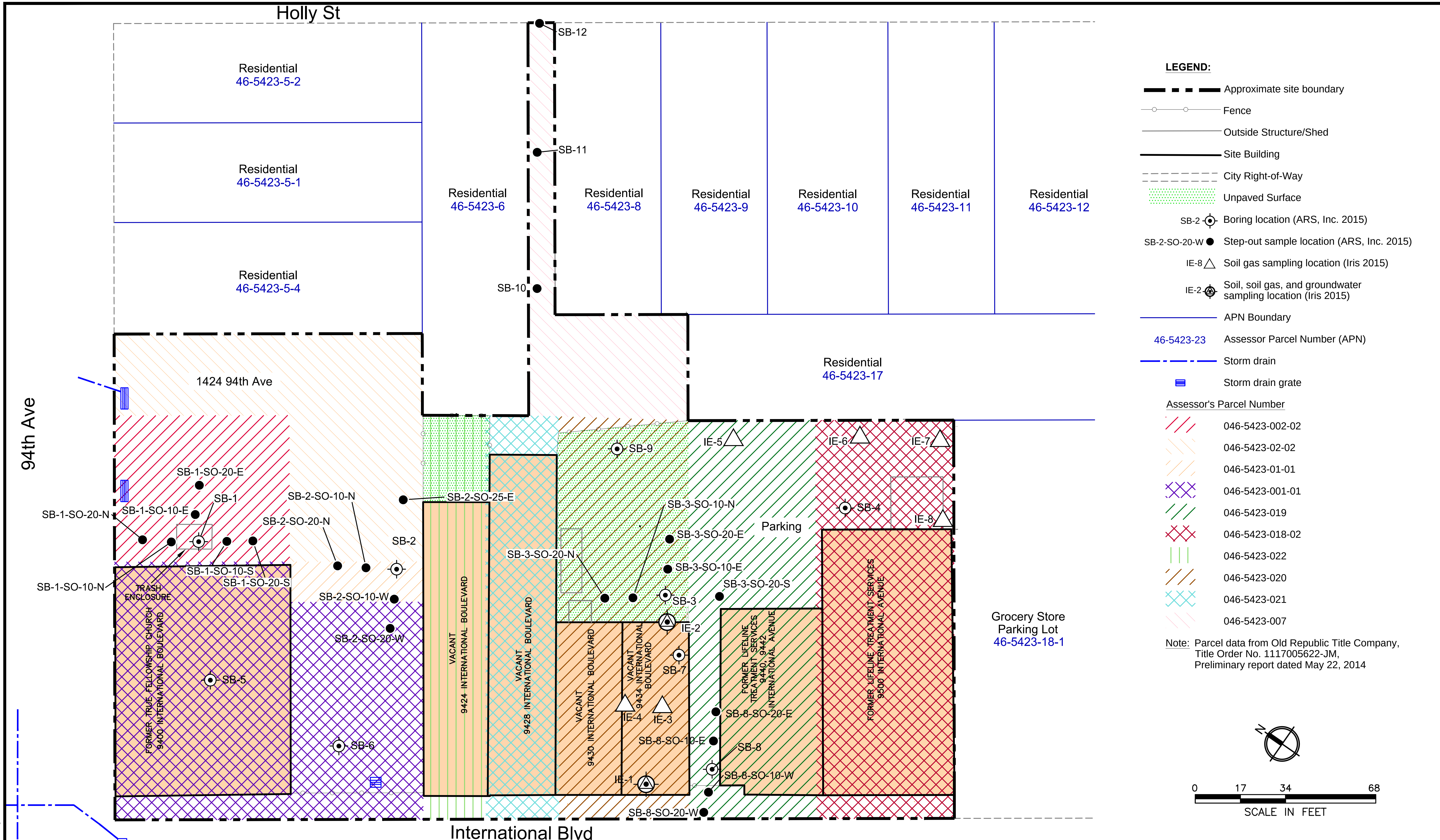

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Site Plan and Historical Boring Locations
9400-9500 International Boulevard
Oakland, California

Figure
2

Drafter: EC

Date: 03/18/16

Contract Number: 15-1325A

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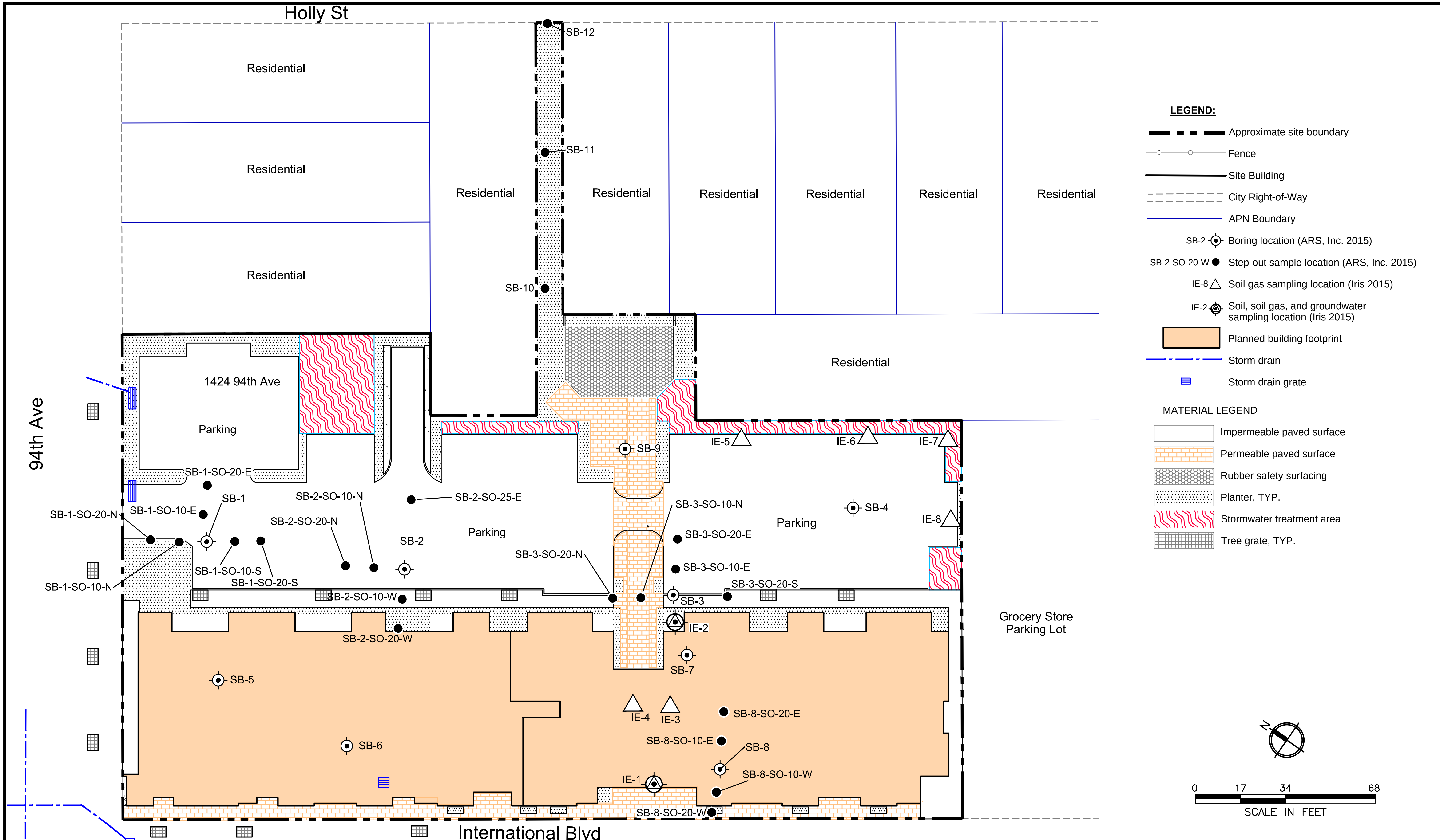

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Proposed Building and Historical Boring Locations
9400-9500 International Boulevard
Oakland, California

Figure
3

Drafter: EC
Date: 03/10/16
Contract Number: 15-1325A

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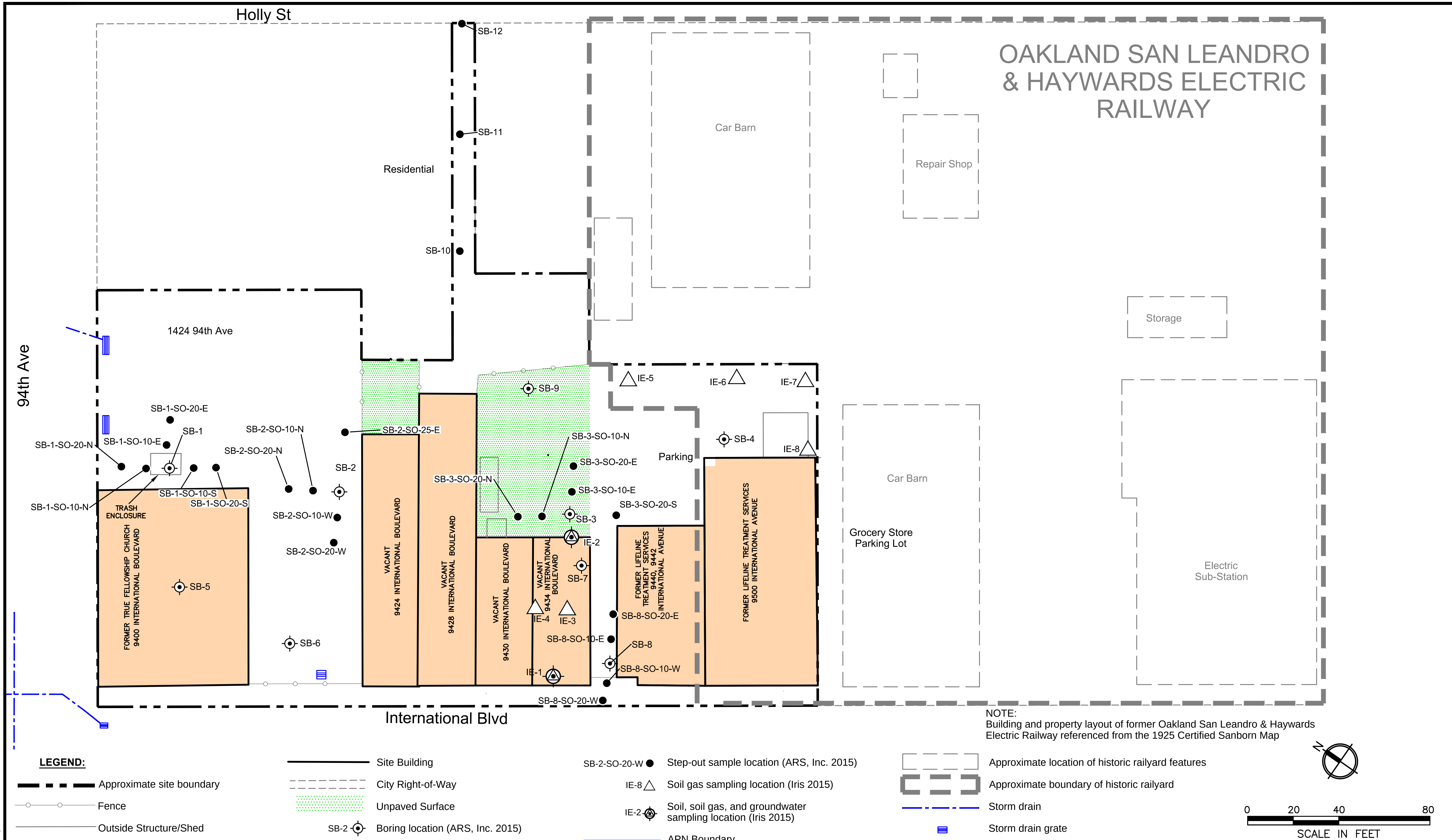

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Layout of Former Oakland San Leandro & Haywards Electric Railway
9400-9500 International Boulevard
Oakland, California

