CORRECTIVE ACTION PLAN FOR SOURCE AREA SOIL
MARYLAND SQUARE SHOPPING CENTER
3661 SOUTH MARYLAND PARKWAY
LAS VEGAS, NEVADA

SUBMITTED TO
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> *I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state and local statutes, regulations and ordinances.*

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EXECUTIVE SUMMARY

This corrective action plan (CAP) develops and reviews possible technologies and integrated approaches to remediate soil contaminated by the historical release of dry cleaning solvent containing tetrachloroethene (also known as perchloroethene [PCE]) at the former Al Phillips the Cleaner (APTC). APTC formerly operated in Maryland Square Shopping Center at 3661 Maryland Parkway, Las Vegas, Nevada, herein referred to as the "Property," from 1969 to 2000. A series of environmental investigations were conducted from 2000 to 2008 to estimate the approximate extent of PCE contamination in soil and groundwater beneath the Property. Based on these investigations, the maximum PCE concentration detected in soil at the Property was 120,000 micrograms per kilogram (µg/kg). Section 1 provides a summary of site characterization information and results from previous investigations.

Section 2.0 defines the proposed action level for Source Area Soil. The proposed action level is:

> Prevent direct-contact with soils exceeding the U.S. Environmental Protection Agency (EPA) Region IX Residential Regional Screening Level (RSL) of 550 µg/kg for residential soil.

Final action levels for soil will be selected based on the results and conclusions of a post-remediation, site-specific risk assessment that will evaluate identified routes of exposure, including vapor intrusion pathways and protection of groundwater.

Section 3 identifies and describes remedial alternatives to address or remove PCE mass in soil at the Property, including:

- No Action (Alternative 1)
- Excavation, Offsite Disposal, and In-Situ Chemical Oxidation (Alternative 2)
- Soil Vapor Extraction (SVE) (Alternative 3)
- Hotspot Excavation, Offsite Disposal, SVE, and In-Situ Chemical Oxidation (Alternative 4).

Section 4 evaluates these corrective action alternatives against the following three criteria: effectiveness, implementability, and cost. All of the alternatives (excluding the *No Action* alternative) are considered effective and implementable. Total costs for the alternatives are estimated to be: Alternative 1 - no cost; Alternative 2 – $436,000, Alternative 3 – $822,000, and Alternative 4 – $711,000.

Based on the criteria considered, Alternative 2 (Excavation, Offsite Disposal, and Chemical Oxidation) is the recommended corrective action alternative to remove PCE from soil at the Property, given its:

- Overall protectiveness of human health and the environment
- Long-term effectiveness and permanence
- Quick time frame for achieving the proposed action level
- Additional treatment of PCE mass in soil and groundwater through chemical oxidation
- Ease of implementability
- Lower cost.

Section 5 provides a basis of design for the recommended alternative, including:

- Preliminary bench-scale testing of chemical oxidant to support the design and implementation of the corrective action
- Soil excavation, removal, and offsite disposal
- Chemical oxidation
- Post-corrective action confirmation sampling of soil and groundwater.

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Corrective Action Plan

This corrective action plan (CAP) develops and evaluates technologies and integrated approaches to remediate soil containing tetrachloroethene (also known industrially as perchloroethene, PCE) at the former Al Phillips the Cleaner (APTC) drycleaner. APTC formerly operated at 3661 South Maryland Parkway, Las Vegas, Nevada, herein referred to as the "Property."

1.0 SITE CHARACTERIZATION

This section provides information on the site location and history, and the distribution of PCE in soil at the Property.

1.1 Site Description and Background

The Property is located in the northeast corner of Parcel No. 162-15-602-004, on the northwest corner of Maryland Parkway and East Twain Avenue, across the street from the Boulevard Mall (Converse Consultants [Converse] 2009),in the Southeast ¼ of the Northeast ¼ of Section 15, Township 21 South, Range 61 East, Clark County, Nevada (Figure 1). The Property was first developed in 1969 as a shopping center that included a dry cleaning facility. APTC took over business operations later that same year, and continued to operate the dry cleaning facility until 2000.

The Property was owned by the Herman Kishner Trust until 1999, when Maryland Square Shopping Center LLC (MSSC) purchased the property (Converse 1999). PCE was subsequently detected in soil and groundwater near the southeast corner of the Property during a Phase II Environmental Site Assessment in 2000, (Converse 2000).

MSSC demolished the former shopping center, including the concrete floor and foundation, in summer 2006. Currently, the site of the former shopping center is covered with asphalt, except for the former APTC facility, which is fenced and covered by native soil. The property use in the immediate area is commercial/industrial.

Previous Investigations and Activities

From 2000 to 2008, a series of environmental investigations were conducted to estimate the approximate distribution and extent of PCE in soil and groundwater at the Property. These studies indicated that PCE concentrations in source area soil are generally below 10,000 micrograms per kilogram (µg/kg), although several samples collected at or near boring locations B-10 and B-24 exhibited higher PCE concentrations. The maximum PCE concentration observed was 120,000 µg/kg (URS Corporation [URS] 2005).

Groundwater was sampled periodically from 2000 to 2004, and quarterly groundwater monitoring has been conducted at and downgradient of the Property since late 2005. The results and data presented in prior investigation reports, associated CAPs, and groundwater monitoring reports prepared since 2000 have provided the basis for establishing site conditions and characteristics relevant to the identification and screening of remedial action alternatives. Particular documents used for these purposes include:

- Converse. *Limited Phase II Subsurface Assessment*. August 22, 2000.
- Converse. *A Through K Data Research and Report*. August 22, 2001.
- Converse. *Additional Soil and Groundwater Investigation*. November 13, 2002.
- Converse. *Additional Soil and Groundwater Investigation*. May 16, 2003.
- Converse. *Preliminary Corrective Action Plan*. June 27, 2003.
- URS. *Report, Subsurface Investigation*. July 11, 2005.
- URS. *Source Removal Corrective Action Plan*. November 13, 2006.
- URS. *Source Area Soil Assessment*. February 23, 2007.
- URS. *Report of Offsite Soil Vapor Assessment Report*. April 13, 2007.

A complete list of work plans, investigation reports, and monitoring reports used to prepare this CAP for Source Area Soil is included in Section 6.

1.2 Site Geology

Regional geology consists of heterogeneous deposits of basin-fill alluvium (Zikmund 1996). Soil boring logs from the URS site investigations (2005 and 2007a) describe soils at the site consisting of sands, silts, and clay with intervals of caliche. URS reported that the subsurface lithology on the Property consists of "a layer of fine silty sand and or sandy silt, of variable thickness, on top of a 3-foot to 12-foot thick layer of firm to hard caliche, overlaying a 2-foot to 8-foot layer of fine sandy silt just above groundwater." (URS 2007a) The site lithology is illustrated in Figures 2 though 6, in conjunction with the locations and depths of boreholes, soil sample depths, PCE concentrations in soil samples, and approximate groundwater elevations (URS 2007a).

Groundwater is generally encountered at 18 to 20 feet below ground surface (bgs) (Tetra Tech EM Inc. [Tetra Tech] 2010). As of June 2010, groundwater flows east, with a gradient of 0.0125 feet/foot, based on potentiometric surface contours exhibited on Figure 7 (Tetra Tech 2010). Slug tests performed near and downgradient of the Property indicate that hydraulic conductivities range from approximately 0.8 to17 feet/day (Converse 2004). Site-specific pump tests or slug tests have not been performed within the footprint of the former APTC facility.

1.3 Nature and Extent of Contamination

The nature and extent of PCE in soil beneath the Property was estimated by URS in 2007. Analytical data used to define the distribution of PCE in soil are illustrated on Figure 2, and Figures 3 through 6 are cross-sections depicting the estimated extent of PCE in soil, based on locations of boreholes, soil sample depths, and associated PCE concentrations (URS 2007a). Most of the soil samples for the Property were collected in January 2007 (53 of the 77 analyzed samples); however, geographic coordinates for these samples are only approximate, using well MW-1 as a benchmark (see Figure 2). Elevated concentrations of PCE centralize near the former floor drain through the central area of the former APTC building, particularly near the junction of the north-south lateral and the east-west lateral of the former floor drain (borings B-10 and B-24, Figure 8).

As described below, the residential and industrial Regional Screening Levels (RSL) from the U.S. Environmental Protection Agency (EPA) Region IX were used to estimate respective volumes of PCE-impacted soil. Soil volumes were estimated using the PCE isoconcentration boundaries of 550 and 2,600 µg/kg (Attachment 1), which are based on the information provided in the 2007 Source Area Soil Assessment report (URS 2007a), Table 1. The volume of PCE-impacted soil is estimated using an expansion factor of 1.5 times the amount of in-place soil (bank cubic yards), and excavated tons are derived using a soil density of 100 pounds/cubic foot or 2,700 pounds/cubic yard. Calculation sheets used for the estimation of soil volumes are included in Attachment 1.

Table 1 - Estimated Volumes of Soil for Removal or Treatment

Description	In-Place Cubic Yards[1]	Excavated Cubic Yards	Excavated Tons
Residential RSL 550 µg/kg to 10 feet	314	471	636
Residential RSL 550 µg/kg to groundwater	583	875	1,181
Industrial RSL 2,600 µg/kg to groundwater	137	206	278

Notes:

1. All loads include 7.5 cubic yards in-place (11.3 cubic yards excavated) that exceed the *Code of Federal Regulations* (CFR) 268.49 Land Disposal Restrictions treatment standard; the 7.5 cubic yards will need to be chemically treated prior to land disposal.

RSL Regional Screening Level
µg/kg Micrograms per kilogram

2.0 IDENTIFICATION OF PROPOSED ACTION LEVELS

In correspondence dated July 9, 2010, the Nevada Division of Environmental Protection (NDEP) requested the submittal of a CAP by September 13, 2010, for remediation of PCE remaining in soil at the Property, based on authority provided under *Nevada Administrative Code* (NAC) 445A.227 and 445A.2273 (NDEP 2010a). Provisions of NAC 445A.2272 and 445A.22705 (Section 13 of the Revised Proposed Regulation R189-08) apply for establishing proposed action levels relevant to the selection and screening of potential corrective action alternatives.

NAC 445A.2272 (Section 13 of the Revised Proposed Regulation R189-08) establishes the mechanism to determine corrective action levels for soil remediation based on: (1) background concentration(s) or (2) the presence of a hazardous substance, hazardous waste, or regulated substance at a concentration based on the protection of Waters of the State, public health and safety for all identified routes of exposure, and the environment. As dictated by this code, the NDEP must determine the appropriate concentration allowed to remain at a corrective action site using the Integrated Risk Information System (IRIS), adopted by the EPA as it existed on October 3, 1996, or any other equivalent method or peer-reviewed source of information chosen by the NDEP.

NAC 445A.22705 further offers that, "if an owner or operator is required to take corrective action pursuant to NAC 445A.227, the owner or operator may conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary action levels or to establish that corrective action is not necessary." (LCB File No. R189-08). Although remedial efficiency is best served by conducting the risk assessment before contemplation of corrective action, currently available data are insufficient to complete a defensible risk-based analysis. As a consequence, and to save time, this CAP for Source Area Soil relies on proposed action levels for the identification, screening, and selection of corrective action alternatives. Implementation of the corrective alternative selected based on the proposed action level will provide the balance of data required to complete the site-specific risk assessment, which will either: (1) confirm the results of the preliminary corrective action as sufficiently protective of all identified routes of exposure and the environment or (2) scope and direct the need and extent of subsequent corrective action based on derived corrective action levels, as afforded by NAC 445A.2207.

2.1 Proposed Action Level

The following proposed action level is proposed for corrective action at the Property:

> Prevent direct-contact with soils exceeding the EPA Region IX RSL (EPA 2010) for residential soil of 550 micrograms per kilogram (µg/kg).

This proposed action level is used to develop initial corrective alternatives and to screen these alternatives for feasibility of implementation. Final action levels (NAC 445A.22705) for soil will be determined based on the site-specific risk assessment that involves an evaluation of “all identified routes of exposure and the environment (NAC 445A.2272),” including vapor intrusion pathways and protection of groundwater. This assessment and the derivation of final action levels are necessarily sequenced after the execution of the initial corrective action, when additional subsurface data will be available for the risk assessment.

2.2 Determination of Corrective Action Scope

Corrective action alternatives in this CAP action level are limited to the remediation of soil at the Property. PCE in soil at the Property is considered a source for PCE in groundwater both beneath and downgradient of the Property. However, the scope of this CAP is to address only PCE in soil at the Property.

2.3 Schedule for Corrective Action

Implementation of the selected remedy will begin upon receipt of NDEP concurrence with the final CAP for Source Area Soil in accordance with NAC 445A.2273. The following schedule, subject to refinement in response to ongoing negotiations, is anticipated to help direct progress and completion of the selected remedy:

Task	Duration after NDEP Concurrence
Permitting, Procurement, and Contracting	7 to 60 days
Subsurface Sampling and Bench-Scale Testing	21 to 60 days
Construction & Implementation	60 to 105 days
System startup and testing (if selected)	105 days to undetermined
Reporting	60 days after implementation events–quarterly thereafter
Risk Assessment	90 to 210 days
Demonstration of Closure Conditions	To be determined

3.0 IDENTIFICATION AND ANALYSIS OF CORRECTIVE ACTION ALTERNATIVES

This section identifies and reviews alternatives available to remediate soil requiring action (or no action) at the Property. Preliminary cost estimates for implementation of these alternatives are also provided in this section. Alternatives were developed and screened based on the requirements of NAC 445A.2271, guidance issued and offered by NDEP, and in a manner consistent with EPA's *Guidance on Conducting Non-Time Critical Removal Actions under CERCLA* (EPA 1993).

3.1 The Identification and Evaluation Process

General response actions, technology types, and process options were developed to identify a list of corrective action alternatives for detailed analysis. (The *No Action* alternative is used as a baseline to compare against other alternatives.) As described by EPA under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (EPA 1988), the term "technology" refers to general categories of technology, whereas the term "process option" refers to specific alternative processes within each technology family. Representative process options were selected for each technology type, as necessary, and then process options were combined to form the corrective action alternatives.

Process options that were retained for further consideration were based on proven technologies available for treatment of PCE and on past studies and analyses at the site (URS 2006, 2007a). EPA guidance indicates that the relevant or reasonable assessment should "identify and assess a limited number of alternatives appropriate for addressing the" corrective action goals. (EPA 1993) "Based on available information, only the most qualified technologies that apply to the media or source of contamination should be discussed" (EPA 1993). Corrective action alternatives were evaluated individually and comparatively against the following three broad criteria: effectiveness, implementability, and cost:

<u>Effectiveness</u>

Effectiveness relates to the potential of an alternative to achieve the proposed action level considering the chemical and physical characteristics of the source and the site conditions. Protection of human health and the environment is achieved by reducing the toxicity, mobility, or volume of the contaminated waste over a short-term and long-term timeframe. Also considered are potential impacts to human health and the environment during the construction and implementation phase and the reliability of the process with respect to the site conditions. The level of treatment or containment is also evaluated. For this evaluation, effectiveness will be designated low, moderate, or high.

<u>Implementability</u>

During an evaluation of the implementability of a corrective action alternative, the technical and administrative feasibility of constructing, operating, and maintaining the alternative is measured (EPA 1993). Technical feasibility considers whether or not the corrective action alternative is applicable to the site and can be properly constructed and operated. The evaluation considers long-term operation, maintenance, and monitoring of the implemented alternative. The availability of services and materials required for the alternative are also considered (for example, are disposal services, disposal locations, and the necessary construction expertise and equipment locally available?). Administrative feasibility considers regulatory approval and scheduling restraints. For this evaluation, implementability will be designated easy, moderately difficult, or difficult.

Cost

The costs that are assessed include:

- Capital costs, including direct and indirect costs
- Annual operation and maintenance (O&M) costs, including long-term monitoring costs to evaluate effectiveness
- Net present worth of capital, O&M costs, and periodic costs.

Initial costs were prepared using Remedial Action Cost Engineering and Requirements (RACER), which is a computerized system used to estimate costs for studies, remedial design, remedial action, and related site work for environmental restoration projects. RACER was developed for the U.S. Air Force but is frequently used by EPA. Engineering judgment and vendor quotes were used to refine the RACER estimates. Costs include a 25 percent contingency.

The present worth of each corrective action alternative provides the basis for the cost comparison. The present worth cost represents the amount of money that, if invested in the initial year of the corrective action at a given rate, would provide the funds required to make future payments to cover all costs associated with the corrective action over its planned life. The present worth analysis was performed on the corrective action alternatives using a 5 percent discount (interest) rate over the expected life of the alternative. Inflation and depreciation were not considered in preparing the present worth costs. Assumptions used in preparing the cost estimates appear in Attachment 2.

The final step of the cost analysis is to conduct a comparative analysis of the corrective action alternatives. The comparative analysis in Section 4.0 discusses relative strengths and weaknesses of each alternative with respect to each of the criteria, and how reasonably key uncertainties could change expectations of the alternatives' relative performances. The completed findings of the comparative analysis are used to identify preferred corrective action alternative(s) in Section 4.2.

3.2 Identification of Alternatives

The proposed action level for the site is established to prevent human exposure to soil containing concentrations of PCE exceeding the action level of 550 µg/kg, the EPA Region IX residential RSL. The volume of soil exceeding this concentration has been estimated to be 314 bank cubic yards if excavated to 10 feet (the typical depth for protection of residents and construction workers) and 583 bank cubic yards if excavated to groundwater (as defined within the area depicted on Figure 8). Volume calculations are provided in Attachment 1. Table 2 provides a screening of alternatives for the site, based on site conditions.

Based on an initial screening of the general response actions listed and described in Table 2, the following technologies and process options have been identified and combined into alternatives for further evaluation against the baseline alternative of *No Action* (Alternative 1):

- Excavation, Offsite Disposal, and In-Situ Chemical Oxidation (ISCO)
- Soil Vapor Extraction (SVE)
- Hotspot Excavation, Offsite Disposal, SVE, and In-Situ Chemical Oxidation.

Institutional controls that could include zoning restrictions, engineering controls (e.g. a requirement for subslab vapor barrier beneath any new buildings), or an environmental covenant can be used to protect human health and the environment by precluding future access to, or development of, affected areas. Because these restrictions may be used to protect an implemented remedy, institutional controls may be a necessary or elective element of corrective actions at the site. However, the ultimate need for institutional controls at the Property cannot be ascertained until remedial action to remove the source-area PCE mass is conducted and post-remediation conditions are evaluated to assess residual risk to human health and the environment.

Table 2 - Summary of General Response Actions, Technology Types and Process Options for Soil with Concentrations of PCE in Excess of the Proposed Action Level

General Response Action	Technology Type	Process Option	Notes
No Action[1]	NA	NA	Retained for comparison purposes.
Institutional Controls	Deed restrictions	Deed restrictions	Potentially applicable; however, their use will be analyzed after completion of the post-remediation risk assessment.
	Zoning restrictions	Zoning restrictions	Potentially applicable; however, their use will be analyzed after completion of the post-remediation risk assessment.
	Access restriction	Fencing	Potentially applicable; however, their use will be analyzed after completion of the post-remediation risk assessment.
	Engineering controls or requirements	Vapor Intrusion Controls	Potentially applicable; however, their use will be analyzed after completion of the post-remediation risk assessment.
Removal/Disposal	Excavation and Disposal	**Excavation and Off-Site Disposal**[2 and 4]	Potentially applicable.
		Excavation and On-Site Disposal	On-site disposal is not practical given current and future use of the area.
Treatment	In Situ Treatment		
	Physical Treatment	Stabilization	Weathering of stabilized material will occur at the surface.
		Vitrification	Expensive; not warranted given the level of contamination.
		Electrokinetics	May be difficult to implement.
		Soil vapor extraction[3 and 4]	Potentially applicable.
	Chemical Treatment	**Chemical oxidation**[2 and 4]	Potentially applicable.
		Gaseous oxidation	Difficult to implement.
	Physical/Chemical Treatment	Soil flushing	Unproven, difficulty in gaining hydraulic capture.
	Biological Treatment	Phytoremediation	Will not treat soil to the 10-foot bgs depth.
		Biological degradation	Potentially applicable; however, there have been difficulties using this approach at other sites in the Las Vegas area.
	Ex-Situ		
	Physical/Chemical Treatment	Soil washing	Potentially applicable; must dispose of contaminated waste solution.
	Thermal Treatment	Thermal desorption	Potentially applicable; can be difficult to implement and permit.
		Incineration	Typically used for VOC concentrations greater than 5 to 10% of the soil matrix. Concentrations found at the site are lower and do not warrant this process option.
Containment	Capping	Asphalt	Potentially applicable, will not remove or treat contamination.
		Concrete	Potentially applicable, will not remove or treat contamination.
		Compacted clay and soil	Potentially applicable, will not remove or treat contamination.
	Surface Infiltration Controls	Grading	Potentially applicable, will not remove or treat contamination.

Notes:
Process options selected for further evaluation as corrective action alternatives are highlighted in bold.
[1 to 4] Indicate the corrective action alternative(s) which used the process option
bgs Below ground surface NA Not applicable VOC Volatile organic compound

3.3 Alternative 1 – No Action

The *No Action* alternative is retained as a baseline for comparison. This alternative is to take no action for soil removal or treatment at the site. Potential human health and environmental impacts associated with the PCE impacts to soil are assumed to remain unchanged.

Effectiveness

Alternative 1 would not be effective in achieving the proposed action level in the short- or long-term. Soil containing PCE concentrations in excess of EPA's residential RSL would remain on site, potentially subject to human contact. Future construction or excavation at the site may present a potential hazard to construction workers or future residents. The potential for continued PCE impact to groundwater would remain. There would be no guarantee the proposed action level would be met in the future.

Implementability

Alternative 1 has no technological implementability considerations; it is not considered administratively feasible because NDEP and the local population may find this alternative unsatisfactory.

Cost

No costs are associated with the *No Action* alternative.

3.4 Alternative 2 – Excavation, Offsite Disposal, and In-Situ Chemical Oxidation

Alternative 2 is to excavate soil (to groundwater, which is found at approximately 18 feet bgs) containing concentrations of PCE in excess of the residential RSL, dispose of the soil in a permitted off-site hazardous waste landfill, and injection of a chemical oxidant to the footprint of the excavation. This volume of soil is calculated to be 583 bank cubic yards (see Attachment 1 for volume calculations).

Soil with concentrations of PCE exceeding the residential RSL would be excavated and transported to a hazardous waste landfill, likely the US Ecology Landfill in Beatty, Nevada. Given that concentrations of PCE were detected in excess of the 6,000 µg/kg threshold in the *Code of Federal Regulations* (CFR) 268.49 Land Disposal Restrictions (LDR), approximately 8 cubic yards will require treatment prior to placement at the hazardous waste landfill. The approximate areal extent of the excavation at ground surface, at 10 feet bgs, and at groundwater are illustrated on Figure 9. Post-excavation confirmation sampling would be conducted.

The open excavation provides an opportunity for additional treatment of PCE, with chemical oxidation, in soil and groundwater below the excavation; these data can be subsequently used to evaluate effectiveness of chemical oxidation as part of remedy selection for groundwater. Chemical oxidation involves applying or injecting oxidant chemicals to react with the PCE and ultimately produce innocuous substances such as carbon dioxide, water, and inorganic chloride. In both the laboratory and the field, a number of oxidant chemicals have proven effective for oxidation of PCE, including: potassium permanganate, sodium permanganate, activated persulfate, and Fenton's Reagent (hydrogen peroxide with an iron catalyst). Bench-scale testing should be conducted to determine the effectiveness of chemical oxidation at the site, soil oxygen demand (SOD), and dosing requirements; if bench-scale testing is unsuccessful, chemical oxidation would not be applied at the site. The chemical oxidant would be applied to the footprint of the excavation and mixed into the top few feet of the saturated zone, oxidizing residual PCE mass remaining in both soil and groundwater below the excavation. For preliminary screening, the use of potassium permanganate as the reagent chemical oxidant is assumed. However, other oxidant chemicals or application methods may be used if they prove more effective or preferred based on bench-scale testing or regulatory issues.

Groundwater would be monitored 1 week and 1 month after application to determine whether oxidant residues are present, and to assess the effectiveness of the application. A groundwater monitoring well may be installed closer to the excavation to monitor aquifer effects immediately downgradient. Subsequently, data from quarterly groundwater monitoring would be used to evaluate the effectiveness

(and effects) of the chemical oxidant on groundwater. Based on preliminary observations, other or additional post-application monitoring and assessment techniques or protocols may be integrated into the groundwater monitoring program, as identified or warranted.

Effectiveness

Alternative 2 is effective because it would meet the proposed action level quickly. Excavation could begin when bench-scale testing of the chemical oxidant is nearly complete. Soil with PCE concentrations exceeding the residential RSL would be removed down to groundwater, eliminating the threat to humans from direct contact and during potential future development at the site. Precautions would be necessary to protect workers and the community during excavation, handling, and disposal. The mobility of contaminants would be reduced in the permitted hazardous waste landfill; approximately 8 cubic yards of the soil would be stabilized before placement in the landfill, which would further reduce mobility. Additional treatment would occur at the site in soil and groundwater with the addition of a chemical oxidant; PCE in soil and the groundwater beneath the excavation would be degraded by the chemical oxidant.

Implementability

Excavation and disposal are proven and readily implementable technologies for contaminated soil; soil can be disposed of at the US Ecology Landfill in Beatty, Nevada, 122 miles from the site. Chemical oxidation for degradation of PCE is a common technology, and potassium permanganate or other chemical oxidants are readily available. Chemical oxidants are typically injected into the subsurface, but this method of application has been used successfully at other sites.

This alternative is also considered administratively feasible. NDEP has indicated that a contingency plan and a short-term Underground Injection Control (UIC) Permit would be required for application of chemical oxidant (NDEP 2010b).