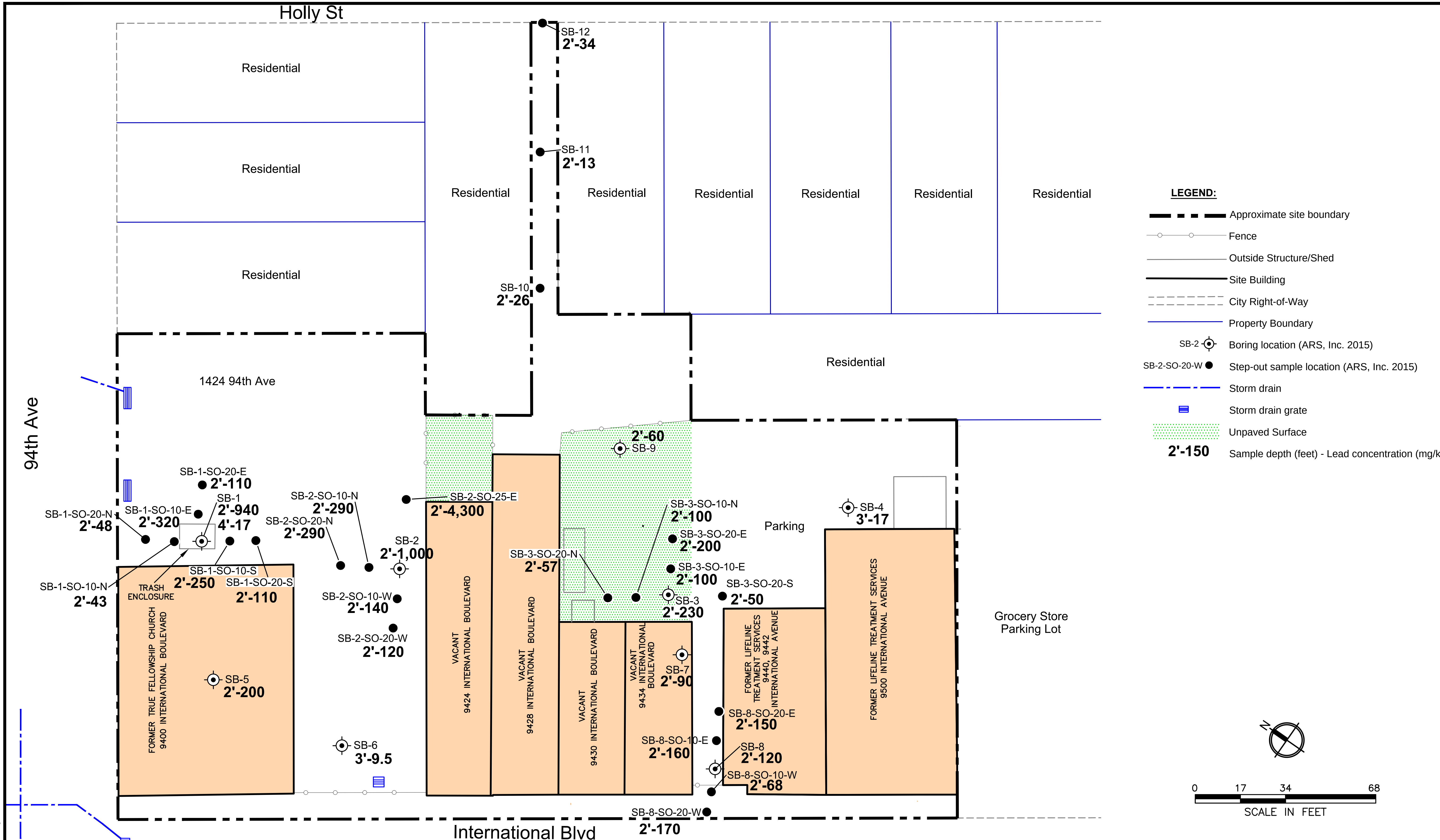
Figure **4**

Drafter: EC

Date: 03/16/16

Contract Number: 15-1325A

I:\CAD\15\15-1325-A\excavation cells.dwg



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Lead Concentrations in Shallow Soils
9400-9500 International Boulevard
Oakland, California

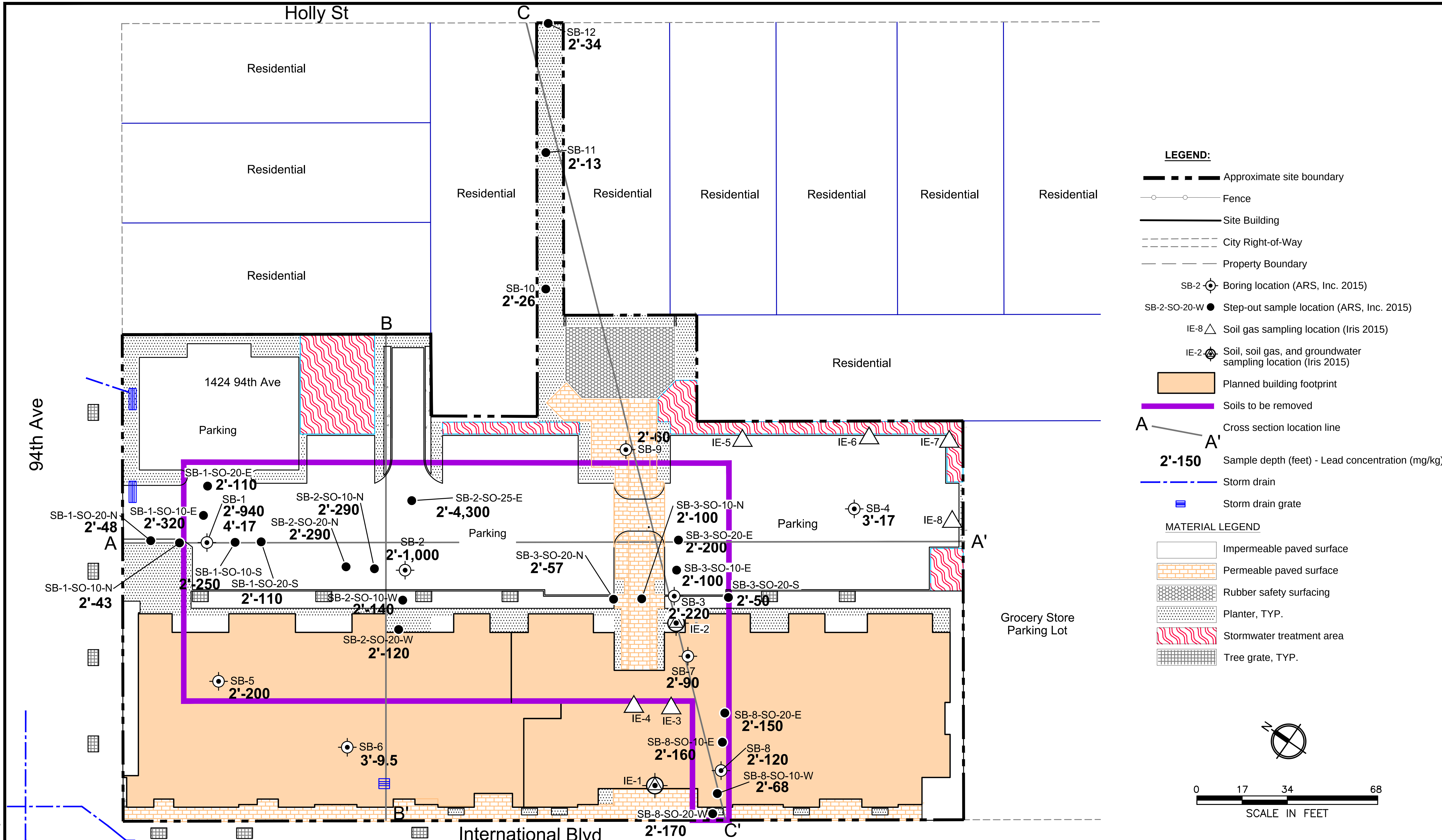
Figure
5

Drafter: EC

Date: 03/18/16

Contract Number: 15-1325A

I:\CAD\15\15-1325-A\excavation cells.dwg



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Proposed Excavation Area
9400-9500 International Boulevard
Oakland, California

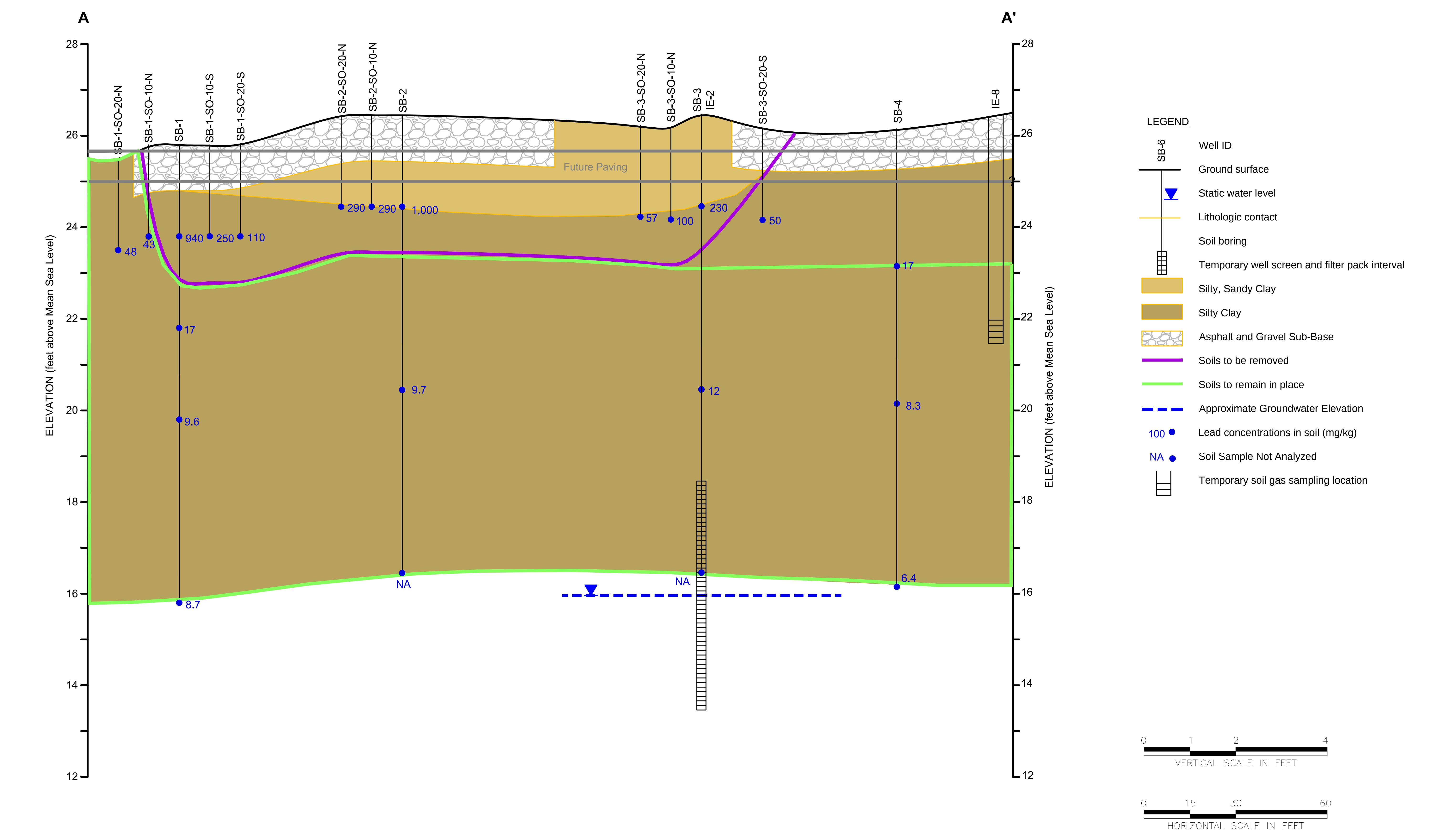
Figure **6**

Drafter: EC

Date: 03/10/16

Contract Number: 15-1325A

I:\CAD\15\15-1325-A\excavation cells.dwg



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Geologic Cross Section A-A' and Lead Concentrations in Shallow Soils
9400-9500 International Boulevard
Oakland, California