Cost

The capital cost of Alternative 2 is $436,000. There are no O&M costs. Groundwater would be monitored 1 week and 1 month following chemical oxidant application, and future groundwater monitoring would be completed as part of the quarterly groundwater monitoring program.

3.5 Alternative 3 – Soil Vapor Extraction and Institutional Controls

The function of an SVE system is to extract volatile organic compounds (VOC) in contaminated soil by applying a negative pressure, or vacuum, to the subsurface. A blower applies the vacuum through a network of extraction wells installed within the contaminated area. The pressure gradient that results from the applied vacuum induces air flow through the vadose zone to the extraction points and the soil gas containing vapor-phase contaminant(s) is removed. Continuing this vapor extraction over time, as the contaminants adsorbed to soil are volatilized, ultimately results in efficient removal of VOCs from the vadose zone. VOCs in blower effluent are removed before the treated air is discharged to the atmosphere.

Soil containing concentrations of PCE in excess of the residential RSL would be treated with six SVE wells screened from approximately 5 feet bgs to approximately 2 feet above the groundwater table. A radius of influence (ROI) of 17 feet is also assumed based on similar applications in the Las Vegas area and the soil type. The projected locations of the SVE wells are shown on Figure 10.

PCE in the extracted vapors would be removed by two vapor-phase granulated activated carbon (GAC) units in series before discharge to the atmosphere. A pilot scale test should be considered to better determine SVE design parameters, including the ROI and likely concentrations in the extracted vapor. It was assumed that SVE would require approximately 4 years of operation based on similar operations and engineering judgment; operation in the latter years would likely be pulsed as yield decreases. O&M of the system would include weekly air monitoring to assure discharge standards associated with an air quality

permit are met. It was assumed that carbon in the lead GAC vessel would be changed monthly, and soil sampling would be conducted at the completion of the SVE operation.

Effectiveness

SVE is an effective means to remove PCE mass from subsurface soil. PCE mass would be captured on vapor phase GAC and would be recovered or destroyed when the spent GAC is thermally regenerated off site. It is assumed that four years of treatment would be required to remove PCE to the proposed action level. Precautions would be necessary to protect workers and the community during SVE well installation. If it is later decided that additional action is required based on the post-remediation risk assessment, SVE wells could be added into the system to achieve future corrective action goals or action levels. The system could also be integrated with an air sparge system for treatment of PCE in groundwater.

Implementability

SVE is considered technically implementable; SVE is a common technology and has been used effectively in the Las Vegas area at similar sites. The alternative is considered administratively feasible; however, the SVE system would require an air permit and air monitoring.

Cost

The capital cost of Alternative 3 is $238,000. O&M costs including SVE system maintenance, GAC replacement, and air monitoring for 4 years are an estimated $584,000. The total cost of Alternative 3 is $822,000.

3.6 Alternative 4 – Hotspot Excavation, Offsite Disposal, SVE, In-Situ Chemical Oxidation

Alternative 4 incorporates excavation of soil containing concentrations of PCE that exceed the industrial RSL of 2,600 µg/kg, or "hot spots." For this alternative, hotspots would be excavated to groundwater (approximately 18 feet bgs) and disposed of in a permitted, off-site hazardous waste landfill. Once the excavation is completed, chemical oxidant would be added to the footprint of the excavation. The volume of soil excavated under this alternative was calculated as 137 bank cubic yards (see Attachment 1), and the estimated footprint of the excavation at ground surface and at the groundwater table is depicted on Figure 11. Excavated soil would be transported to a hazardous waste landfill (US Ecology Landfill in Beatty, Nevada). Because some soil samples contained concentrations of PCE in excess of the 6,000 µg/kg maximum concentration allowed under CFR 268.49 LDRs, approximately 8 cubic yards of soil would require treatment prior to placement at the hazardous waste landfill. Post-excavation confirmation sampling would be conducted. Soil requiring treatment prior to landfill may be transported to a treatment, storage, and disposal facility other than US Ecology, as needed.

As stated in Section 3.3, a number of chemical oxidizers have proven effective for oxidation of PCE, including: potassium permanganate, sodium permanganate, activated persulfate, and Fenton's Reagent (hydrogen peroxide with an iron catalyst). Bench-scale testing should be conducted to determine the effectiveness of chemical oxidation at the site, SOD, and dosing requirements. If bench-scale testing indicates a probable, in-situ, remedial benefit or effect, chemical oxidant would be placed in the footprint of the excavation and mixed into the top few feet of the saturated zone. Groundwater monitoring would be conducted 1 week and 1 month following application to determine the effectiveness of the application. Data from quarterly groundwater monitoring would be used to evaluate the effectiveness (and effects) of the chemical oxidant on groundwater.

After completion of excavation and possibly oxidation efforts, remaining soil exhibiting PCE concentrations exceeding the residential RSL would be treated using five SVE wells screened from approximately 5 feet bgs to 2 feet above the groundwater table, assuming a radius of influence per well of 17 feet (based on similar applications in the Las Vegas area and soil type)—also illustrated on Figure 11. PCE in the effluent gas would be treated by two vapor-phase GAC units in series before discharge to the atmosphere. Upon startup, a better determination of SVE design parameters including the ROI and likely

influent concentrations would be possible, and system modifications to enhance recovery may be proposed. Current assumptions are that:

- SVE would require approximately 2 years of operation based on similar operations and engineering judgment.
- Operation in the latter year would likely be pulsed as the yield decreased.
- O&M of the system would include weekly air monitoring to assure discharge standards associated with an air quality permit are met.
- Carbon in the lead GAC vessel would be charged every other month.
- Soil sampling would be conducted at the completion of SVE operation.

Effectiveness

Alternative 4 is effective because it would meet the proposed action level. Soil with PCE concentrations that exceed the industrial RSL would be excavated down to groundwater, and soil with concentrations exceeding the residential RSL would be treated by SVE. Precautions would be necessary to protect workers and the community during excavation, handling, disposal of soil, and installation of the SVE system. The mobility of PCE would be reduced in the permitted hazardous waste landfill; 8 cubic yards of the soil would be treated to achieve Universal Treatment Standards before placement in the landfill, which would further reduce mobility. Additional treatment would occur at the site in soil and groundwater by adding a chemical oxidant to the excavation footprint; PCE beneath the excavation would be degraded by the chemical oxidant.

Residual PCE would be captured on vapor phase GAC, and would be either reclaimed or destroyed when the spent GAC is thermally regenerated off site. It was assumed that two years of treatment would be required to remove PCE mass to achieve proposed action level concentrations in soil at the Property. If it is later decided that additional action is required at the site based on the post-remediation risk assessment, SVE wells could be added into the system to achieve future corrective action goals. The system could also be combined with an air sparge system for the concurrent treatment of groundwater.

Implementability

Excavation, offsite disposal, chemical oxidation, and SVE are considered technically implementable and readily available; they are common technologies used in the treatment of PCE. The alternative is considered administratively feasible. Application of the chemical oxidant may require a permit, and the SVE system would require an air permit and air monitoring.

Cost

The capital cost of Alternative 4 is $425,000. O&M costs including SVE system maintenance, GAC replacement, and air monitoring for 2 years are estimated at $286,000. The total cost of Alternative 4 is $711,000.

4.0 COMPARATIVE ANALYSIS OF CORRECTIVE ACTION ALTERNATIVES

This section compares the corrective action alternatives retained for detailed analysis at the Property. The comparison focuses on the effectiveness, implementability, and cost of each alternative. The following sections present the comparative analysis, a summary of findings, and the recommended corrective action based on the comparative analysis.

4.1 Comparative Analysis

This analysis will discuss relative strengths and weaknesses of each alternative with respect to each of the criteria, and how reasonably key uncertainties could change expectations of the alternatives' relative performances. The purpose of the analysis is to compare the relative effectiveness, implementability, and cost of the corrective action alternatives, in order to recommend one corrective action alternative. The effectiveness comparison will include consideration of: (1) overall protectiveness; (2) long-term effectiveness and permanence; (3) reduction of toxicity, mobility, and volume through treatment; and (4) short-term effectiveness of each alternative. The implementability comparison will include consideration of: (1) ability to construct and operate, (2) ease of implementing more action if necessary, (3) availability of services and capacities, and (4) availability of equipment and materials to implement each alternative. The cost comparison will include consideration of the estimated total present worth cost of each alternative. A summary of the comparison is in Table 3.

<u>Effectiveness</u>

All alternatives described, excluding the no action alternative, could effectively achieve the proposed action level and the overall protection of human health at the site. Each alternative considered, with the exception of the *No Action* alternative, could be effective as a long-term and permanent remedy. Alternative 2 (Excavation, Offsite Disposal, and Chemical Oxidation) can be completed and, given current data and assumptions, achieve the proposed action level in the shortest time–a few months. Alternative 3 (SVE) would require the longest time to achieve the proposed action level because of the time required to partition PCE mass into the vapor phase for recovery and capture above grade (for cost estimating, it was assumed this would require approximately 4 years). Alternative 4 (Hotspot Excavation, Offsite Disposal, Chemical Oxidation, and SVE) would require less time than Alternative 3 but more time than Alternative 4 (for cost estimating purposes, 2 years were assumed). Alternatives 2 and 4, given the additional construction and heavy equipment requirements, may pose a higher risk of exposure to workers at the property, but risks can be mitigated through proper health and safety procedures.

Alternative 2 would reduce the mobility of PCE in soil transported to (and treated at) a hazardous waste landfill, and would treat additional PCE by chemical oxidation. Alternative 3 would reduce the volume of PCE in soil, and PCE removed by means of SVE would be reclaimed or destroyed upon regeneration of the vapor phase GAC. Alternative 4, a hybrid of Alternatives 2 and 3, would also achieve reductions in the mobility and volume of PCE through treatment.

<u>Implementability</u>

Each of the described alternatives is considered technically implementable, and the materials, equipment and expertise required for each alternative should be readily available. Each alternative could accommodate additional corrective actions if necessary; however, it would be easiest to add additional SVE wells or an air sparge system to the SVE systems considered in Alternatives 3 and 4.

Cost

Alternative 1 (*No Action*) is the least expensive with no cost. Alternative 2 (Excavation, Offsite Disposal, and Chemical Oxidation) is estimated to have the lowest remedial cost at $436,000, followed by Alternative 4 (Hotspot Excavation, Offsite Disposal, Chemical Oxidation, and SVE) with total costs of $711000. Alternative 3 (SVE) is the most expensive alternative, due to its O&M costs, with a total cost of $822,000.

4.2 Recommended Alternative

Alternative 2 (Excavation, Offsite Disposal, and Chemical Oxidation) is the recommended corrective action alternative for soil at the Property, given its:

- Overall protectiveness of human health and the environment
- Long-term effectiveness and permanence
- Rapid achievement of the proposed action level
- Additional treatment of PCE mass in soil and groundwater through chemical oxidation
- Ease of implementability
- Lower cost.

The only functional and mechanical difference between Alternative 2 and Alternative 4, which is considered the secondary remedial selection, is the subsequent addition of the SVE component after completion of excavation and chemical oxidation activities. Because of potential to gain significant information and understanding of site conditions during an excavation, deferring implementation of SVE would be reasonable until after (1) excavation and oxidation activities, and (2) assessment of how successful excavation and oxidation were in the remedial effort.

If the post-remediation risk assessment concludes that the corrective actions employed under Alternative 2 adequately protect human health and the environment from subsequent PCE exposure, remediation of the source area soils would be considered successful. If the risk assessment determines that remaining PCE in the soil poses unacceptable risk to human health or the environment, the remaining SVE component assessed under Alternative 4 could be implemented.