Figure
7a

Drafter: EC | Date: 03/16/16 | Contract Number: 15-1325A

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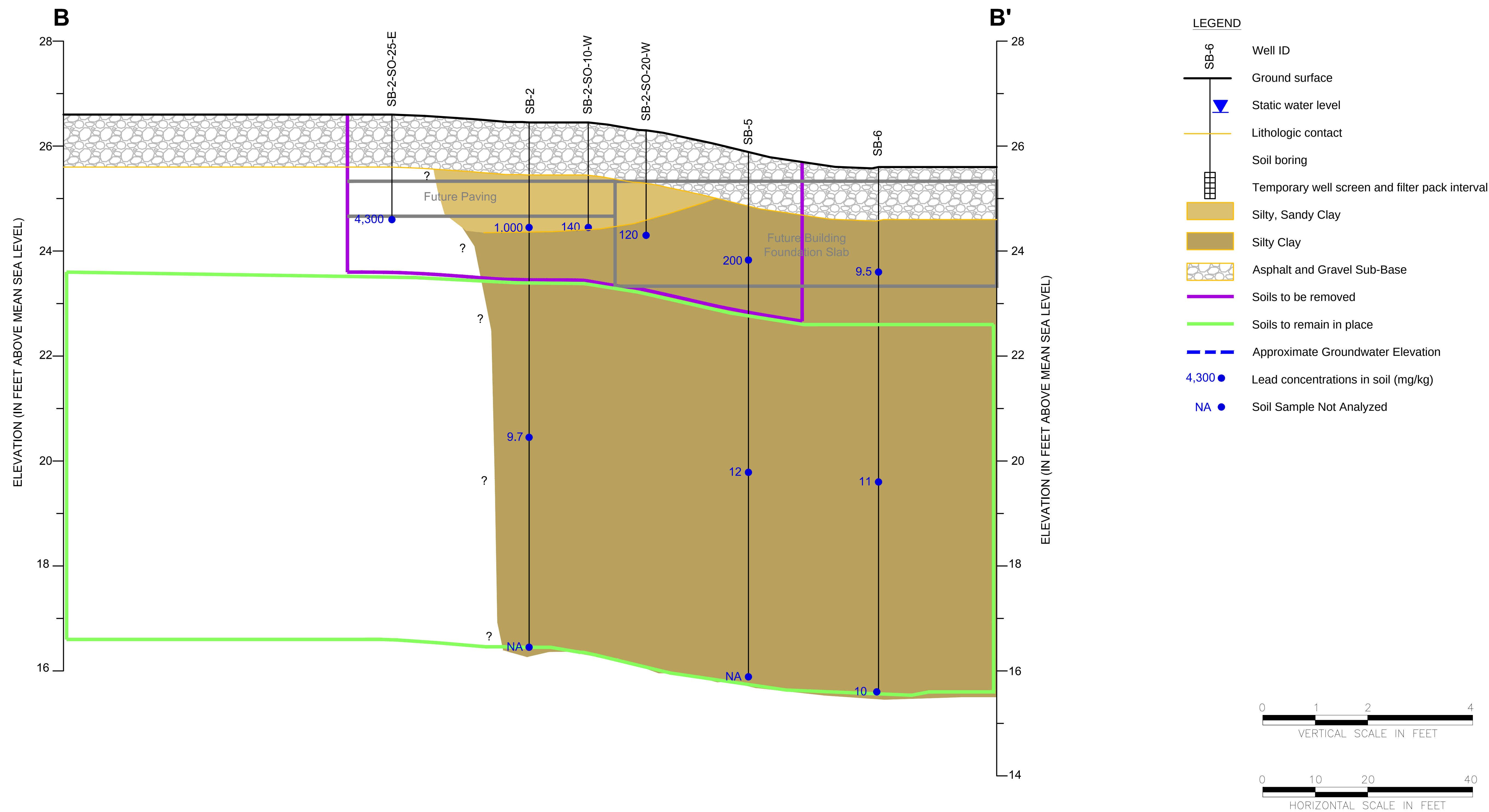

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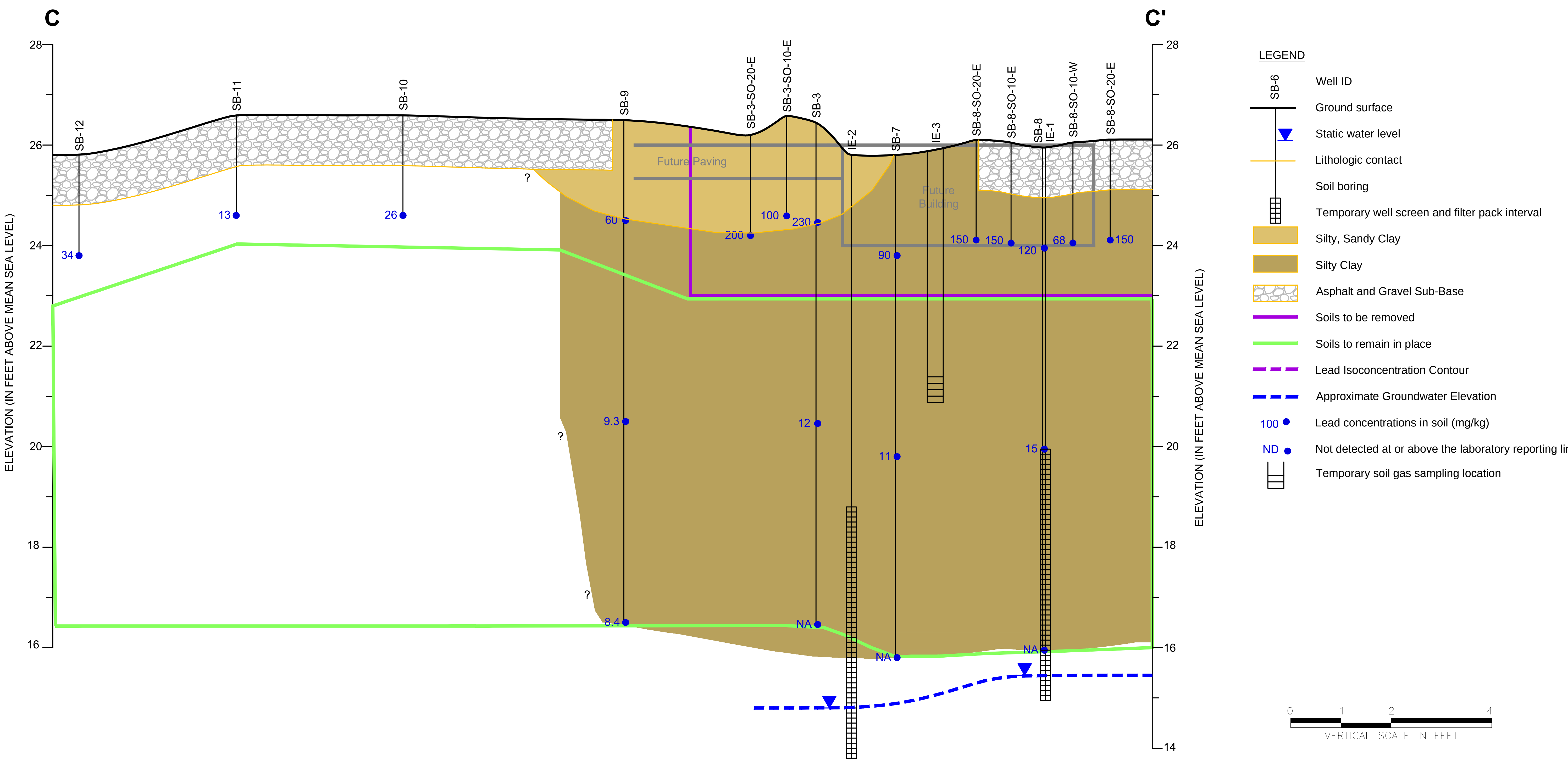
Geologic Cross Section B-B' and Lead Concentrations in Shallow Soils
9400-9500 International Boulevard
Oakland, California

Figure
7b

Drafter: EC
Date: 03/16/16
Contract Number: 15-1325A

I:\CAD\15\15-1325-A\Cross sections.dwg



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Geologic Cross Section C-C' and Lead Concentrations in Shallow Soils
9400-9500 International Boulevard
Oakland, California

Figure
7c

Drafter: EC

Date: 03/16/16

Contract Number: 15-1325A

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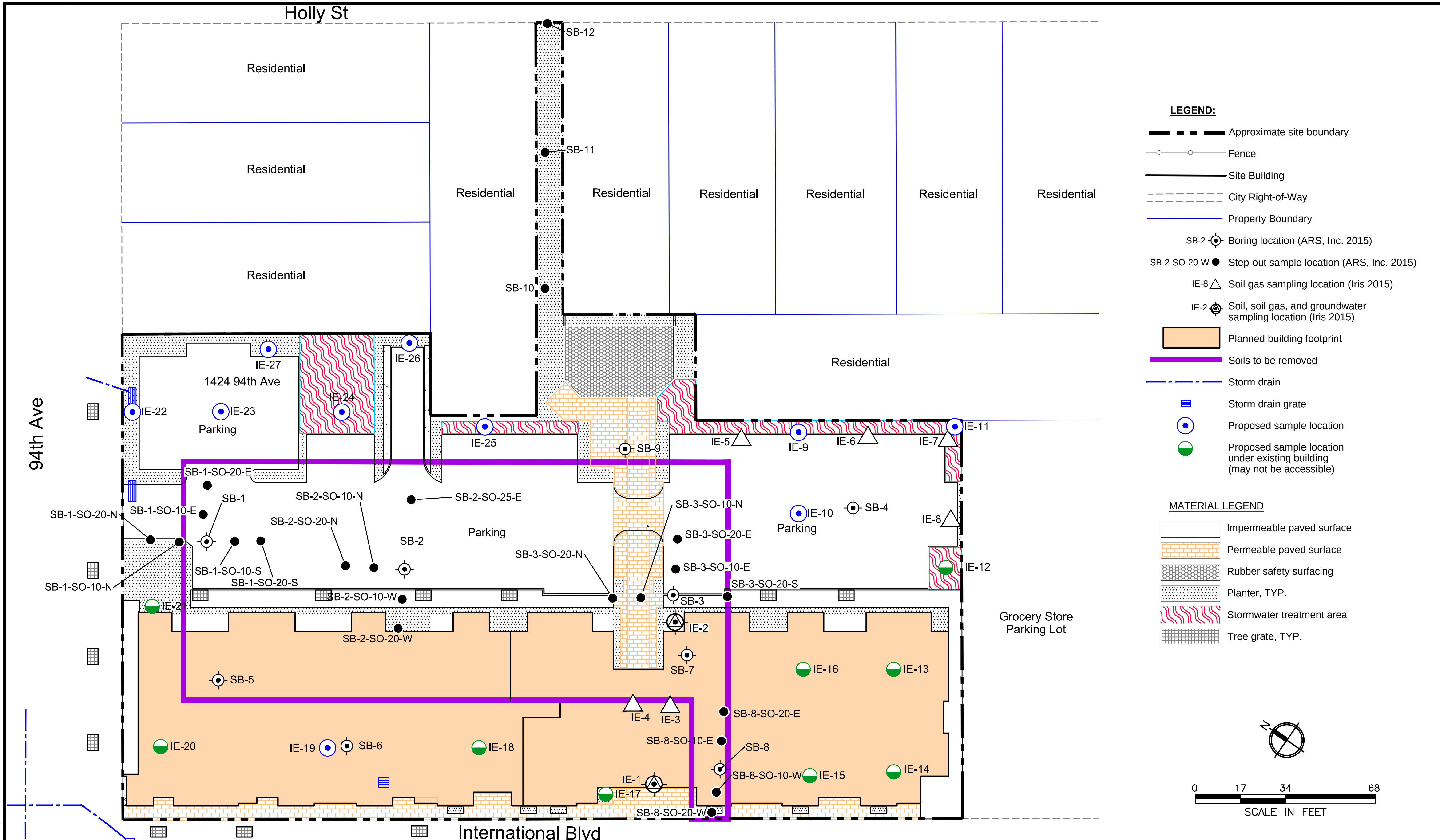