Table 3 – Comparison of Alternatives Summary

Alternative	Description	Effectiveness	Implementability	Cost
1	No Action	Low – The *No Action* alternative is not effective in preventing exposure to soil with concentrations exceeding the proposed action level.	Difficult – While this alternative is technically implementable, the alternative does not meet the proposed action level and may be unacceptable to regulating agencies and the community.	Capital Costs: None O&M Costs: None
2	Excavation, Off-Site Disposal, and Chemical Oxidation	High – Soil with concentrations exceeding the proposed action level to the depth of groundwater is removed from site, removing the threat from direct contact to soil. Precautions can be taken to prevent exposure of workers and the community during excavation. The mobility of the contaminants would be reduced by placement (and treatment of soil exceeding the LDR) in a permitted landfill. Treatment of PCE in soil and groundwater would decrease PCE concentrations (and volume) in the soil and groundwater below the excavation.	Easy – This alternative would be technically feasible; excavation, offsite disposal, and chemical oxidation are easily implementable. A bench-scale test should be conducted to better determine chemical oxidant design parameters; if the bench-scale testing is unsuccessful, chemical oxidant would not be applied. This alternative is administratively feasible. A permit may be required for chemical oxidant application.	Capital Costs: $436,000 O&M Costs: None Total: $436,000
3	Soil Vapor Extraction	High – PCE in soil with concentrations exceeding the proposed action level would be removed through SVE, captured on GAC, and reclaimed or destroyed in the carbon regeneration process. The mobility and volume of the contaminants would be reduced. Precautions can be taken to prevent exposure of workers and the community during installation.	Easy – This alternative would be technically feasible; SVE is a readily implementable technology. A pilot-scale test should be considered to allow for better determination of SVE design parameters. This alternative is administratively feasible; an air permit would be required for operation of the SVE system.	Capital Costs: $238,000 O&M Costs: $584,000 Total: $822,000
4	Hotspot Excavation, Off-Site Disposal, Chemical Oxidation, and Soil Vapor Extraction	High – Soil with concentrations exceeding industrial RSLs would be removed to the depth of groundwater. Treatment of PCE in soil and groundwater would decrease PCE concentrations in the soil and groundwater below the excavation. PCE in soil with concentrations exceeding the proposed action level but below the industrial RSL would be removed through SVE, captured on GAC, and reclaimed or destroyed in the carbon regeneration process. Precautions can be taken to prevent exposure of workers and the community during excavation. The mobility of the contaminants would be reduced by placement in a permitted landfill (after treatment of soil with concentrations exceeding the LDR), and the mobility and volume of the contaminants would be reduced through chemical oxidation and removal.	Easy – This alternative would be technically feasible; all components are readily implementable technologies. Bench-scale testing of the chemical oxidant and pilot-scale testing of an SVE well should be considered. If the bench-scale testing is unsuccessful, chemical oxidant would not be applied. This alternative is considered administratively feasible; an air permit would be required for the SVE system, and a permit may be required for the chemical oxidant application.	Capital Costs: $425,000 O&M Costs: $286,000 Total: $711,000

Notes:
GAC – Granular activated carbon
PCE – Tetrachloroethene
LDR – Land disposal regulations
RSL – U.S. Environmental Protection Agency Region IX Regional Screening Level
O&M – Operation and maintenance
SVE – Soil vapor extraction

5.0 PRELIMINARY BASIS OF DESIGN

This section describes the basis of design for the components of the proposed soil corrective action, including:

- Preliminary activities to support the design and implementation of the corrective action
- Soil excavation, removal, and off-site disposal
- Chemical oxidation
- Post-corrective action confirmation sampling of soil and groundwater.

The components for the design of the proposed corrective actions, illustrated on Figure 9, are based on previous investigations and the analysis of alternatives completed in this CAP for Source Area Soil. The criteria for the design are based on engineering best practice, professional judgment, and attainment of the proposed action level developed in Section 2. Soil containing PCE in excess of the proposed action level will be removed to a depth of approximately 18 feet bgs, which is the approximate depth to groundwater. Confirmation samples collected from the footprint of the excavation would be used to assess the residual mass remaining in soil and groundwater after excavation. Remaining PCE mass quantified in soil and groundwater beneath the excavation would be treated by the application of a chemical oxidant prior to backfill.

5.1 Initial Activities

One or more subsurface soil samples immediately below the groundwater table would be collected (in the vicinity of former boring B-10) for bench-scale testing of chemical oxidant(s) and analysis of geophysical properties (grain size distribution, total organic carbon content, and horizontal and vertical permeability). The purpose of the bench testing is to determine native soil oxidant demand and, consequently, the required amount and effectiveness of chemical oxidants to completely react with and degrade site contaminants to achieve the proposed action levels.

A laboratory would execute the bench test, and monitor oxidant demand and chemical concentrations until solvents contained within the sample have been effectively oxidized. Results of the bench-scale testing would refine the necessary “dosing rate” of oxidant to be used at the site, and then to be used to help evaluate the effectiveness of chemical oxidation and provide critical information for refinement of cost estimating and full-scale design.

5.2 Description of Recommended Corrective Action Alternative

The recommended alternative is excavation of soil with concentrations exceeding the proposed action level of 550 µg/kg to the depth of groundwater (approximately 18 feet bgs), off-site disposal of excavated soil, and in-situ chemical oxidation of residual contamination. Construction workers would be required to use appropriate precautions and personal protective equipment. Air monitoring and dust control would be implemented during construction activities. The Property would remain fenced to prevent unauthorized access.

<u>Excavation</u>

Based on preliminary calculations and data from previous investigation, 583 in-place cubic yards of soil would be excavated (Figure 9). Attachment 1 provides the volume calculations. Standard excavation equipment (backhoes and excavators, breakers for the caliche) and standard practices for excavation of contaminated materials would be employed. Sampling for the purpose of bench-scale testing of chemical oxidants would be conducted before excavation, and confirmation samples would be collected after excavation.

<u>Disposal</u>

The approximate volume of soil excavated, 851 excavated cubic yards (assumes a bulking factor and additional soil to achieve slope stability), would be disposed off site at an appropriately permitted hazardous waste landfill. Disposal of the soil is anticipated at the US Ecology Landfill in Beatty, Nevada,

approximately 122 miles from the site. Because concentrations of PCE were detected exceeding the 6,000 µg/kg threshold under LDR, approximately 8 cubic yards would require treatment by stabilization at the landfill.

Confirmation Sampling

Confirmation soil samples would be collected at the following frequencies and locations:

- One sample per 50 feet of horizontal side wall exposed, and from the approximate depth of original samples in the area that exceeded the proposed action level
- One sample per quadrant from the floor of the excavation, and a sample from the center of the floor.

Confirmatory soil samples would be analyzed for PCE. If samples contain PCE exceeding the proposed action level, the excavation would be extended and an additional sample would be collected. Excavation and sampling would continue until all sidewall confirmation samples are below the proposed action level or until utilities or structural impediments are encountered.

Chemical Oxidant Application

The amount of oxidant, potential type of oxidant, and application and delivery method would be refined after bench scale testing and in conjunction with the geophysical parameters of the soils. If bench scale testing is unsuccessful, the chemical oxidant would not be applied. If the chemical oxidant is applied to the open excavation, a contingency plan would be submitted to NDEP (NDEP 2010b). The initial amount of chemical oxidant (approximately 2,800 pounds of potassium permanganate) required to treat soil and groundwater below the excavation was based on previous site sampling, discussions with a chemical oxidant vendor, and a conservative contingency factor of 300%.

Two application methods are possible: mixing a chemical oxidant powder into the top few feet of the saturated zone with an excavator or infiltrating a slurry. A preferred method would be developed in conjunction with the bench scale testing and described in the contingency plan (for the purposes of cost estimating, mixing with an excavator was the assumed application method). The potassium permanganate would be delivered to the site as a powder, which would allow either method of application.

If the oxidant is infiltrated as a solution, a water truck, tank and mixer would be used to mix the water and the potassium permanganate to a 6% solution. A hose would be used to manually spray the solution into the excavation at the same rate as the infiltration, so only a few inches of the solution would be allowed to sit in the bottom of the excavation. Based on an infiltration rate of 1 inch per hour, application could take as long as 13 hours.

Groundwater Sampling

After application of the chemical oxidant, groundwater would be monitored after 1 week and 1 month (after then quarterly) to determine the effectiveness of the application; an anticipated three to five groundwater monitoring wells in the vicinity would be monitored to assess the reach and effectiveness of the oxidant application. The groundwater monitoring strategy would be refined as the design progresses. Monitoring wells MW-1, MW-9, and MW-17 are closest to the excavation area (Figure 7); however, a new groundwater monitoring well may be installed closer to the excavation. The purple color of the potassium permanganate solution would generally allow its presence in groundwater to be monitored visually. Quarterly groundwater monitoring would evaluate the continuing oxidative effects and remedial effectiveness of the ISCO application.

Filling and Compaction

Excavations will be filled using clean imported fill material. The required compaction would be based on potential future use.

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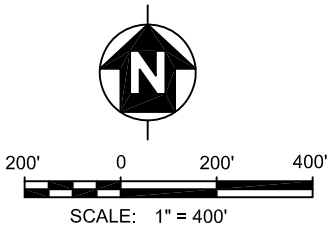
FIGURES



MARYLAND SQUARE SHOPPING CENTER
3661 South Maryland Parkway
Las Vegas, Nevada

FIGURE 1
SITE LOCATION MAP

Soil Corrective Action Plan

TETRA TECH

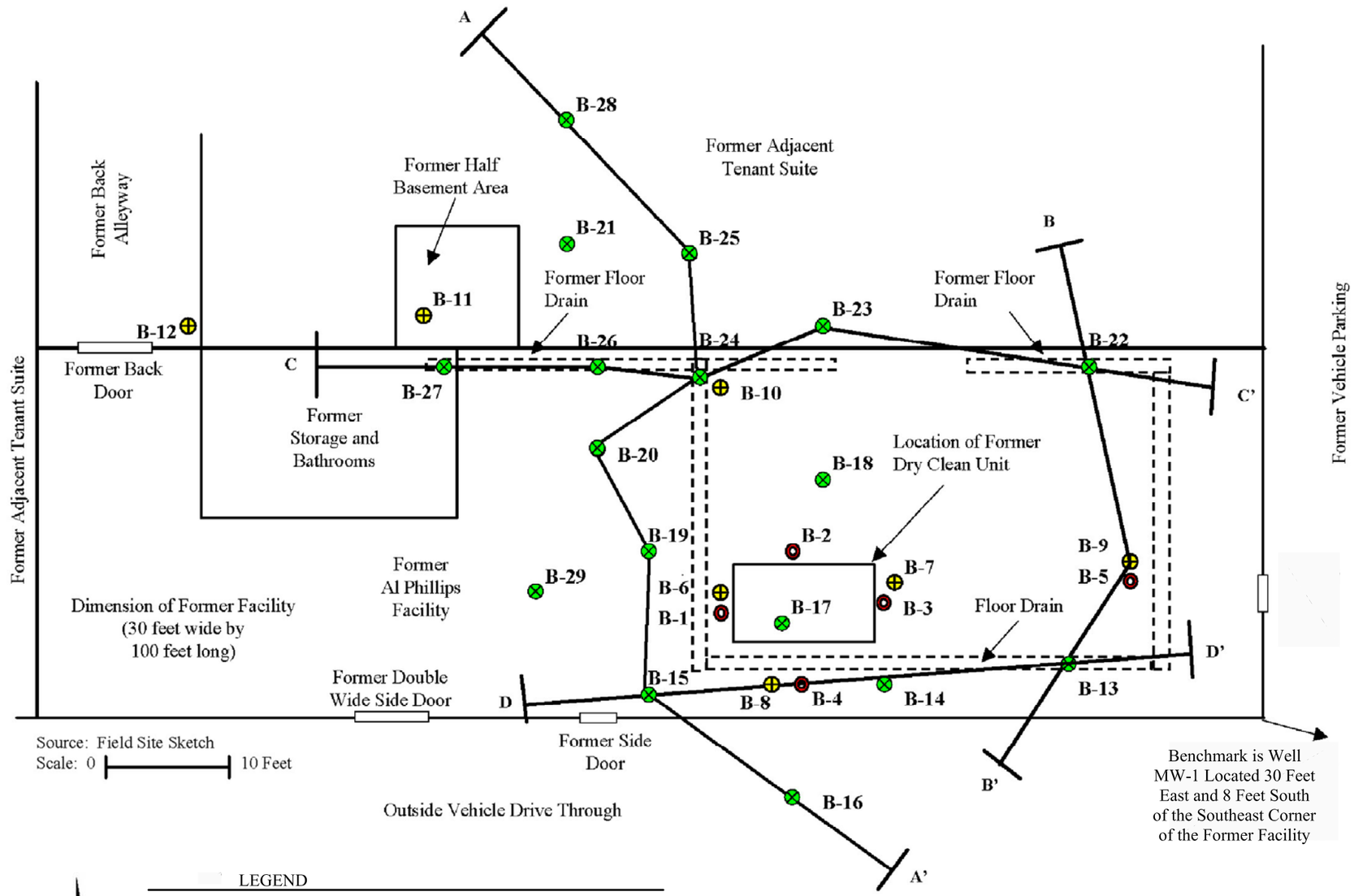
R:\Clients\Maryland Square, Las Vegas NV\ Figure 1 Site Map.dwg 12/14/2010 deborah.ford DN

Concentration of PCE in Soil Boreholes
(January 2007)

Sample Number / Sample Elevation / PCE Concentration

B-6-5	1991	830	B-19-10	1984.5	21
B-6-10	1986	300	B-19-13	1981.5	270
B-6-15	1981	1,500	B-19-15	1979.5	1,500
B-7-5	1991	850	B-20-5	1989.5	270
B-7-10	1986	52	B-20-10	1984.5	1,200
B-7-15	1981	169	B-20-13	1981.5	1,600
B-8-5	1991	4,700	B-20-15	1979.5	860
B-8-10	1986	360	B-21-8	1984	110
B-8-15	1981	640	B-21-13	1979	380
B-9-5	1991	ND	B-22-0.5	1993	9
B-9-10	1986	38	B-22-1.5	1992	21
B-9-15	1981	ND	B-22-10.5	1983	91
B-10-5	1991	1,200	B-22-14.5	1979	380
B-10-10	1986	120,000	B-23-3	1989.5	350
B-10-15	1981	3,500	B-23-5	1987.5	4
B-11-2.5	1946	46	B-23-10	1982.5	92
B-12-3.5	1992	ND	B-23-13	1979.5	86
B-13-13	1980	110	B-24-5	1988.5	56,000
B-13-16	1977	300	B-24-8	1985.5	6,800
B-14-6.5	1988	340	B-24-13	1980.5	4,300
B-14-8	1987.5	64	B-25-5	1987	490
B-14-10	1985.5	62	B-25-10	1982	290
B-14-16	1979.5	450	B-25-13	1979	140
B-15-5	1990	460	B-26-2.5	1991	390
B-15-8	1987	44	B-26-5	1988	900
B-15-15	1980	94	B-26-8	1985	870
B-16-7.5	1986.5	290	B-26-10	1983	7,200
B-16-10.5	1983.5	210	B-26-13	1980	1,000
B-16-15.5	1978.5	150	B-27-5	1987	430
B-17-5	1990	460	B-27-13	1979	540
B-17-10	1985	570	B-28-10	1982	91
B-17-15	1980	680	B-28-13	1979	74
B-18-5	1989	140	B-29-5	1990	320
B-18-13	1981	480	B-29-10	1985	ND
B-18-15	1979	140	B-29-15	1980	27
B-19-5	1989.5	560	B-29-15.5	1979	6

PCE Concentrations in micrograms per kilogram (µg/kg).
Elevations are in feet (ft.). ND = none detected.