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Proposed Lead Sampling Locations in Shallow Soils (2 feet bgs)
9400-9500 International Boulevard
Oakland, California

Figure
8

Drafter: EC

Date: 03/16/16

Contract Number: 15-1325A

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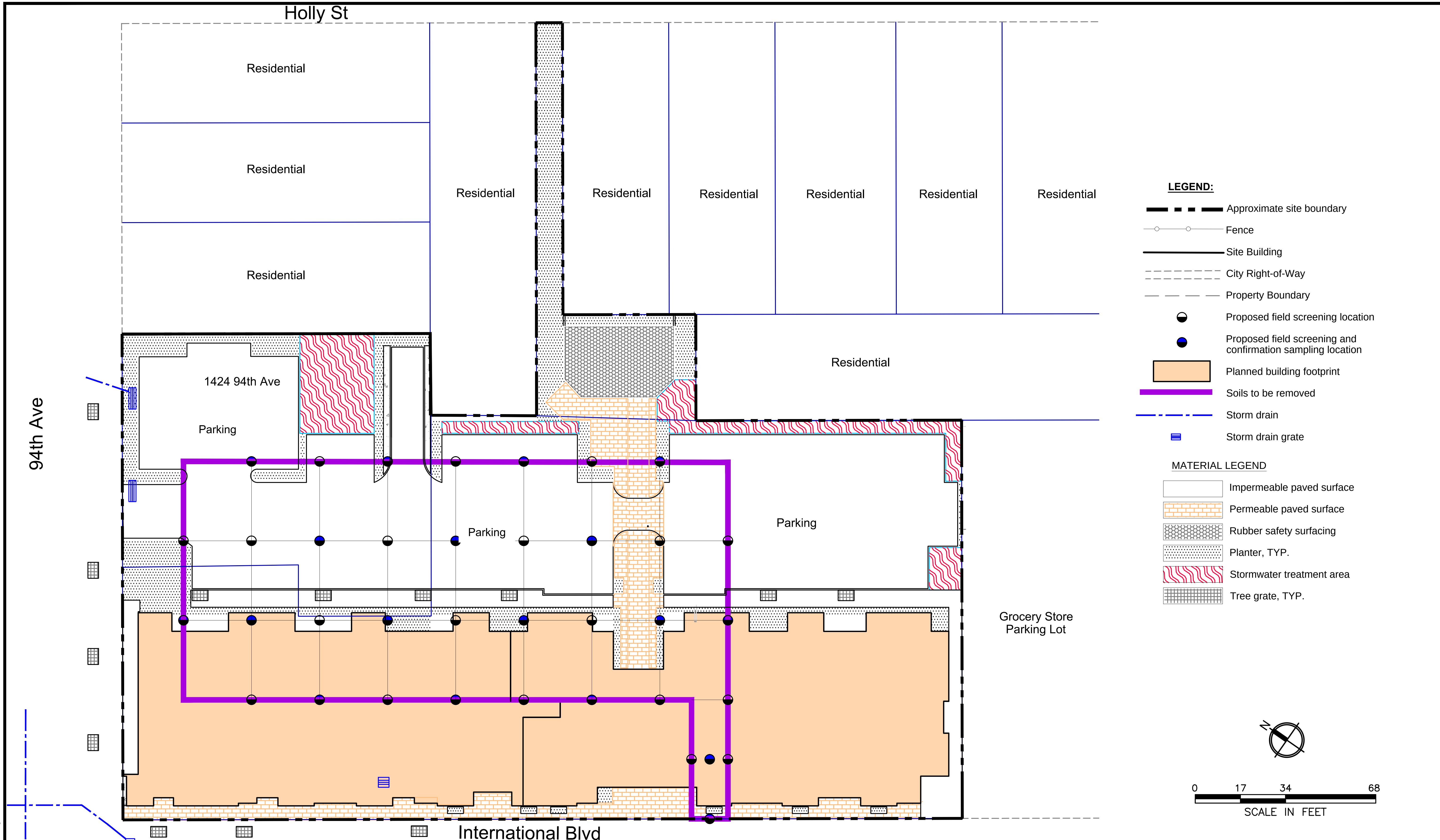

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Proposed Field Screening and Confirmation Sampling Locations
9400-9500 International Boulevard
Oakland, California

Figure
9

Drafter: EC

Date: 03/10/16

Contract Number: 15-1325A

I:\CAD\15\15-1325-A\excavation cells.dwg

Tables

Table 1. Site Parcel Summary Table

Site Address APN	Current Property Description[1]	Property History[2] Related Dates	Property History[2] Description	Historic Borings ID	Historic Borings Rationale	Proposed Borings ID	Proposed Borings Rationale
9400 International Boulevard 046-5432-002-02 046-5423-02-02 046-5423-01-01 046-5423-001-01	Vacant	2012	True Fellowship Church	SB-1	staining observed, within historic trash enclosure	IE-19 / IE-20 / IE-21 / IE-22 / IE-23 / IE-24 / IE-26 / IE-27	delineate lead in soil
		2000	Bethlehem Christian Center	SB-1-SO-10-S / SB-1-SO-10-E / SB-1-SO-20-S / SB-1-SO-20-E / SB-1-SO-10-N / SB-1-SO-20-N / SB-1-F-4.0	delineate horizontal and lateral extent of lead from SB-1		
		1992-1996	Kragen Auto Parts	SB-5	within future building footprint		
		1933-1986	Bank of America/other bank	SB-2, SB-6	within future building footprint, possible staining observed, historic vehicle storage		
				SB-2-SO-10-N / SB-2-SO-10-W / SB-2-SO-25-E / SB-2-SO-20-N / SB-2-SO-20-W	delineate SB-2 lead extent		
9424 International Boulevard 046-5423-021	Vacant	1998-2008	Apartments			IE-18 and IE-25	delineate lead in soil
		1967	Café				
		1950	Office Machines				
		1945	Locksmith				
		1938	Key System Works				
9428 International Boulevard 046-5423-022	Vacant	1998-2008	Apartments and office space				
9430 International Boulevard 046-5423-020	Vacant	2006	Beauty Salon	SB-3-SO-20-N	delineate SB-3 lead extent	IE-17	delineate lead in soil
		1980-1992	Apostolic Faith Church				
		1967-1975	Tavern				
		1945-1950	Attorney's Office				
		1938	Furniture Shop				

Table 1. Site Parcel Summary Table

Site Address APN	Current Property Description[1]	Property History[2]		Historic Borings		Proposed Borings	
		Related Dates	Description	ID	Rationale	ID	Rationale
9434 International Boulevard 046-5423-020	Vacant	2000-2010	Resturant	IE-1-S-GW-SG / IE-2-S-GW-SG / IE-3-SG	site-specific soil, groundwater, and soil gas characterization of former dry cleaners		
		1986	Second Timothy Baptist Church				
		1950-1970	Elmhurst Cleaners & Launderette	SB-3	possible observed staining or debris		
		1945	Gateway Radio Co. and Modern Home, Inc.	SB-3-SO-10-E / SB-3-SO-10-N / SB-3-SO-20-E / SB-3-SO-20-S	delineate lateral extent of lead from SB-3		
		1943	Pentecostal church	SB-7	within future building footprint, possible staining observed		
		1933	Meat Sales				
		1925	Creamery	SB-9	observed debris		
		1920	Fruit Market				
9440, 9442 International Boulevard 046-5423-019	Vacant	2003-2015	Lifeline Treatment Services	IE-5-SG	site-specific soil gas characterization of former former railyard	IE-9 / IE-10 / IE-15 / IE-16	delineate lead in soil
		1986	Beauty Salon	SB-8	within future building footprint, possible staining observed		
		1955-1975	Credit union	SB-8-SO-10-E / SB-8-SO-20-W / SB-8-SO-20-E / SB-8-SO-	delineate lateral extent of lead from SB-8		
		1920-1943	Barber & cigars				
9500 International Boulevard 046-5423-018-02	Vacant	2003-2015	Lifeline Treatment Services	SB-4	possible staining, soil characterization	IE-11 / IE-12 / IE-13 / IE-14	delineate lead in soil
		1992	Do Drop Inn	IE-6-SG / IE-7-SG / IE-8-SG	site-specific soil gas characterization of former former railyard		
		1986	Motorcycle Club				
		1970-1975	Credit Union				
		1962-1967	Furniture and Carpet Store				
		1950-1955	Billiards Hall				
NA / 046-5423-007	Access Road / Parking Lot	1950 to current	Access Road / Parking Lot	SB-10 / SB-11 / SB-12	delineate lead in soil		

Notes:

[1] All parcels will be redeveloped into a residential apartments and ground-floor community and retail spaces

[2] Property history pulled from Phase I Environmental Site Assessment, 9400-9500 International Boulevard, Oakland, California and Iris Environmental's FOIA file review request

Table 2. Soil Sampling Summary Table

					Soil (mg/kg)										Leachate (mg/L)
Sample ID	Sample Date	Approximate Top of Boring Elevation (ft msl)	Approximate Sample Depth (ft bgs)	Approximate Sample Elevation (ft msl)	Lead EPA Method 6010B	CAM-17 Metals EPA Method 6020	TPH-d and TPH-mo EPA Method 8015B	Organochlorine Pesticides EPA Method 8081A	VOCs EPA Method 8260B	SVOCs EPA Method 8270C	TPH-g EPA Method 8015Bm	PAHs EPA Method 8270C	PCBs EPA Method 8082	Asbestos EPA Method 600 PLM	TCLP / WET Metals
SB1	7/2/15	25.8	2	24	x	x	x	x	x		x		x	x	x
			6	20	x		x				x				
			10	16	x		x				x				
SB2	7/2/15	26.5	2	24	x	x	x				x	x	x	x	x
			6	20	x		x				x			x	
			10	16											
SB3	7/2/15	26.5	2	24	x	x	x	x	x		x	x		x	x
			6	20	x		x	x	x		x				
			10	16											
SB4	6/24/15	26.2	3	23	x	x	x				x				x
			6	20	x		x				x				
			10	16	x		x				x				
SB5	7/2/15	25.5	2	24	x		x				x			x	x
			6	20	x		x				x				
			10	16											
SB6	6/24/15	25.6	3	23	x		x				x				
			6	20	x	x	x				x				x
			10	16	x		x				x				
SB7	7/2/15	25.8	2	24	x		x	x	x	x	x		x	x	x
			6	20	x		x	x			x				
			10	16											
SB8	7/2/15	26.0	2	24	x	x	x				x				x
			6	20	x		x				x				
			10	16											
SB9	7/2/15	26.5	2	25	x		x	x	x		x		x	x	
			6	21	x		x				x			x	
			10	17	x		x				x				
SB-1-SO-10-S	8/17/15	25.8	2	24	x										
SB-1-SO-20-S	8/17/15	25.8	2	24	x										
SB-1-SO-10-E	8/17/15	25.8	2	24	x										
SB-1-SO-20-E	8/17/15	25.7	2	24	x										
SB-1-SO-20-N	8/17/15	25.5	2	24	x										
SB-1-SO-10-N	8/17/15	25.8	2	24	x										
SB1-F-4.0	8/17/15	25.8	4	22	x										
SB-2-SO-10-N	8/17/15	26.5	2	24	x										
SB-2-SO-20-N	8/17/15	26.5	2	24	x										

Table 2. Soil Sampling Summary Table

					Soil (mg/kg)										Leachate (mg/L)
Sample ID	Sample Date	Approximate Top of Boring Elevation (ft msl)	Approximate Sample Depth (ft bgs)	Approximate Sample Elevation (ft msl)	Lead EPA Method 6010B	CAM-17 Metals EPA Method 6020	TPH-d and TPH-mo EPA Method 8015B	Organochlorine Pesticides EPA Method 8081A	VOCs EPA Method 8260B	SVOCs EPA Method 8270C	TPH-g EPA Method 8015Bm	PAHs EPA Method 8270C	PCBs EPA Method 8082	Asbestos EPA Method 600 PLM	TCLP / WET Metals
SB-2-SO-10-W	8/17/15	26.5	2	24	x										
SB-2-SO-20-W	8/17/15	26.3	2	24	x										
SB2-SO-25-E	8/17/15	26.6	2	25	x										
SB-3-SO-10-E	8/17/15	26.6	2	25	x										
SB-3-SO-20-E	8/17/15	26.2	2	24	x										
SB-3-SO-10-N	8/17/15	26.2	2	24	x										
SB-3-SO-20-N	8/17/15	26.2	2	24	x										
SB-3-SO-20-S	8/17/15	26.2	2	24	x										
SB-8-SO-10-W	8/17/15	26.1	2	24	x										
SB-8-SO-20-W	8/17/15	25.1	2	23	x										
SB-8-SO-10-E	8/17/15	26.1	2	24	x										
SB-8-SO-20-E	8/17/15	26.1	2	24	x										
SB10-2.0	8/17/15	26.6	2	25	x										
SB11-2.0	8/17/15	26.6	2	25	x										
SB12-2.0	8/17/15	25.8	2	24	x										
IE-1-5.0	10/20/15	25.8	5	21					x						
IE-2-5.0	10/20/15	25.8	5	21					x						

Notes:

x Sampled analyzed for header compounds

Definitions:

ft = feet
bgs = below ground surface
msl = mean sea level

Table 3. Groundwater and Soil Gas Sampling Summary Table

					Groundwater (µg/L)	Soil Gas (µg/m^3)
Sample ID	Sample Date	Approximate Top of Boring Elevation (ft msl)	Approximate Sample Depth (ft bgs)	Approximate Sample Elevation (ft msl)	VOCs EPA Method 8260B	VOCs EPA Method TO-15
IE-1-GW	10/20/15	25.8	--	--	x	
IE-2-GW	10/20/15	25.8	--	--	x	
IE-1-SG	10/20/15	25.8	5	21		x
IE-2-SG	10/20/15	25.8	5	21		x
IE-3-SG	10/20/15	25.8	5	21		x
IE-4-SG	10/20/15	25.8	5	21		x
IE-5-SG	10/20/15	26.3	5	21		x
IE-6-SG	10/20/15	26.05	5	21		x
IE-7-SG	10/20/15	26.13	5	21		x
IE-8-SG	10/20/15	26.3	5	21		x

Notes:
x Sampled analyzed for header compounds

Definitions:
ft = feet
bgs = below ground surface
msl = mean sea level

Table 4. Comparison of Soil Sampling Results to Residential Environmental Screening Levels

			Lead	Other Metals			TPH	Organochlorine Pesticides
				Arsenic	Cobalt	Mercury	Motor Oil	Chlordane
			RWQCB Residential ESL	RWQCB Residential ESL			RWQCB Odor Level	RWQCB Residential ESL
Sample ID	Sample Date	Approximate Sample Elevation (ft msl)	80 (mg/kg)	0.067 (mg/kg)	23 (mg/kg)	13 (mg/kg)	100 (mg/kg)	0.48 (mg/kg)
Soils to be Removed								
SB1-2’	7/2/15	24	940	14	10	0.47	140	0.84
SB2-2’	7/2/15	25	1,000	4.5	9.5	15	560	--
SB3-2’	7/2/15	25	230	14	9.9	0.29	41	< 0.12
SB5-2’	7/2/15	24	200	--	--	--	< 5.0	--
SB7-2’	7/2/15	24	90	--	--	--	17	< 0.025
SB8-2’	7/2/15	24	120	7.3	29	0.13	70	--
SB-1-SO-10-S	8/17/15	24	250	--	--	--	--	--
SB-1-SO-10-E	8/17/15	24	320	--	--	--	--	--
SB-2-SO-10-N	8/17/15	25	290	--	--	--	--	--
SB-2-SO-10-W	8/17/15	25	140	--	--	--	--	--
SB-2-SO-25-E	8/17/15	25	4,300	--	--	--	--	--
SB-8-SO-10-E	8/17/15	24	160	--	--	--	--	--
SB-3-SO-10-E	8/17/15	25	100	--	--	--	--	--
SB-3-SO-10-N	8/17/15	24	100	--	--	--	--	--
SB-1-SO-20-S	8/17/15	24	110	--	--	--	--	--
SB-1-SO-20-E	8/17/15	24	110	--	--	--	--	--
SB-2-SO-20-N	8/17/15	25	290	--	--	--	--	--
SB-2-SO-20-W	8/17/15	24	120	--	--	--	--	--
SB-8-SO-20-W	8/17/15	23	170	--	--	--	--	--
SB-8-SO-20-E	8/17/15	24	150	--	--	--	--	--
SB-3-SO-20-E	8/17/15	24	200	--	--	--	--	--

Table 4. Comparison of Soil Sampling Results to Residential Environmental Screening Levels

			Lead	Other Metals			TPH	Organochlorine Pesticides
				Arsenic	Cobalt	Mercury	Motor Oil	Chlordane
			RWQCB Residential ESL	RWQCB Residential ESL			RWQCB Odor Level	RWQCB Residential ESL
Sample ID	Sample Date	Approximate Sample Elevation (ft msl)	80 (mg/kg)	0.067 (mg/kg)	23 (mg/kg)	13 (mg/kg)	100 (mg/kg)	0.48 (mg/kg)
Soils to Remain in Place								
SB1-6’	7/2/15	20	9.6	--	--	--	< 5.0	--
SB1-10’	7/2/15	16	8.7	--	--	--	< 5.0	--
SB2-6’	7/2/15	20	9.7	--	--	--	< 5.0	--
SB2-10’	7/2/15	16	--	--	--	--	--	--
SB3-6’	7/2/15	20	12	--	--	--	< 5.0	< 0.025
SB3-10’	7/2/15	16	--	--	--	--	--	--
SB4-3’	6/24/15	23	17	8	7.2	0.055	< 5.0	--
SB4-6’	6/24/15	20	8.3	--	--	--	< 5.0	--
SB4-10’	6/24/15	16	6.4	--	--	--	< 5.0	--
SB5-6’	7/2/15	20	12	--	--	--	< 5.0	--
SB5-10’	7/2/15	16	--	--	--	--	--	--
SB6-3’	6/24/15	23	9.5	--	--	--	< 5.0	--
SB6-6’	6/24/15	20	11	8.1	12	0.055	< 5.0	--
SB6-10’	6/24/15	16	7.1	--	--	--	< 5.0	--
SB7-6’	7/2/15	20	11	--	--	--	< 5.0	< 0.025
SB7-10’	7/2/15	16	--	--	--	--	--	--
SB8-6’	7/2/15	20	15	--	--	--	< 5.0	--
SB8-10’	7/2/15	16	--	--	--	--	--	--
SB9-2’	7/2/15	25	60	--	--	--	15	< 0.025
SB9-6’	7/2/15	21	9.3	--	--	--	< 5.0	--

Table 4. Comparison of Soil Sampling Results to Residential Environmental Screening Levels

			Lead	Other Metals			TPH	Organochlorine Pesticides
				Arsenic	Cobalt	Mercury	Motor Oil	Chlordane
			RWQCB Residential ESL	RWQCB Residential ESL			RWQCB Odor Level	RWQCB Residential ESL
Sample ID	Sample Date	Approximate Sample Elevation (ft msl)	80 (mg/kg)	0.067 (mg/kg)	23 (mg/kg)	13 (mg/kg)	100 (mg/kg)	0.48 (mg/kg)
Soils to Remain in Place								
SB9-10’	7/2/15	17	8.4	--	--	--	< 5.0	--
SB-1-SO-10-N	8/17/15	24	43	--	--	--	--	--
SB-8-SO-10-W	8/17/15	24	68	--	--	--	--	--
SB-1-SO-20-N	8/17/15	24	48	--	--	--	--	--
SB-3-SO-20-N	8/17/15	24	57	--	--	--	--	--
SB10-2.0'	8/17/15	25	26	--	--	--	--	--
SB11-2.0'	8/17/15	25	13	--	--	--	--	--
SB12-2.0'	8/17/15	24	34	--	--	--	--	--
SB1-F-4.0'	8/17/15	22	17	--	--	--	--	--
SB-3-SO-20-S	8/17/15	24	50	--	--	--	--	--
IE-1-5.0	10/20/15	21	--	--	--	--	--	--
IE-2-5.0	10/20/15	21	--	--	--	--	--	--

Notes:

(1) Soil sampling results are compared to San Francisco Bay Regional Water Quality Control Board (RWQCB) residential shallow soil Environmental Screening human health risk (ESLs Table S-1) Levels (ESLs) for evaluation of direct exposure or RWQCB odor nuisance levels (ESLs Table S-4)

(2) Analytical results reported by McCampbell Analytical in Pittsburg, California and Curtis & Tompkins Laboratories in Berkeley, California.

Definitions:

ft = feet
msl = mean sea level
mg/kg = milligrams per kilogram
-- = Not Analyzed
[shaded cell] = Sample exceeds respective RWQCB residential ESL from Table B-2
<5.0 = Not detected at or above the laboratory reporting limit of 5.0 µg/L

Table 5. Comparison of Groundwater Sampling Results to Environmental Screening Levels

Analyte	Direct Exposure Human Health Risk		Vapor Intrusion Risk		Groundwater Sampling Results	
	Protective Screening Level (µg/L)	Screening Level Source	Protective Screening Levels (µg/L)	Screening Level Source	IE-1-GW 10/20/15 (µg/L)	IE-2-GW 10/20/15 (µg/L)
Acetone	14,065	ESL- Drinking Water	22,597,943	OSWER VISL	<10	<10
Benzene	0.15	ESL- Drinking Water	1.1	ESL-Vapor Intrusion	<0.50	<0.50
Bromobenzene	62	USEPA	620	OSWER VISL	<0.50	<0.50
Bromodichloromethane	0.12	ESL- Drinking Water	0.9	OSWER VISL	<0.50	<0.50
Bromoform	2.88	ESL- Drinking Water	117	OSWER VISL	<1.0	<1.0
Bromomethane (methyl bromide)	7.55	ESL- Drinking Water	17.4	OSWER VISL	<1.0	<1.0
2-Butanone (methyl ethyl ketone)	5,565	ESL- Drinking Water	2,241,987	OSWER VISL	<10	<10
n-Butylbenzene	290	HHRA Note 3	--	--	<0.50	<0.50
sec-Butylbenzene	590	HHRA Note 3	--	--	<0.50	11
tert-Butylbenzene	690	USEPA	--	--	<0.50	1.1
Carbon disulfide	810	USEPA	1,240	OSWER VISL	<0.50	<0.50
Carbon tetrachloride	0.10	ESL- Drinking Water	0.2	ESL-Vapor Intrusion	<0.50	<0.50
Chlorobenzene	70	ESL- Drinking Water	410	OSWER VISL	<0.50	<0.50
Chlorobromomethane (bromochloromethane)	83	USEPA	0.88	OSWER VISL	<0.50	<0.50
Chlorodibromomethane (dibromochloromethane)	0.70	ESL- Drinking Water	3.25	OSWER VISL	<0.50	<0.50
Chloroethane (ethyl chloride)	20,857	ESL- Drinking Water	22,985	OSWER VISL	<1.0	<1.0
Chloroform	0.23	ESL- Drinking Water	0.81	OSWER VISL	<0.50	<0.50
Chloromethane (methyl chloride)	188	ESL- Drinking Water	260	OSWER VISL	<1.0	<1.0
2-Chlorotoluene	240	USEPA	--	--	<0.50	<0.50
4-Chlorotoluene	250	USEPA	--	--	<0.50	<0.50
Cumene (isopropylbenzene)	450	USEPA	887	OSWER VISL	<0.50	8.8
Cymene (p-isopropyltoluene)	--	--	--	--	<0.50	<0.50
1,2-Dibromo-3-chloropropane	0.001	ESL- Drinking Water	0.03	OSWER VISL	<2.0	<2.0