LEGEND

- Approximate Location of Borehole Drilled by URS 2005.
- Approximate Location of Borehole Drilled by Converse.
- Approximate Location of Borehole Drilled by URS 2007.
- A – A' Approximate Location of of Lithologic Cross-Section
- PCE Tetrachloroethene

Source: Source Area Soil Assessment, Former Phillips Facility Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. URS Corporation, February 23, 2007.

MARYLAND SQUARE SHOPPING CENTER
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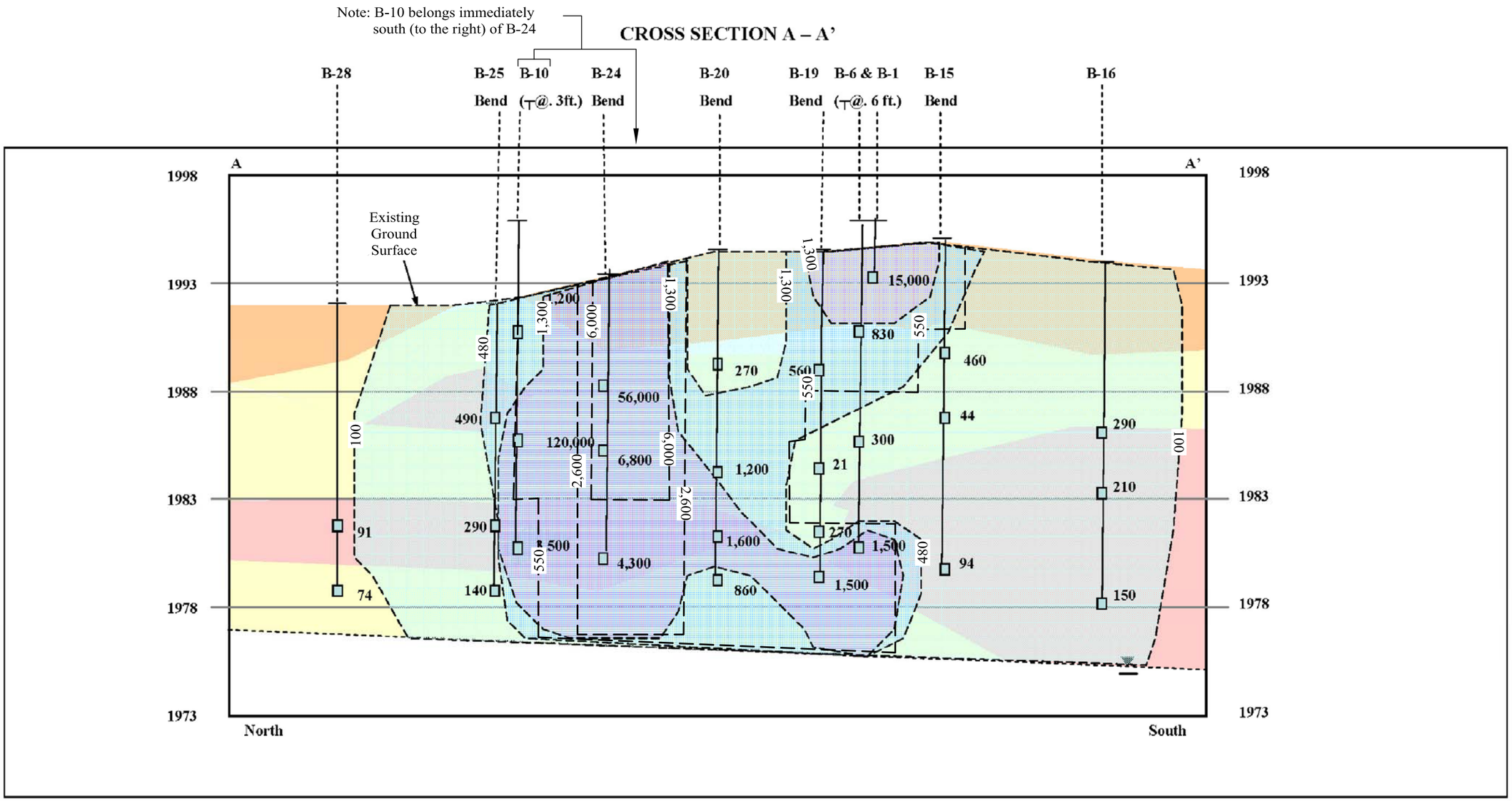
FIGURE 2
SITE PLAN

Soil Corrective Action Plan

TETRA TECH

R:\Clients\Maryland Square, Las Vegas NV\ Figure 2 Source Area.dwg 12/14/2010 deborah.ford DN



Horizontal Scale: 0 — 10 feet

Vertical Scale: 0 — 5 feet

Boreholes B-1, B-6, and B-10 were drilled from the elevation of the concrete floor that existed at the former facility.

LEGEND

Approximate Lithologic Boundary Changes

Approximate Groundwater Table

Above Ground
Sandy Silt (Fine)
Caliche
Sandy Silt (Fine)
Sand

Estimated Vertical and Lateral Area of PCE Contaminated Soil at 100 µg/kg, 480 µg/kg, and 1,300 µg/kg (Based on April 2005 Soil Samples, URS).

350 PCE Concentration in µg/kg at Corresponding Depth

PCE Tetrachloroethene

µg/kg Micrograms Per Kilogram

Source: Source: Source Area Soil Assessment, Former Phillips Facility Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. URS Corporation, February 23, 2007.

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FIGURE 3
CROSS SECTION A-A'

Soil Corrective Action Plan

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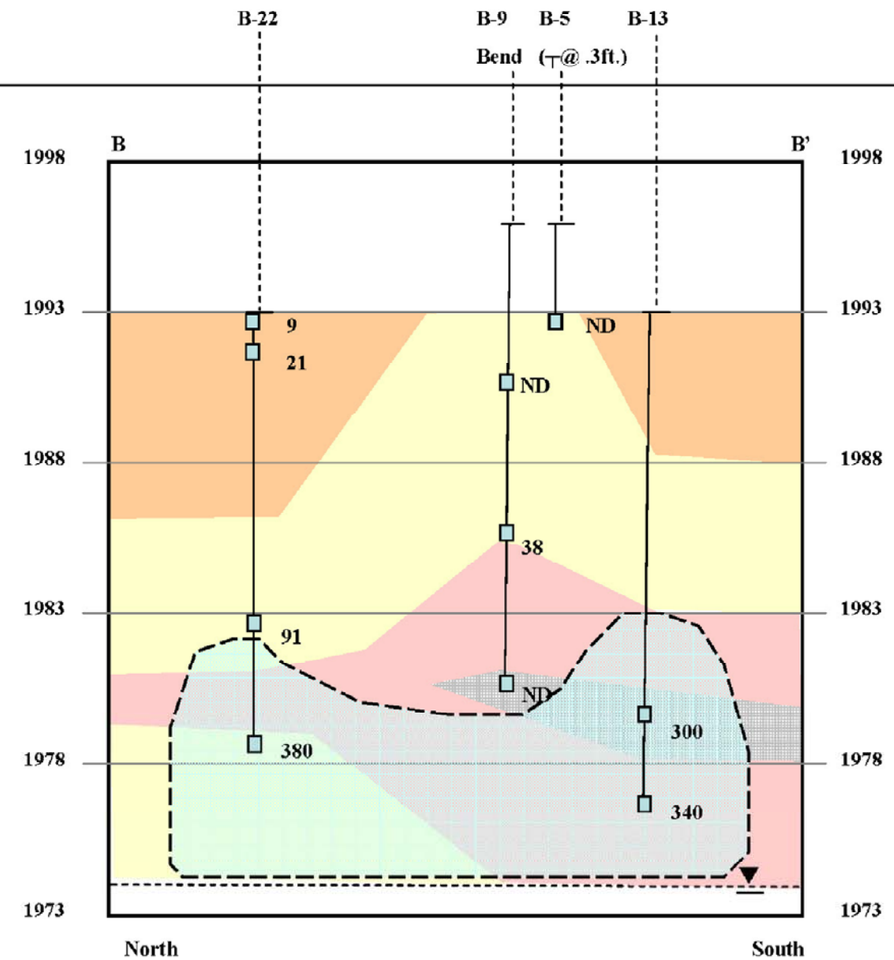
R:\Clients\Maryland Square, Las Vegas NV\ Figure 3 Cross Section A.dwg 12/14/2010 deborah.ford DN

CROSS SECTION B – B'



Horizontal Scale: 0 ├──┤ 10 feet

Vertical Scale: 0 ├──┤ 5 feet

Note:

Boreholes B-5 and B-9 were drilled from the elevation of the concrete floor that existed at the former facility.

LEGEND

Approximate Lithologic Boundary Changes

- Above Ground
- Sandy Silt (Fine)
- Caliche
- Sandy Silt (Fine)
- Sand

Approximate Groundwater Table

Estimated Vertical and Lateral Area of PCE Contaminated Soil at 100 µg/kg.

350 PCE Concentration in µg/kg at Corresponding Depth

PCE Tetrachloroethene

µg/kg Micrograms Per Kilogram

Source: Source: Source Area Soil Assessment, Former Phillips Facility Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. URS Corporation, February 23, 2007.

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FIGURE 4
CROSS SECTION B-B'

Soil Corrective Action Plan

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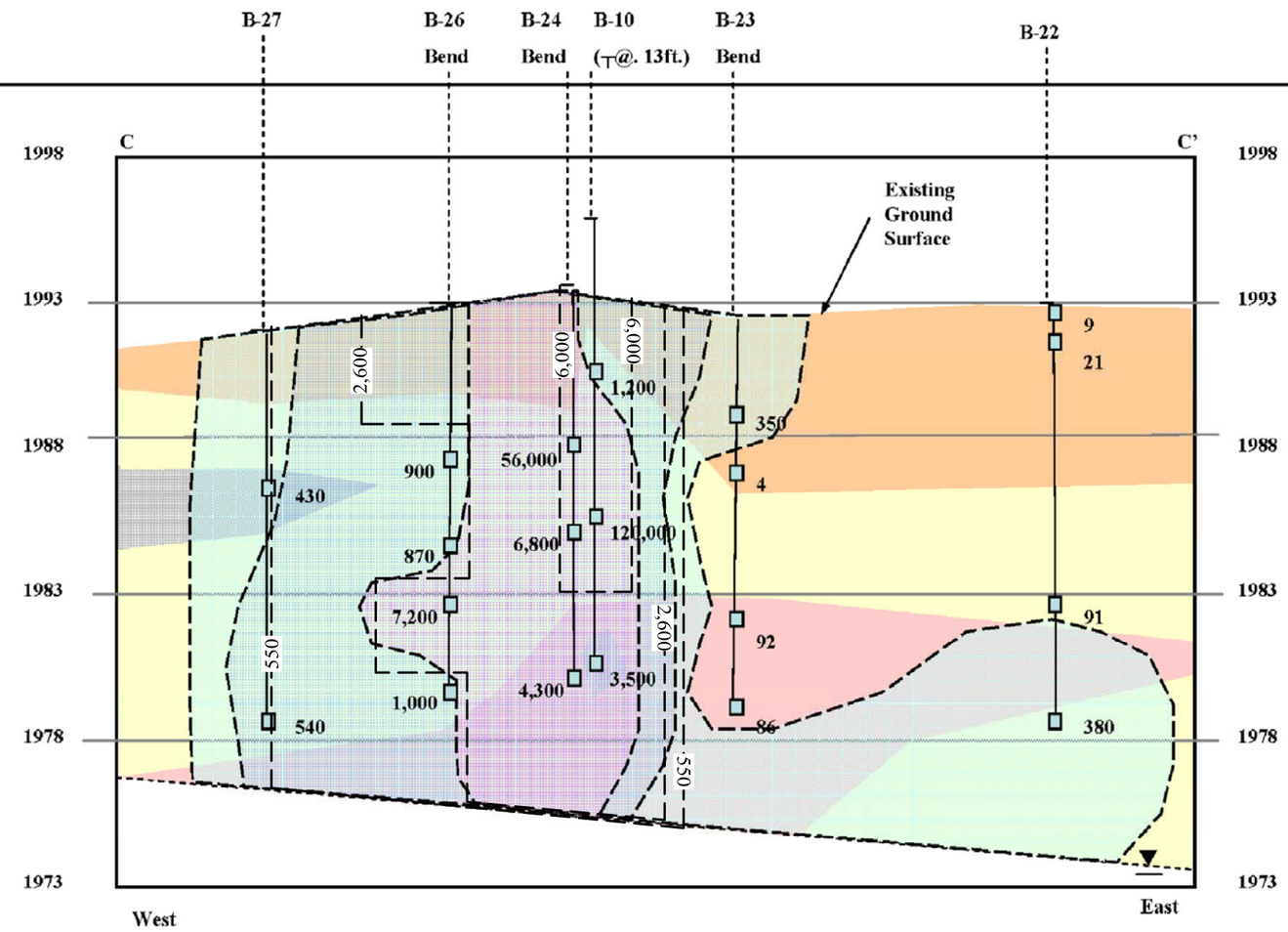
CROSS SECTION C – C'



Horizontal Scale: 0 — 10 feet

Vertical Scale: 0 — 5 feet

Note:

Borehole B-10 was drilled from the elevation of the concrete floor that existed at the former facility.