Table 5. Comparison of Groundwater Sampling Results to Environmental Screening Levels

Analyte	Direct Exposure Human Health Risk		Vapor Intrusion Risk		Groundwater Sampling Results	
	Protective Screening Level (µg/L)	Screening Level Source	Protective Screening Levels (µg/L)	Screening Level Source	IE-1-GW 10/20/15 (µg/L)	IE-2-GW 10/20/15 (µg/L)
1,2-Dibromoethane (ethylene dibromide)	0.007	ESL- Drinking Water	0.18	OSWER VISL	<0.50	<0.50
Dibromomethane (methylene bromide)	8.30	USEPA	0.18	OSWER VISL	<0.50	<0.50
1,2-Dichlorobenzene	100	ESL- Drinking Water	2,658	OSWER VISL	<0.50	<0.50
1,3-Dichlorobenzene	600	ESL- Drinking Water	--	--	<0.50	<0.50
1,4-Dichlorobenzene	0.48	ESL- Drinking Water	2.59	OSWER VISL	<0.50	<0.50
Dichlorodifluoromethane (Freon 12)	200	USEPA	7.44	OSWER VISL	<1.0	<1.0
1,1-Dichloroethane (1,1-DCA)	2.75	ESL- Drinking Water	7.64	OSWER VISL	<0.50	<0.50
1,2-Dichloroethane (1,2-DCA)	0.17	ESL- Drinking Water	2.24	OSWER VISL	<0.50	<0.50
1,1-Dichloroethene (1,1-DCE)	6	ESL- Drinking Water	170	ESL-Vapor Intrusion	<0.50	<0.50
cis-1,2-Dichloroethene (cis-1,2-DCE)	6	ESL- Drinking Water	110	ESL-Vapor Intrusion	<0.50	<0.50
trans-1,2-Dichloroethene (trans-1,2-DCE)	10	ESL- Drinking Water	940	ESL-Vapor Intrusion	<0.50	<0.50
Dichloromethane (methylene chloride)	2.74	ESL- Drinking Water	48	ESL-Vapor Intrusion	<10	<10
1,2-Dichloropropane	0.44	ESL- Drinking Water	2.4	OSWER VISL	<0.50	<0.50
1,3-Dichloropropane	110	HHRA Note 3	--	--	<0.50	<0.50
2,2-Dichloropropane	--	--	--	--	<0.50	<0.50
1,1-Dichloropropene	--	--	4.8	OSWER VISL	<0.50	<0.50
cis-1,3-Dichloropropene	0.47	USEPA	3.8	ESL-Vapor Intrusion	<0.50	<0.50
trans-1,3-Dichloropropene	0.47	USEPA	3.8	ESL-Vapor Intrusion	<0.50	<0.50
Ethylbenzene	1.49	ESL- Drinking Water	3.49	OSWER VISL	<0.50	1.9
Hexachlorobutadiene	0.14	ESL- Drinking Water	0.3	OSWER VISL	<2.0	<2.0
2-Hexanone (methyl butyl ketone)	38	USEPA	8,213	OSWER VISL	<10	<10
Methyl tert-butyl ether (MTBE)	5	ESL- Drinking Water	450	OSWER VISL	0.60	1.7
4-Methyl-2-pentanone (methyl isobutyl ketone)	120	ESL- Drinking Water	554,648	ESL-Vapor Intrusion	<10	<10
Naphthalene	0.12	ESL- Drinking Water	5	OSWER VISL	<2.0	4.2

Table 5. Comparison of Groundwater Sampling Results to Environmental Screening Levels

Analyte	Direct Exposure Human Health Risk		Vapor Intrusion Risk		Groundwater Sampling Results	
	Protective Screening Level (µg/L)	Screening Level Source	Protective Screening Levels (µg/L)	Screening Level Source	IE-1-GW 10/20/15 (µg/L)	IE-2-GW 10/20/15 (µg/L)
n-Propylbenzene	660	USEPA	8,213	OSWER VISL	<0.50	3.9
Styrene	0.50	ESL- Drinking Water	9,278	OSWER VISL	<0.50	<0.50
1,1,1,2-Tetrachloroethane	0.57	ESL- Drinking Water	3.7	OSWER VISL	<0.50	<0.50
1,1,2,2-Tetrachloroethane	0.08	ESL- Drinking Water	3.23	OSWER VISL	<0.50	<0.50
Tetrachloroethene (PCE)	0.06	ESL- Drinking Water	3	ESL-Vapor Intrusion	<0.50	<0.50
Toluene	40	ESL- Drinking Water	3,600	ESL-Vapor Intrusion	<0.50	<0.50
1,2,3-Trichlorobenzene	7	USEPA	--	--	<0.50	<0.50
1,2,4-Trichlorobenzene	1.13	ESL- Drinking Water	36	OSWER VISL	<0.50	<0.50
1,1,1-Trichloroethane (1,1,1-TCA)	200	ESL- Drinking Water	200	ESL-Vapor Intrusion	<0.50	<0.50
1,1,2-Trichloroethane (1,1,2-TCA)	0.28	ESL- Drinking Water	5.2	OSWER VISL	<0.50	<0.50
Trichloroethene (TCE)	0.71	ESL- Drinking Water	1.2	OSWER VISL	<0.50	<0.50
Trichlorofluoromethane (Freon 11)	1,700	HHRA Note 3	184	OSWER VISL	<1.0	<1.0
1,2,3-Trichloropropane	0.000	HHRA Note 3	--	--	<0.50	<0.50
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon	55,000	USEPA	184	OSWER VISL	<2.0	<2.0
1,2,4-Trimethylbenzene	15	USEPA	29	OSWER VISL	<0.50	<0.50
1,3,5-Trimethylbenzene	120	USEPA	--	--	<0.50	<0.50
Vinyl acetate	410	USEPA	9,986	OSWER VISL	<10	<10
Vinyl chloride	0.04	ESL- Drinking Water	0.1	ESL-Vapor Intrusion	<0.50	<0.50
m-, p-Xylene	20	ESL- Drinking Water	355	OSWER VISL	<0.50	<0.50
o-Xylene	190	USEPA	493	OSWER VISL	<0.50	<0.50

Table 5. Comparison of Groundwater Sampling Results to Environmental Screening Levels

Analyte	Direct Exposure Human Health Risk		Vapor Intrusion Risk		Groundwater Sampling Results	
	Protective Screening Level (µg/L)	Screening Level Source	Protective Screening Levels (µg/L)	Screening Level Source	IE-1-GW 10/20/15 (µg/L)	IE-2-GW 10/20/15 (µg/L)

Notes:

(1) ESL-Drinking Water = San Francisco Bay Regional Water Quality Control Board (RWQCB) residential shallow groundwater Environmental Screening Levels (ESLs) for evaluation of direct exposure human health risk (ESLs W-1)
(2) HHRA Note 3 = DTSC's Office of Human and Ecological Risk (HERO) Human Health Risk Assessment (HHRA) Note Number 3 residential Screening Levels
(3) USEPA = United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for tap water
(4) ESL-Vapor Intrusion = RWQCB's residential shallow groundwater ESLs for evaluation of vapor intrusion (ESLs Table W-3)
(5) OSWER VISL = USEPA's Office of Solid Waste and Emergency Response (OSWER) Vapor Intrusion Screening Levels (VISLs) for target groundwater concentration for residential vapor intrusion considerations using TCR = 1E-6 or THQ=1
(6) Analytical results reported by Curtis & Tompkins Laboratories in Berkeley, California.

Definitions:

µg/L = micrograms per liter
<1.7 = not detected at or above the laboratory reporting limit of 1.7 µg/L
-- = regulatory screening level not established
[shaded] = shaded cells exceeds protective levels for direct exposure
[outlined] = outlined cells exceeds protective levels for vapor intrusion
[shaded and outlined] = shaded and outlined cells exceed both protective levels for direct exposure and vapor intrusion

Table 6. Comparison of Soil Gas Sampling Results to Environmental Screening Levels

	Vapor Intrusion Risk		Soil Gas Sampling Results							
Analyte	Protective Screening Levels (µg/m3)	Screening Level Source	IE-1-SG 10/20/15 (µg/m3)	IE-2-SG 10/20/15 (µg/m3)	IE-3-SG 10/20/15 (µg/m3)	IE-4-SG 10/20/15 (µg/m3)	IE-5-SG 10/20/15 (µg/m3)	IE-6-SG 10/20/15 (µg/m3)	IE-7-SG 10/20/15 (µg/m3)	IE-8-SG 10/20/15 (µg/m3)
Acetone	16,000,000	ESL-Vapor Intrusion	13	<9.4	17	<8.1	22	31	20	32
Acrolein	--	ESL-Vapor Intrusion	<9.4	<9.0	<9.2	<7.8	<17	<17	<19	<7.8
Benzene	48	ESL-Vapor Intrusion	<3.3	<3.1	4.4	<2.7	<5.8	11	<6.5	5.0
Benzyl chloride	--	ESL-Vapor Intrusion	<5.3	<5.1	<5.2	<4.4	<9.4	<9.5	<11	<4.4
Bromodichloromethane	38	ESL-Vapor Intrusion	<6.8	<6.6	<6.7	<5.7	<12	<12	<14	<5.7
Bromoform	1,300	ESL-Vapor Intrusion	<11	<10	<10	<8.8	<19	<19	<21	<8.8
Bromomethane	2,600	ESL-Vapor Intrusion	<4.0	<3.8	<3.9	<3.3	<7.1	<7.1	<7.9	<3.3
1,3-Butadiene	--	ESL-Vapor Intrusion	<2.3	<2.2	<2.2	<1.9	<4.0	<4.1	<4.5	<1.9
2-Butanone	2,600,000	ESL-Vapor Intrusion	<3.0	<2.9	3.2	<2.5	<5.4	5.5	<6.0	7.9
Carbon disulfide	365,000	USEPA	32	100	18	<2.7	<5.7	<5.7	<6.3	12
Carbon tetrachloride	33	ESL-Vapor Intrusion	<6.4	<6.2	<6.3	<5.4	<11	<12	<13	<5.4
Chlorobenzene	26,000	ESL-Vapor Intrusion	<4.7	<4.5	<4.6	<3.9	<8.4	<8.5	<9.3	<3.9
Chlorodibromomethane	--	ESL-Vapor Intrusion	<8.7	<8.4	<8.5	<7.3	<16	<16	<17	<7.3
Chloroethane	5,200,000	ESL-Vapor Intrusion	<2.7	<2.6	<2.6	<2.3	<4.8	<4.9	<5.4	<2.3
Chloroform	61	ESL-Vapor Intrusion	<5.0	<4.8	<4.9	<4.2	<8.9	<9.0	<9.9	<4.2
Chloromethane	47,000	ESL-Vapor Intrusion	<2.1	<2.0	<2.1	<1.8	<3.8	<3.8	<4.2	<1.8
Cyclohexane	3,150,000	USEPA	<3.5	<3.4	<3.4	<2.9	<6.3	8.1	<7.0	3.1
1,2-Dibromoethane	2	ESL-Vapor Intrusion	<7.8	<7.6	<7.7	<6.6	<14	<14	<16	<6.6
1,2-Dichlorobenzene	100,000	ESL-Vapor Intrusion	<6.1	<5.9	<6.0	<5.1	<11	<11	<12	<5.1
1,3-Dichlorobenzene	--	ESL-Vapor Intrusion	<6.1	<5.9	<6.0	<5.1	<11	<11	<12	<5.1
1,4-Dichlorobenzene	130	ESL-Vapor Intrusion	<6.1	<5.9	<6.0	<5.1	<11	<11	<12	<5.1
Dichlorodifluoromethane	--	ESL-Vapor Intrusion	<5.0	<4.9	<4.9	<4.2	<9.0	<9.1	<10	<4.2
1,1-Dichloroethane	880	ESL-Vapor Intrusion	<4.1	<4.0	<4.0	<3.5	<7.4	<7.4	<8.2	<3.5
1,2-Dichloroethane	54	ESL-Vapor Intrusion	<4.1	<4.0	<4.0	<3.5	<7.4	<7.4	<8.2	<3.5

Table 6. Comparison of Soil Gas Sampling Results to Environmental Screening Levels

Analyte	Vapor Intrusion Risk		Soil Gas Sampling Results							
	Protective Screening Levels (µg/m3)	Screening Level Source	IE-1-SG 10/20/15 (µg/m3)	IE-2-SG 10/20/15 (µg/m3)	IE-3-SG 10/20/15 (µg/m3)	IE-4-SG 10/20/15 (µg/m3)	IE-5-SG 10/20/15 (µg/m3)	IE-6-SG 10/20/15 (µg/m3)	IE-7-SG 10/20/15 (µg/m3)	IE-8-SG 10/20/15 (µg/m3)
1,1-Dichloroethene	37,000	ESL-Vapor Intrusion	<4.0	<3.9	<4.0	<3.4	<7.2	<7.3	<8.0	<3.4
cis-1,2-Dichloroethene	4,200	ESL-Vapor Intrusion	<4.0	<3.9	<4.0	<3.4	<7.2	<7.3	<8.0	<3.4
trans-1,2-Dichloroethene	31,000	ESL-Vapor Intrusion	<4.0	<3.9	<4.0	<3.4	<7.2	<7.3	<8.0	<3.4
1,2-Dichloropropane	140	ESL-Vapor Intrusion	<4.7	<4.6	<4.6	<4.0	<8.4	<8.5	<9.4	<4.0
cis-1,3-Dichloropropene	88	ESL-Vapor Intrusion	<4.6	<4.5	<4.5	<3.9	<8.3	<8.4	<9.2	<3.9
trans-1,3-Dichloropropene	88	ESL-Vapor Intrusion	<4.6	<4.5	<4.5	<3.9	<8.3	<8.4	<9.2	<3.9
1,2-Dichloro-1,1,2,2-tetrafluoroethane	--	ESL-Vapor Intrusion	<7.1	<6.9	<7.0	<6.0	<13	<13	<14	<6.0
Ethyl acetate	--	ESL-Vapor Intrusion	<3.7	<3.5	<3.6	<3.1	<6.6	<6.6	<7.3	<3.1
Ethylbenzene	560	ESL-Vapor Intrusion	<4.4	<4.3	<4.3	<3.7	<7.9	<8.0	<8.8	<3.7
4-Ethyltoluene	--	ESL-Vapor Intrusion	<5.0	<4.8	<4.9	<4.2	<9.0	<9.0	<10	<4.2
Heptane	365,000	USEPA	<4.2	<4.0	<4.1	<3.5	<7.5	<7.5	<8.3	4.4
Hexachlorobutadiene	64	ESL-Vapor Intrusion	<11	<11	<11	<9.1	<19	<20	<22	<9.1
Hexane	--	ESL-Vapor Intrusion	<3.6	<3.5	<3.5	<3.0	<6.4	<6.5	<7.2	<3.0
2-Hexanone	--	ESL-Vapor Intrusion	<4.2	<4.0	<4.1	<3.5	<7.5	<7.5	<8.3	<3.5
Methyl tert-butyl ether	5,400	ESL-Vapor Intrusion	<3.7	<3.6	<3.6	<3.1	<6.6	<6.6	<7.3	<3.1
Methylene chloride	1,400	ESL-Vapor Intrusion	<3.5	<3.4	7.2	<3.0	<6.3	<6.4	<7.1	<3.0
4-Methyl-2-pentanone	1,600,000	ESL-Vapor Intrusion	<4.2	<4.0	<4.1	<3.5	7.6	<7.5	13	7.8
Naphthalene	41	ESL-Vapor Intrusion	<21	<21	<21	<18	<38	<39	<43	<18
Styrene	470,000	ESL-Vapor Intrusion	<4.3	<4.2	<4.3	<3.6	<7.8	<7.8	<8.6	<3.6
1,1,2,2-Tetrachloroethane	24	ESL-Vapor Intrusion	<7.0	<6.8	<6.9	<5.9	<13	<13	<14	<5.9
Tetrachloroethene	240	ESL-Vapor Intrusion	<6.9	<6.7	<6.8	<5.8	<12	<12	<14	<5.8
Tetrahydrofuran	None	ESL-Vapor Intrusion	<3.0	<2.9	<2.9	<2.5	<5.4	<5.4	<6.0	<2.5
Toluene	160,000	ESL-Vapor Intrusion	4.1	<3.7	4.1	<3.2	<6.9	7.8	<7.7	6.1
1,2,4-Trichlorobenzene	1,000	ESL-Vapor Intrusion	<7.6	<7.3	<7.4	<6.3	<14	<14	<15	<6.3

Table 6. Comparison of Soil Gas Sampling Results to Environmental Screening Levels

Analyte	Vapor Intrusion Risk		Soil Gas Sampling Results							
	Protective Screening Levels (µg/m3)	Screening Level Source	IE-1-SG 10/20/15 (µg/m3)	IE-2-SG 10/20/15 (µg/m3)	IE-3-SG 10/20/15 (µg/m3)	IE-4-SG 10/20/15 (µg/m3)	IE-5-SG 10/20/15 (µg/m3)	IE-6-SG 10/20/15 (µg/m3)	IE-7-SG 10/20/15 (µg/m3)	IE-8-SG 10/20/15 (µg/m3)
1,1,1-Trichloroethane	520,000	ESL-Vapor Intrusion	<5.6	<5.4	<5.5	<4.7	<10	<10	<11	<4.7
1,1,2-Trichloroethane	88	ESL-Vapor Intrusion	<5.6	<5.4	<5.5	<4.7	<10	<10	<11	<4.7
Trichloroethene	340	ESL-Vapor Intrusion	<5.5	<5.3	<5.4	<4.6	<9.8	<9.9	<11	<4.6
Trichlorofluoromethane	--	ESL-Vapor Intrusion	<5.7	<5.5	<5.6	<4.8	<10	<10	<11	<4.8
1,1,2-Trichloro-1,2,2-trifluoroethane	--	ESL-Vapor Intrusion	<7.8	<7.5	<7.7	<6.6	<14	<14	<16	<6.6
1,2,4-Trimethylbenzene	--	ESL-Vapor Intrusion	<5.0	<4.8	<4.9	<4.2	<9.0	<9.0	<10	<4.2
1,3,5-Trimethylbenzene	--	ESL-Vapor Intrusion	<5.0	<4.8	<4.9	<4.2	<9.0	<9.0	<10	<4.2
Vinyl acetate	--	ESL-Vapor Intrusion	<3.6	<3.5	<3.5	<3.0	<6.4	<6.5	<7.1	<3.0
Vinyl chloride	18	ESL-Vapor Intrusion	<2.6	<2.5	<2.6	<2.2	<4.7	<4.7	<5.2	<2.2
o-Xylene	52,000	ESL-Vapor Intrusion	<4.4	<4.3	<4.3	<3.7	<7.9	<8.0	<8.8	<3.7
m-,p-Xylene	52,000	ESL-Vapor Intrusion	<4.4	<4.3	<4.3	<3.7	<7.9	<8.0	<8.8	<3.7

Notes:

(1) ESL-Vapor Intrusion = RWQCB's soil gas ESLs for evaluation of vapor intrusion at residential properties (ESLs Table SG-1)
(2) USEPA = USEPA’s RSLs for residential indoor air with DTSCs HHRA Note 3 sub-slab/soil gas attenuation factor

Definitions:

µg/m3 = micrograms per cubic meter

<1.7 = Not detected at or above the laboratory reporting limit of 1.7 µg/m3

-- = regulatory screening level not established

Table 7. Comparison of Soil Solubility Sampling Results to STLC and TCLP Thresholds

Sample ID	Sample Date	Approximate Sample Elevation (ft msl)	WET Lead	TCLP Lead	TCLP Mercury	WET Chromium
			5 (mg/L)	5 (mg/L)	0.2 (mg/L)	5 (mg/L)
Soils to be Removed						
SB1-2’	7/2/15	24	57	0.97	--	--
SB2-2’	7/2/15	25	19	<0.2	<0.01	--
SB3-2’	7/2/15	25	5.8	0.36	--	--
SB4-3'	7/6/15	23	--	--	--	0.09
SB5-2’	7/2/15	24	2.2	--	--	--
SB6-6'	7/6/15	23	--	--	--	0.1
SB7-2’	7/2/15	24	3.2	--	--	--
SB8-2’	7/2/15	24	6.8	<0.2	--	--
SB-1-SO-10-S	8/17/15	24	10	--	--	--
SB-1-SO-10-E	8/17/15	24	18	--	--	--
SB-2-SO-10-N	8/17/15	25	9.5	--	--	--
SB-2-SO-10-W	8/17/15	25	6.9	--	--	--
SB-2-SO-25-E	8/17/15	25	270	13	--	--
SB-8-SO-10-E	8/17/15	24	7.5	--	--	--
SB-3-SO-10-E	8/17/15	25	3.2	--	--	--
SB-3-SO-10-N	8/17/15	24	2.7	--	--	--
SB-1-SO-20-S	8/17/15	24	80	--	--	--
SB-1-SO-20-E	8/17/15	24	--	--	--	--
SB-2-SO-20-N	8/17/15	25	--	--	--	--
SB-2-SO-20-W	8/17/15	24	6.9	--	--	--
SB-8-SO-20-W	8/17/15	23	--	--	--	--
SB-8-SO-20-E	8/17/15	24	--	--	--	--
SB-3-SO-20-E	8/17/15	24	--	--	--	--

Table 7. Comparison of Soil Solubility Sampling Results to STLC and TCLP Thresholds

Sample ID	Sample Date	Approximate Sample Elevation (ft msl)	WET Lead 5 (mg/L)	TCLP Lead 5 (mg/L)	TCLP Mercury 0.2 (mg/L)	WET Chromium 5 (mg/L)
Soils to Remain in Place						
SB1-6’	7/2/15	20	--	--	--	--
SB1-10’	7/2/15	16	--	--	--	--
SB2-6’	7/2/15	20	--	--	--	--
SB2-10’	7/2/15	16	--	--	--	--
SB3-6’	7/2/15	20	--	--	--	--
SB3-10’	7/2/15	16	--	--	--	--
SB4-3’	6/24/15	23	--	--	--	--
SB4-6’	6/24/15	20	--	--	--	--
SB4-10’	6/24/15	16	--	--	--	--
SB5-6’	7/2/15	20	--	--	--	--
SB5-10’	7/2/15	16	--	--	--	--
SB6-3’	6/24/15	23	--	--	--	--
SB6-6’	6/24/15	20	--	--	--	--
SB6-10’	6/24/15	16	--	--	--	--
SB7-6’	7/2/15	20	--	--	--	--
SB7-10’	7/2/15	16	--	--	--	--
SB8-6’	7/2/15	20	--	--	--	--
SB8-10’	7/2/15	16	--	--	--	--
SB9-2’	7/2/15	25	--	--	--	--
SB9-6’	7/2/15	21	--	--	--	--
SB9-10’	7/2/15	17	--	--	--	--
SB-1-SO-10-N	8/17/15	24	--	--	--	--
SB-8-SO-10-W	8/17/15	24	3.8	--	--	--
SB-1-SO-20-N	8/17/15	24	--	--	--	--
SB-3-SO-20-N	8/17/15	24	--	--	--	--
SB10-2.0	8/17/15	25	--	--	--	--
SB11-2.0	8/17/15	25	--	--	--	--
SB12-2.0	8/17/15	24	--	--	--	--
SB1-F-4.0	8/17/15	22	--	--	--	--
SB-3-SO-20-S	8/17/15	24	0.58	--	--	--
IE-1-5.0	10/20/15	21	--	--	--	--
IE-2-5.0	10/20/15	21	--	--	--	--

Notes:

(1) Soil solubility sampling results are compared to California's Department of Toxic Substances Control (DTSC) Characteristics of Hazardous Waste 22CCR Section 66261.24 Characteristic of Toxicity EPA regulatory levels (Table I) and STLCs (Table II)

(2) Analytical results reported by McCampbell Analytical, Inc. in Pittsburg, California.