LEGEND

Approximate Lithologic Boundary Changes

- Above Ground
- Sandy Silt (Fine)
- Caliche
- Sandy Silt (Fine)
- Sand

Approximate Groundwater Table

Estimated Vertical and Lateral Area of PCE Contaminated Soil at 100 µg/kg, 480 µg/kg, and 1,300 µg/kg.

350 — PCE Concentration in µg/kg at Corresponding Depth

PCE — Tetrachloroethene

µg/kg — Micrograms Per Kilogram

Source: Source: Source Area Soil Assessment, Former Phillips Facility Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. URS Corporation, February 23, 2007.

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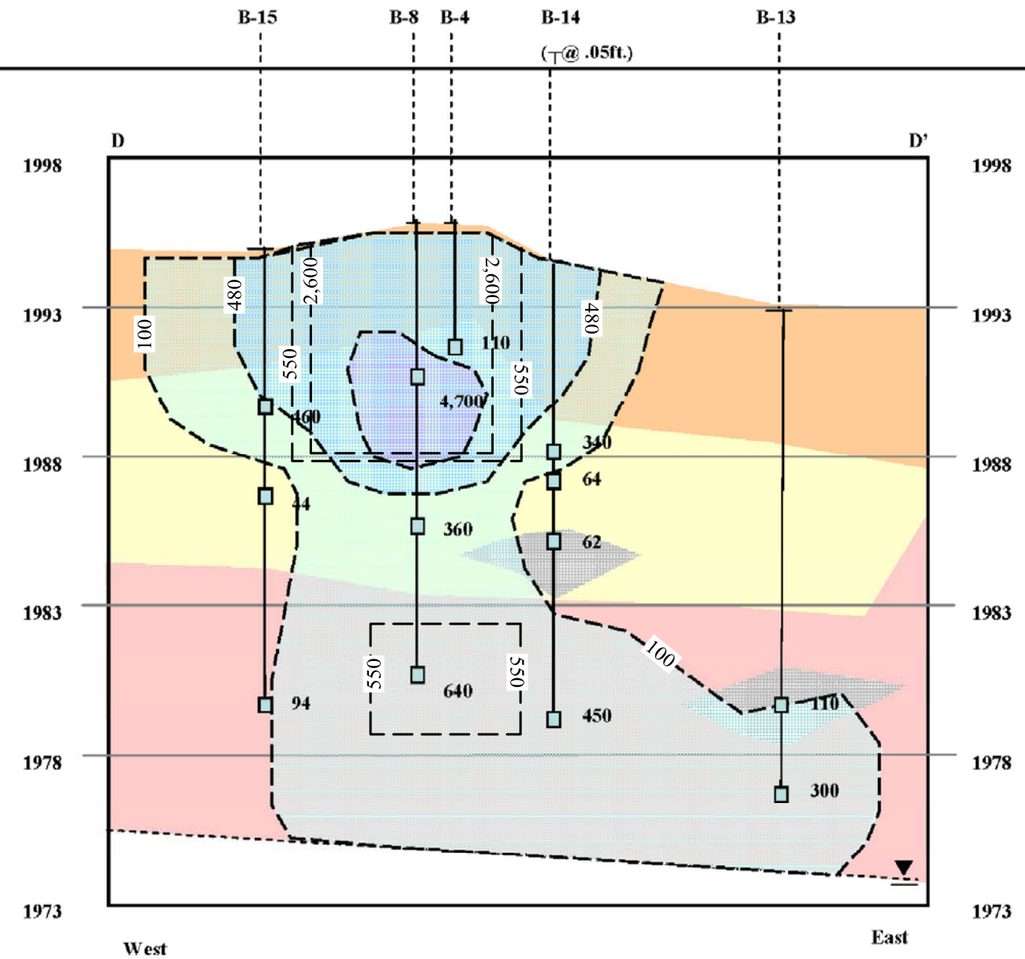
FIGURE 5
CROSS SECTION C-C'

Soil Corrective Action Plan

TETRA TECH

R:\Clients\Maryland Square, Las Vegas NV\ Figure 5 Cross Section C.dwg 12/14/2010 deborah.ford DN

CROSS SECTION D – D'



Horizontal Scale: 0 ├──┤ 10 feet

Vertical Scale: 0 ├──┤ 5 feet

Note:

Boreholes B-4 and B-8 were drilled from the elevation of the concrete floor that existed at the former facility.

LEGEND

Approximate Lithologic Boundary Changes

- Above Ground
- Sandy Silt (Fine)
- Caliche
- Sandy Silt (Fine)
- Sand

Approximate Groundwater Table

Estimated Vertical and Lateral Area of PCE Contaminated Soil at 100 µg/kg, 480 µg/kg, and 1,300 µg/kg.

350 PCE Concentration in µg/kg at Corresponding Depth

PCE Tetrachloroethene

µg/kg Micrograms Per Kilogram

Source: Source Area Soil Assessment, Former Phillips Facility Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. URS Corporation, February 23, 2007.

MARYLAND SQUARE SHOPPING CENTER
3661 South Maryland Parkway
Las Vegas, Nevada

FIGURE 6
CROSS SECTION D-D'

Soil Corrective Action Plan

TETRA TECH

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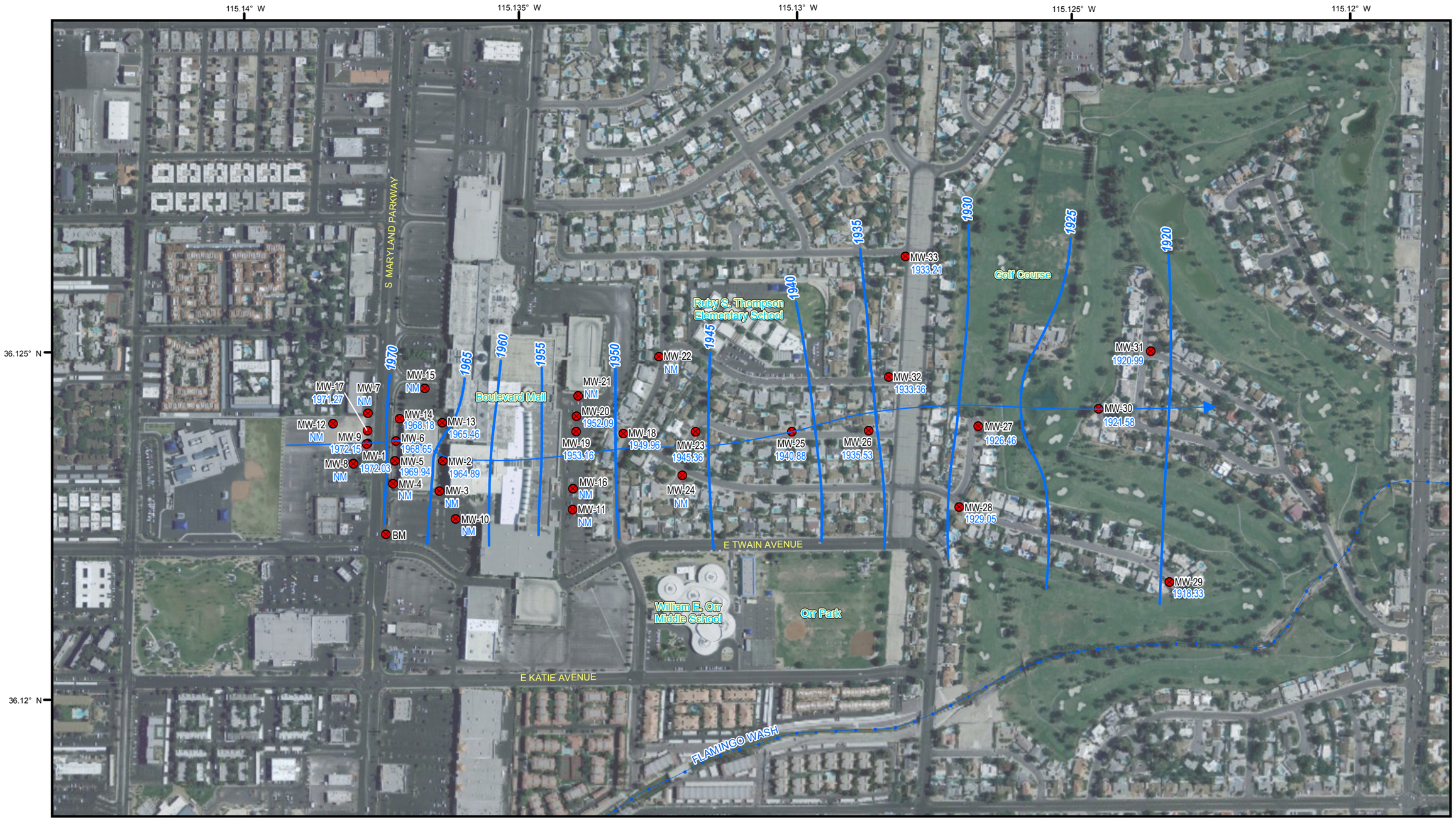

Legend

- Monitoring Well Location
- Groundwater Elevation Contour (5 ft Intervals)
- Direction of Groundwater Flow
- 1965.46 Groundwater Elevation (ft amsl)
- NM Not Measured
- ft amsl Feet Above Mean Sea Level

N
W E
S

0 250 500 Feet

Approximate Scale in Feet

MARYLAND SQUARE SHOPPING CENTER
3661 South Maryland Parkway
Las Vegas, Nevada

FIGURE 7
Groundwater Potentiometric Map with Contours

TETRA TECH

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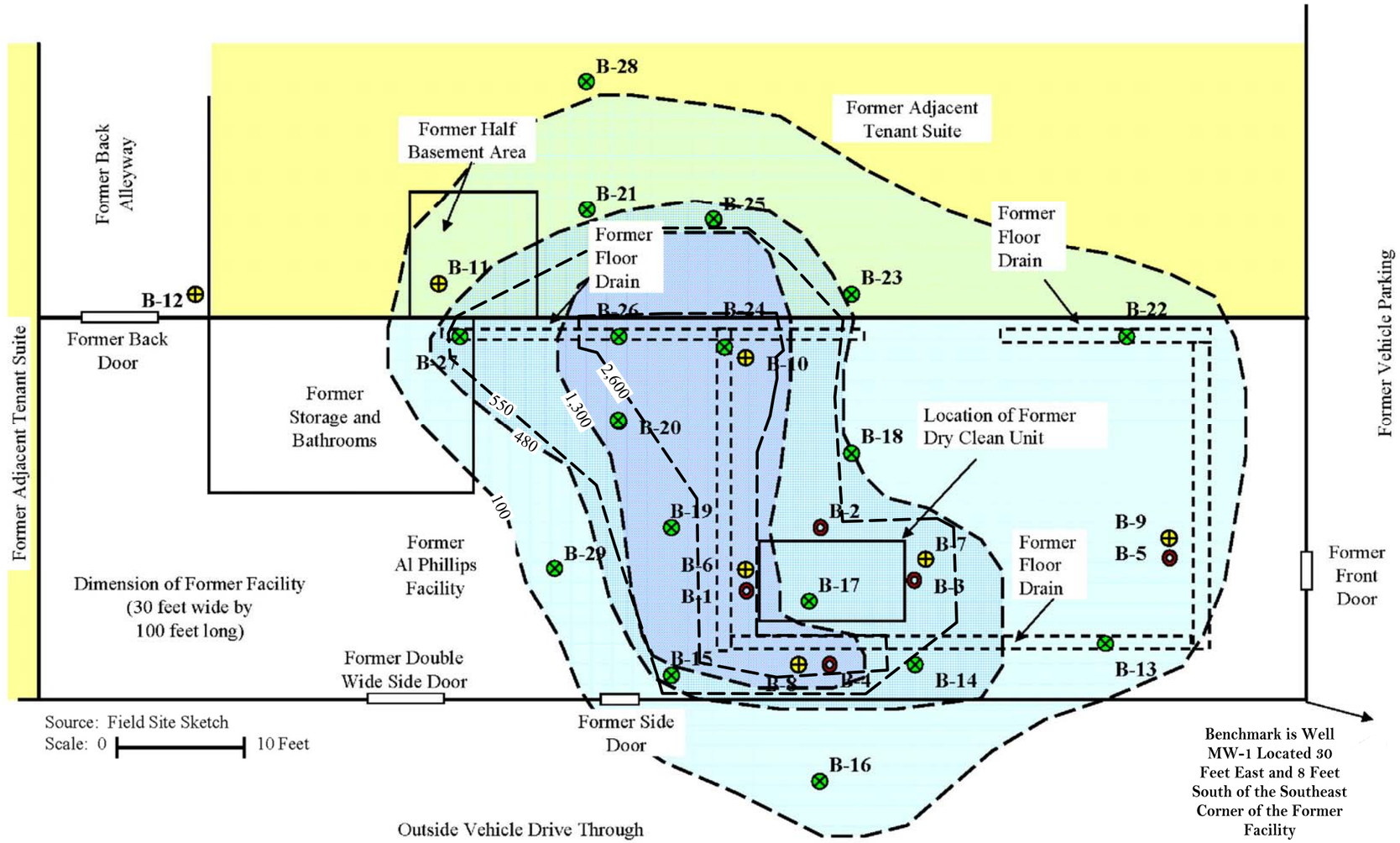


N

LEGEND

- Approximate Location of Borehole Drilled by URS 2005.
- Approximate Location of Borehole Drilled by Converse.
- Approximate Location of Borehole Drilled by URS 2007.
- A – A' Approximate Location of of Lithologic Cross-Section
- Estimated Lateral Area of PCE Contaminated Soil at 100 µg/kg, 480 µg/kg, and 1,300 µg/kg.
- PCE Tetrachloroethene
- µg/kg Micrograms Per Kilogram

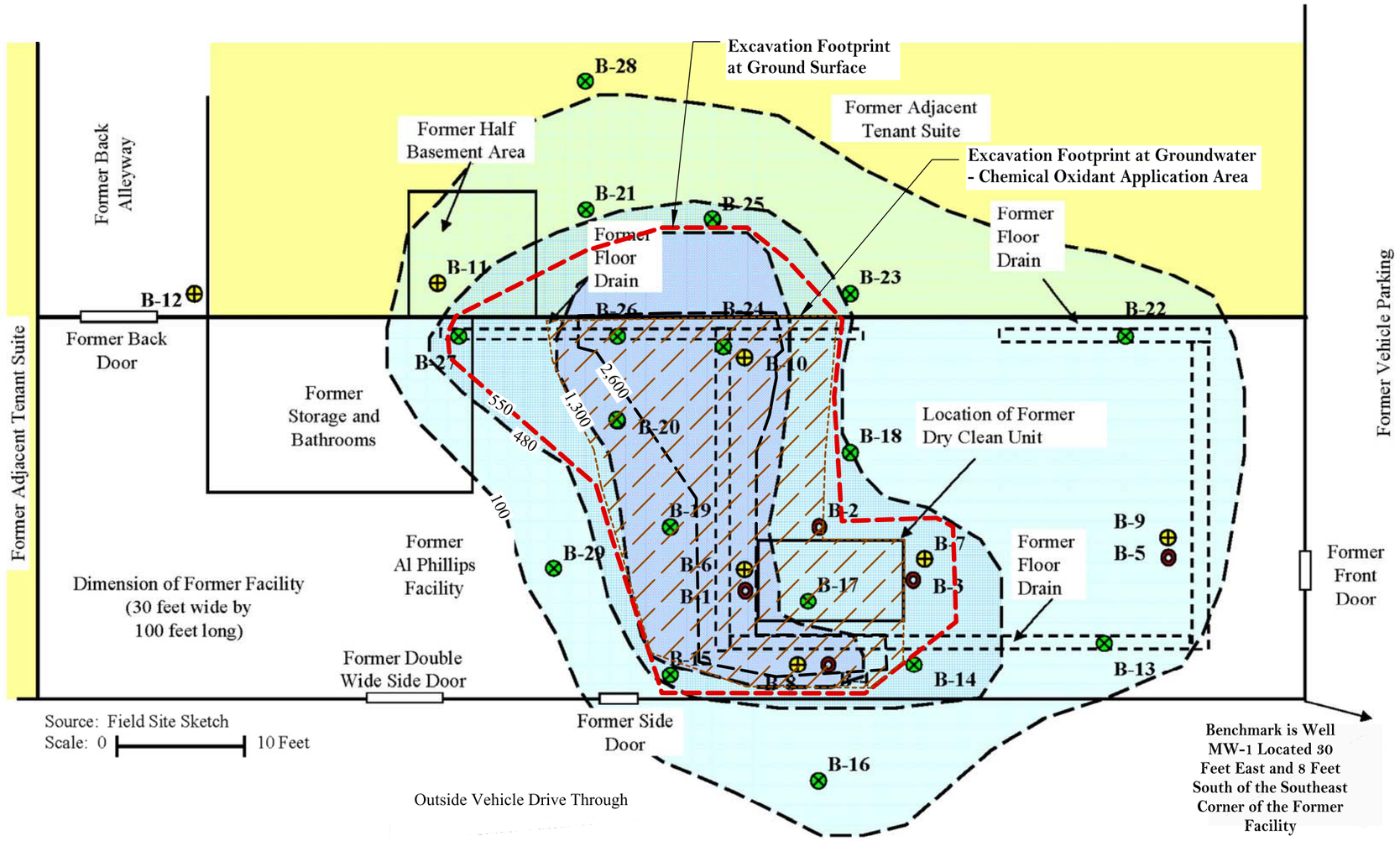
Source: Source Area Soil Assessment, Former Phillips Facility Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. URS Corporation, February 23, 2007.

MARYLAND SQUARE SHOPPING CENTER
3661 South Maryland Parkway
Las Vegas, Nevada

FIGURE 8
APPROXIMATE EXTENT OF PCE CONTAMINATED SOIL
Soil Corrective Action Plan

TETRA TECH

R:\Clients\Maryland Square, Las Vegas NV\ Figure 8 PCE Contamination.dwg 12/14/2010 deborah.ford DN



LEGEND

- Approximate Location of Borehole Drilled by URS 2005.
- Approximate Location of Borehole Drilled by Converse.
- Approximate Location of Borehole Drilled by URS 2007.
- A – A' Approximate Location of of Lithologic Cross-Section
- Estimated Lateral Area of PCE Contaminated Soil at 100 µg/kg, 480 µg/kg, and 1,300 µg/kg.
- PCE Tetrachloroethene
- µg/kg Micrograms Per Kilogram
- Excavation Footprint at Ground Surface
- Excavation Footprint at Groundwater

N

Note:
Conceptual layout for estimating purpose, not for construction.

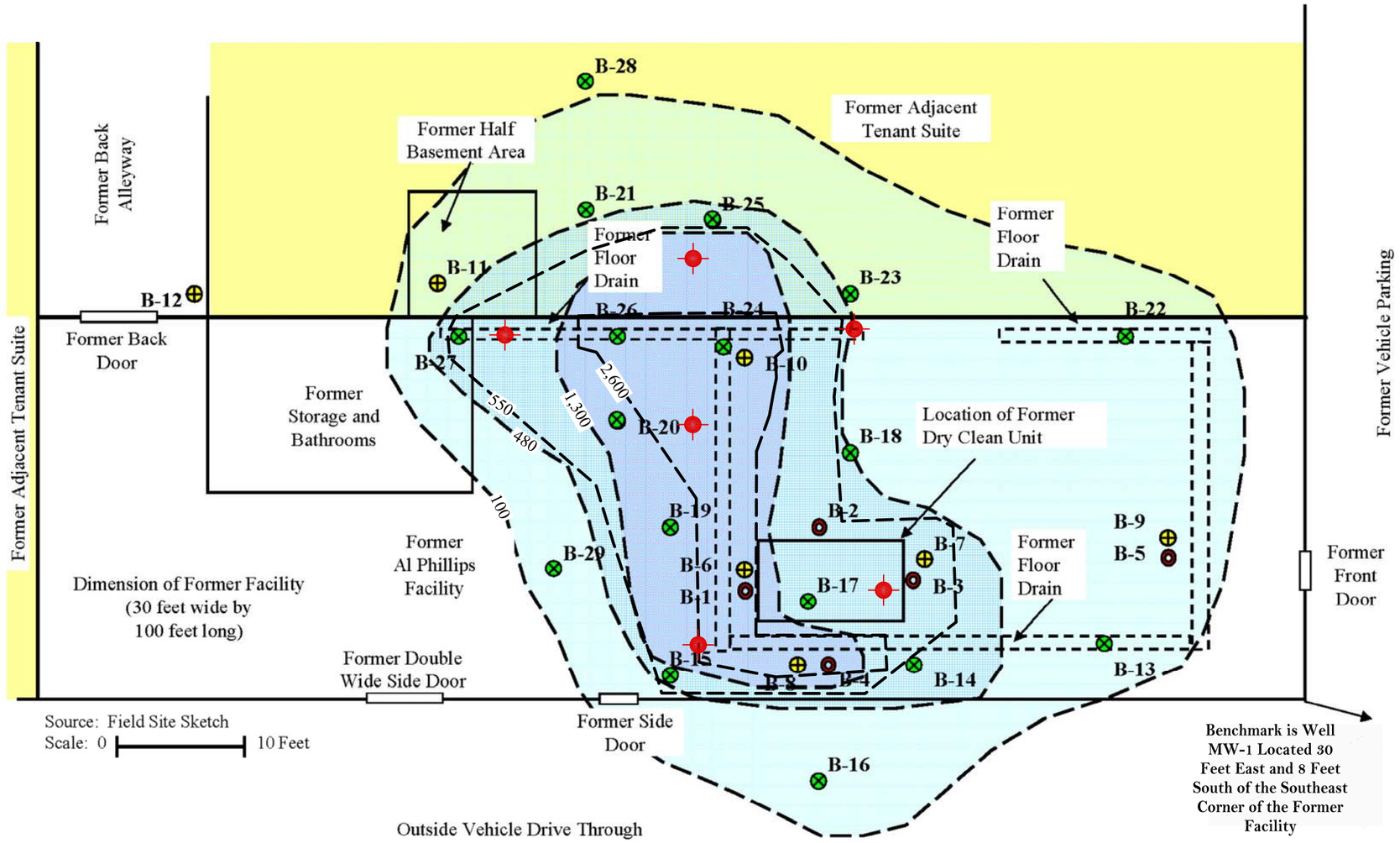
Source: Source Area Soil Assessment, Former Phillips Facility Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. URS Corporation, February 23, 2007.

MARYLAND SQUARE SHOPPING CENTER
3661 South Maryland Parkway
Las Vegas, Nevada

FIGURE 9
ALTERNATIVE 2
CONCEPTUAL PLAN
Soil Corrective Action Plan

TETRA TECH

R:\Clients\Maryland Square, Las Vegas NV\ Figure 9 Alternative 2.dwg 12/14/2010 deborah.ford DN



Source: Field Site Sketch
Scale: 0 — 10 Feet

N

LEGEND

- Approximate Location of Borehole Drilled by URS 2005.
- Approximate Location of Borehole Drilled by Converse.
- Approximate Location of Borehole Drilled by URS 2007.
- A – A' Approximate Location of of Lithologic Cross-Section
- Estimated Lateral Area of PCE Contaminated Soil at 100 µg/kg, 480 µg/kg, and 1,300 µg/kg.
- µg/kg Micrograms Per Kilogram
- SVE Soil Vapor Extraction
- PCE Tetrachloroethene
- Soil Vapor Extraction Well

Note:
Conceptual layout for estimating purpose, not for construction.

Source: Source Area Soil Assessment, Former Phillips Facility Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. URS Corporation, February 23, 2007.