Definitions:

mg/L = milligram per liter

[grey shading] = Sample exceeds respective STLC and TCLP threshold

ft = feet

msl = mean sea level

-- = Not Analyzed

Appendix A

Leadspread 8 Model

LEAD RISK ASSESSMENT SPREADSHEET 8
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Click here for ABBREVIATED INSTRUCTIONS FOR LEADSPREAD 8

INPUT	
MEDIUM	LEVEL
Lead in Soil/Dust (ug/g)	**1315**
Respirable Dust (ug/m^3)	**320**

OUTPUT						
Percentile Estimate of Blood Pb (ug/dl)						PRG-90
	50th	90th	95th	98th	99th	(ug/g)
BLOOD Pb, CHILD	0.5	**1.00**	1.2	1.4	1.6	1310
BLOOD Pb, PICA CHILD	0.5	1.0	1.2	1.4	1.6	1310

EXPOSURE PARAMETERS		
	units	children
Days per week	days/wk	7
Geometric Standard Deviation		1.6
Blood lead level of concern (ug/dl)		1
Skin area, residential	cm^2	2900
Soil adherence	ug/cm^2	**0**
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001
Soil ingestion	mg/day	**0**
Soil ingestion, pica	mg/day	**0**
Ingestion constant	(ug/dl)/(ug/day)	0.16
Bioavailability	unitless	0.44
Breathing rate	m^3/day	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.192

Click here for REFERENCES

PATHWAYS						
CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	0.0E+0	0.00	0%		0.00	0%
Soil Ingestion	0.0E+0	0.00	0%	0.0E+0	0.00	0%
Inhalation	4.2E-4	0.55	100%		0.55	100%

READ ME

GIVEN THESE SITE-SPECIFIC ASSUMPTIONS:
> No ingestion or dermal contact; inhalation only
> 1,315 mg/kg is 95UCL lead concentration in soils to be removed
> Target is 90th percentile child blood lead level of 1.00 ug/dl

SOLVE FOR RESPIRABLE DUST CONCENTRATION THAT PRODUCES TARGET BLOOD LEAD LEVEL = 320 ug/m3

UCL Statistics for Data Sets with Non-Detects		

User Selected Options	
Date/Time of Computation	2/11/2016 8:31:09 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics			
Total Number of Observations	21	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	90	Mean	444.3
Maximum	4300	Median	170
SD	915.7	Std. Error of Mean	199.8
Coefficient of Variation	2.061	Skewness	4.113
Normal GOF Test			
Shapiro Wilk Test Statistic	0.393	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.411	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.193	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	788.9	95% Adjusted-CLT UCL (Chen-1995)	964.6
		95% Modified-t UCL (Johnson-1978)	818.8
Gamma GOF Test			
A-D Test Statistic	2.783	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.777	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.323	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	0.196	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.853	k star (bias corrected MLE)	0.763
Theta hat (MLE)	520.8	Theta star (bias corrected MLE)	582.3
nu hat (MLE)	35.83	nu star (bias corrected)	32.05
MLE Mean (bias corrected)	444.3	MLE Sd (bias corrected)	508.6
		Approximate Chi Square Value (0.05)	20.11
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	19.38
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50))	708	95% Adjusted Gamma UCL (use when n<50)	734.6
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.794	**Shapiro Wilk Lognormal GOF Test**	

	A–E	F	G–K	L
53	5% Shapiro Wilk Critical Value	0.908	Data Not Lognormal at 5% Significance Level	
54	Lilliefors Test Statistic	0.207	**Lilliefors Lognormal GOF Test**	
55	5% Lilliefors Critical Value	0.193	Data Not Lognormal at 5% Significance Level	
56	**Data Not Lognormal at 5% Significance Level**			
57				
58	**Lognormal Statistics**			
59	Minimum of Logged Data	4.5	Mean of logged Data	5.407
60	Maximum of Logged Data	8.366	SD of logged Data	0.94
61				
62	**Assuming Lognormal Distribution**			
63	95% H-UCL	584.2	90% Chebyshev (MVUE) UCL	567.2
64	95% Chebyshev (MVUE) UCL	671.6	97.5% Chebyshev (MVUE) UCL	816.5
65	99% Chebyshev (MVUE) UCL	1101		
66				
67	**Nonparametric Distribution Free UCL Statistics**			
68	**Data do not follow a Discernible Distribution (0.05)**			
69				
70	**Nonparametric Distribution Free UCLs**			
71	95% CLT UCL	773	95% Jackknife UCL	788.9
72	95% Standard Bootstrap UCL	770.7	95% Bootstrap-t UCL	1700
73	95% Hall's Bootstrap UCL	1698	95% Percentile Bootstrap UCL	820.5
74	95% BCA Bootstrap UCL	1010		
75	90% Chebyshev(Mean, Sd) UCL	1044	95% Chebyshev(Mean, Sd) UCL	1315
76	97.5% Chebyshev(Mean, Sd) UCL	1692	99% Chebyshev(Mean, Sd) UCL	2432
77				
78	**Suggested UCL to Use**			
79	95% Chebyshev (Mean, Sd) UCL	1315		
80				
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
84	For additional insight the user may want to consult a statistician.			
85				

Appendix B

Thermo Scientific Niton XL2 GOLDD Environmental Analyzer Specifications

Call: **800-301-9663** CEMS: **877-427-7368**
Email: **info@pine-environmental.com**
www.pine-environmental.com

Thermo Scientific Niton XL2 980 GOLDD XRF Analyzer

Key Features

- Niton XL2 analyzer - High-performance semiconductor detector
- Niton XL2 GOLDD analyzer - Geometrically optimized large area drift detector
- Fixed-angle, color, touch-screen display
- USB and Bluetooth™ communications
- 45 kV miniaturized x-ray tube

Applications

- Precious Metals & Jewellery Analysis
- Positive Material Identification (PMI)
- Ore Grade Control
- Exploration
- Scrap Metal Sorting
- Mine Mapping
- Alloy Quality Control (QC)
- Toys

Thermo Scientific Niton XL2 Series x-ray fluorescence (XRF) analyzers are purpose-built for your most demanding needs.

The performance-leading Niton XL2 GOLDD™ is a lightweight, rugged, handheld XRF analyzer perfectly suited for your particular testing applications.

Ergonomically designed and featuring daylight-readable icons, the Niton XL2 provides customizable menus for ease of use, multi-language options, and a standard analytical range of more than 25 elements, plus light element detection (Mg-S) with the Niton XL2 GOLDD.

The Niton XL2 XRF analyzer provide you with many distinct advantages:

- Very easy to use – even by non-technical personnel
- Rugged design for real-world industrial applications
- Truly nondestructive test
- From turn on to trigger pull to results in seconds
- Confident analysis with technology from the industry leader

More than 30,000 Thermo Scientific Niton XRF analyzers can be found at work in more than 75 countries on 6 continents.

Niton XL2 Series – Engineered for the Way You Work

Niton XL2 Series analyzers offer high performance and advanced electronics while maintaining the point-and-shoot simplicity that has been the hallmark of all of our of portable XRF instruments. Sealed against moisture and dust, these analyzers are ruggedly built to withstand the harshest environments – in the field or on the shop floor.

Ergonomically designed and featuring daylight-readable icons, the Niton XL2 analyzer provides customizable menus for ease of use, multi-language options, and a standard analytical range of more than 25 elements, plus light element detection (Mg-S) with the Niton XL2 GOLDD.

What's more, by taking advantage of our standard Thermo Scientific Niton Data Transfer (NDT™) PC software suite, you can:

- Set operator permissions
- Generate custom reports
- Print certificates of analysis to document results
- Operate the analyzer remotely from your PC

Technical Specification

Title	Values
Tube - Precious Metals & Environmetal applications	Ag anode 45 kV maximum, 100 µA maximum
Detector	High-performance semiconductor
System Electronics	400 MHz ARM 11 CPU 300 MHz dedicated DSP 80 MHz ASICS DSP for signal processing 4096 channel MCA 64 MB internal system memory/ 128MB interna
Display	Fixed angle, color, touch-screen display
Standard Analytical Range	14 elements including all precious metals
Data Storage	Internal >10,000 readings with spectra
Data Transfer	USB, Bluetooth™, and RS-232 serial communication
Security	Password-protected user security
Data Entry	Touch-screen keyboard User-programmable pick lists Optional wireless remote barcode reader
Standard Accessories and Features	Locking shielded carrying case Shielded belt holster One 6-cell lithium-ion battery pack 110/220 VAC battery charger/ AC adaptor PC connecti
Optional Features and Accessories	Thermo Scientific portable test stand Additional battery pack Wireless portable printer Barcode scanner
Compliance	CE, RoHS

Dimensions

Title	(mm)	(inch)	(kg)	(lb)
Weight			1.66 kg	< 3 lbs 10.7 oz
Size	256 x 275 x 100 mm	10.25 x 11 x 4 in		

Call: **800-301-9663** CEMS: **877-427-7368**
www.pine-environmental.com

PINE

Thermo Scientific Niton XL2 GOLDD Series Environmental Analyzers

Elemental Limits of Detection in SiO_2 and SRM Matrices Using Soil Analysis

In addition to the offices listed below, Thermo Scientific Niton Anaylzers maintains a network of sales and service organizations throughout the world.

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The Niton® XL2 GOLDD Series x-ray fluorescence (XRF) analyzer is the performance choice for your toughest testing applications. Where low detection limits and high sample throughput are critical, our combination of hardware, software, and direct industry experience are combined to provide you with a solution to your most difficult analytical requirements. The chart below details the sensitivity, or limits of detection (LODs)[1], of the Niton XL2 GOLDD using Soil Analysis Mode for an SiO_2 matrix, a typical soil matrix (SiO_2 with Ca/Fe), and SRM matrix. Soil Analysis Mode offers optimum performance for low levels of RCRA metals and other contaminants/constituents found in soil/sediment type samples. LODs are calculated as three standard deviations (99.7% confidence interval) for each element for a 120-second total analysis time.

Limits of detection (LODs) are dependent on the following factors:

- Testing time
- Interferences/matrix
- Level of statistical confidence

Please Note:
Ongoing research and advancements in our Niton XL2 Series analyzers with geometrically optimized large area drift detector (GOLDD) technology will lead to continual improvement in many of the values detailed in this chart. Contact a Thermo Fisher Scientific office or your local representative for the latest performance specifications.

Actual analysis time is based on your requirements, and, in most cases, shorter times will give you the detection limits you require. For example, if analysis time was reduced from 60 seconds/filter to 15 seconds/filter, then the detection limits obtained would be twice the values shown in the chart. Similarly, increasing the analysis time will reduce the detection limits by the square root of the increased time.

A/S = Application-specific
N/A = Not applicable

1. *Definition and Procedure for the Determination of the Method of Detection Limit,* 40 CFR, Part 136, Appendix B. Revision 1.11. U.S. Environmental Protection Agency. U.S. Government Printing Office: Washington, DC, 1995.

Limits of Detection in ppm (mg/kg)

	Time	60s per filter		
	Matrix	SiO_2	SiO_2+Fe+Ca	SRM
Elements	Ba	55	65	65
	Sb	20	25	22
	Sn	20	25	22
	Cd	10	12	12
	Ag	A/S	A/S	A/S
	Pd	8	8	8
	Zr	10	12	13
	Sr	4	6	10
	Rb	4	4	7
	Pb	7	12	10
	Se	4	5	5
	As	5	10	8
	Hg	7	10	8
	Au	10	12	12
	Zn	8	16	16
	W	50	75	75
	Cu	14	20	20
	Ni	30	40	40
	Co	25	125	125
	Fe	40	N/A	N/A
	Mn	40	70	90
	Cr	70	90	100
	Ti	650	750	1000

Element list shown is not exhaustive. For limits of detection for elements not shown, please contact a Thermo Fisher Scientific office or your local representative.

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