MARYLAND SQUARE SHOPPING CENTER
3661 South Maryland Parkway
Las Vegas, Nevada

FIGURE 10
ALTERNATIVE 3
CONCEPTUAL PLAN

Soil Corrective Action Plan

TETRA TECH

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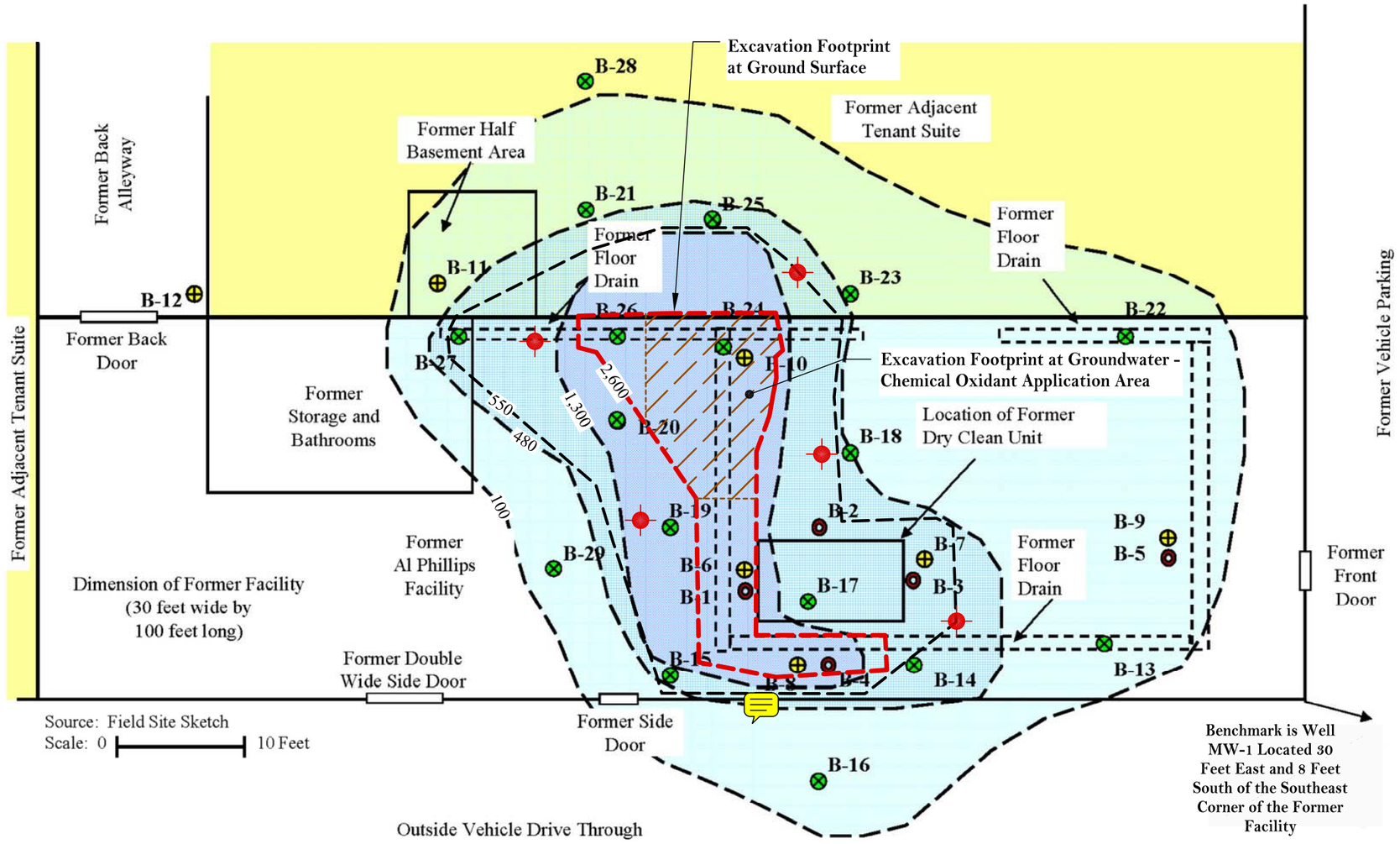


LEGEND

⊕	Approximate Location of Borehole Drilled by URS 2005.
⊙	Approximate Location of Borehole Drilled by Converse.
⊗	Approximate Location of Borehole Drilled by URS 2007.
A – A'	Approximate Location of of Lithologic Cross-Section
	Estimated Lateral Area of PCE Contaminated Soil at 100 µg/kg, 480 µg/kg, and 1,300 µg/kg.
µg/kg	Micrograms Per Kilogram
	Excavation Footprint at Ground Surface
	Excavation Footprint at Groundwater
SVE	Soil Vapor Extraction
PCE	Tetrachloroethene
	Soil Vapor Extraction Well

N

Note:
Conceptual layout for estimating purpose, not for construction.

MARYLAND SQUARE SHOPPING CENTER
3661 South Maryland Parkway
Las Vegas, Nevada

FIGURE 11
ALTERNATIVE 4
CONCEPTUAL PLAN
Soil Corrective Action Plan

TETRA TECH

Source: Source Area Soil Assessment, Former Phillips Facility Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. URS Corporation, February 23, 2007.

R:\Clients\Maryland Square, Las Vegas NV\ Figure 11 HotSpot.dwg 12/14/2010 deborah.ford DN

Attachment 1

Soil Volume Calculations

Soil Volume Calculations

Volume exceeding *Code of Federal Regulations* (CFR) 268.49 Land Disposal Restrictions treatment standard (6,000 micrograms per kilogram [μg/kg])

Area, ft^2	Depth, ft	Volume, ft^3	Volume, yd^3
20.25	10	202.5	7.5

Industrial Regional Screening Level, 2,600 μg/kg to Groundwater

Area Identified on Figure	Area, ft^2	Depth, ft	Volume, ft^3	Volume, yd^3
A1	32.8	12.5	410	15.2
A2	148	18	2,664	98.7
A3	58.2	4	233	8.6
A4	26.2	7	393	14.6
Total			3,700	137

Residential Remedial Screening Level, 550 μg/kg to 10 feet

Area Identified on Figure	Area, ft^2	Depth, ft	Volume, ft^3	Volume, yd^3
C1	140.4	10	1,404	52.0
C2	401.4	10	4,014	149
C3	65.0	7	455	16.9
C4	182.7	10	1,827	67.7
C5	33.3	8	266	9.9
C6	15.8	4	63.2	2.3
C7	54.6	8	437	16.2
Total			8,466	314

Residential Remedial Screening Level, 550 μg/kg to Groundwater

Area Identified on Figure	Area, ft^2	Depth, ft	Volume, ft^3	Volume, yd^3
C1	140.4	16	2,246	83.2
C2	401.4	18	7,225	268
C3	65.0	20	1,300	48.1
C4	182.7	20	3,654	135
C5	33.3	7	266	9.9
C6	15.8	7	63.2	2.3
C7	54.6	18	983	36.4
Total			15,738	583

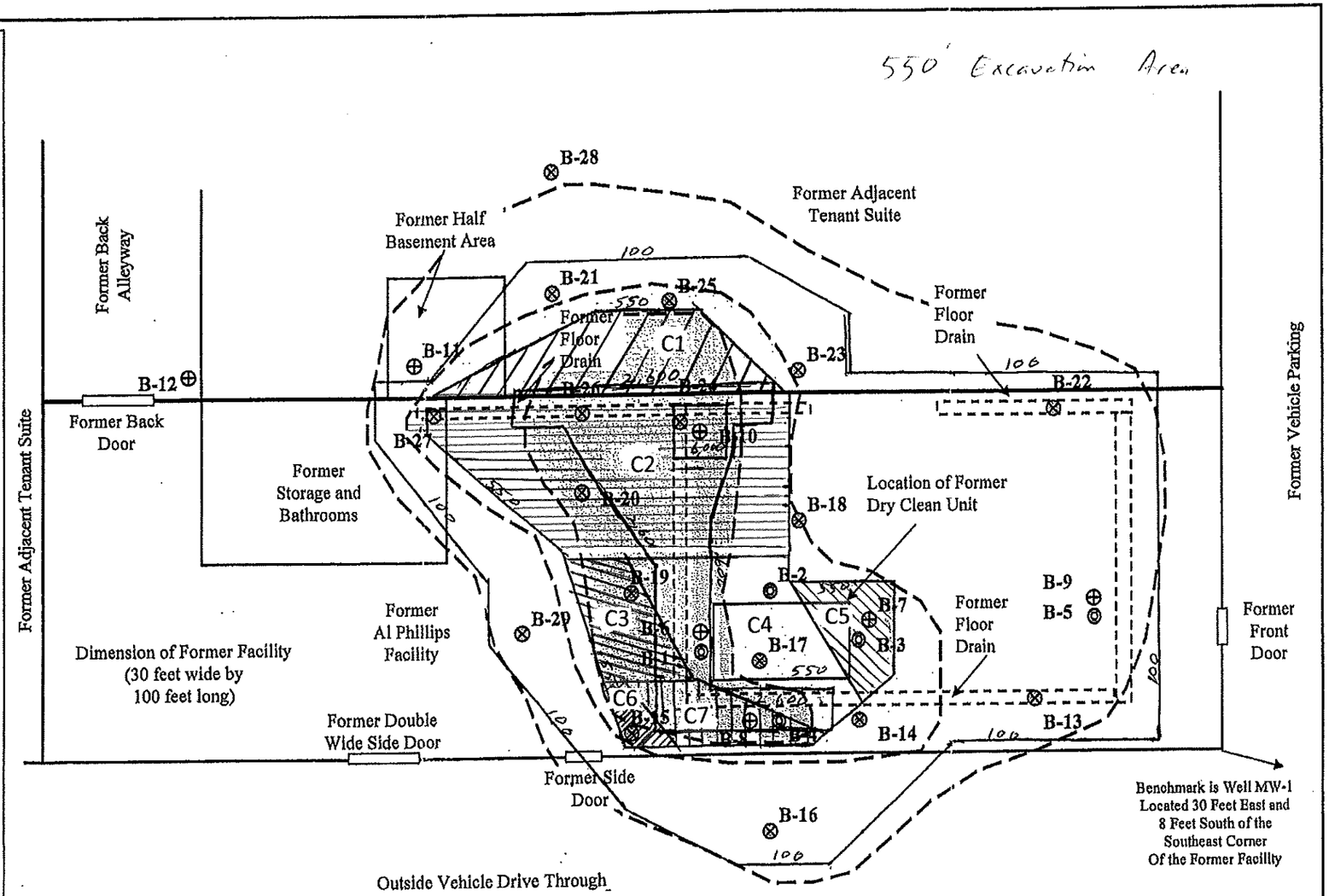
For Appendix

Concentration of PCE in Soil Boreholes
(January 2007)

Sample Number / Sample Elevation / PCE Concentration

B-6-5	1991	830	B-19-10	1984.5	21
B-6-10	1986	300	B-19-13	1981.5	270
B-6-15	1981	1,500	B-19-15	1979.5	1,500
B-7-5	1991	850	B-20-5	1989.5	270
B-7-10	1986	52	B-20-10	1984.5	1,200
B-7-15	1981	169	B-20-13	1981.5	1,600
B-8-5	1991	4,700	B-20-15	1979.5	860
B-8-10	1986	360	B-21-8	1984	110
B-8-15	1981	640	B-21-13	1979	380
B-9-5	1991	ND	B-22-0.5	1993	9
B-9-10	1986	38	B-22-1.5	1992	21
B-9-15	1981	ND	B-22-10.5	1983	91
B-10-5	1991	1,200	B-22-14.5	1979	380
B-10-10	1986	120,000	B-23-3	1989.5	350
B-10-15	1981	3,500	B-23-5	1987.5	4
B-11-2.5	1946	46	B-23-10	1982.5	92
B-12-3.5	1992	ND	B-23-13	1979.5	86
B-13-13	1980	110	B-24-5	1988.5	56,000
B-13-16	1977	300	B-24-8	1985.5	6,800
B-14-6.5	1988	340	B-24-13	1980.5	4,300
B-14-8	1987.5	64	B-25-5	1987	490
B-14-10	1985.5	62	B-25-10	1982	290
B-14-16	1979.5	450	B-25-13	1979	140
B-15-5	1990	460	B-26-2.5	1991	390
B-15-8	1987	44	B-26-5	1988	900
B-15-15	1980	94	B-26-8	1985	870
B-16-7.5	1986.5	290	B-26-10	1983	7,200
B-16-10.5	1983.5	210	B-26-13	1980	1,000
B-16-15.5	1978.5	150	B-27-5	1987	430
B-17-5	1990	460	B-27-13	1979	540
B-17-10	1985	570	B-28-10	1982	91
B-17-15	1980	680	B-28-13	1979	74
B-18-5	1989	140	B-29-5	1990	320
B-18-13	1981	480	B-29-10	1985	ND
B-18-15	1979	140	B-29-15	1980	27
B-19-5	1989.5	560	B-29-15.5	1979	6

PCE Concentrations are in microgram per kilogram (ug/kg).
Elevations are in feet (ft.). ND = none detected.



Source: Field Site Sketch
Scale: 0 — 10 Feet

URS

N

Legend:

- ⊕ Approximate Location of Borehole Drilled by URS 2005.
- ◎ Approximate Location of Borehole Drilled by Converse.
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APPROXIMATE EXTENT OF PCE CONTAMINATED SOIL

Source Area Soil Assessment
Al Phillips The Cleaner
Maryland Square Shopping Center
3661 South Maryland Parkway
Las Vegas, Nevada

January 2007
Job No. 26698724
MS Source Area Assessment Fig 8.ppt

FIGURE 8

For Appendix

Concentration of PCE in Soil Boreholes (January 2007)

Sample Number / Sample Elevation / PCE Concentration

B-6-5	1991	830	B-19-10	1984.5	21
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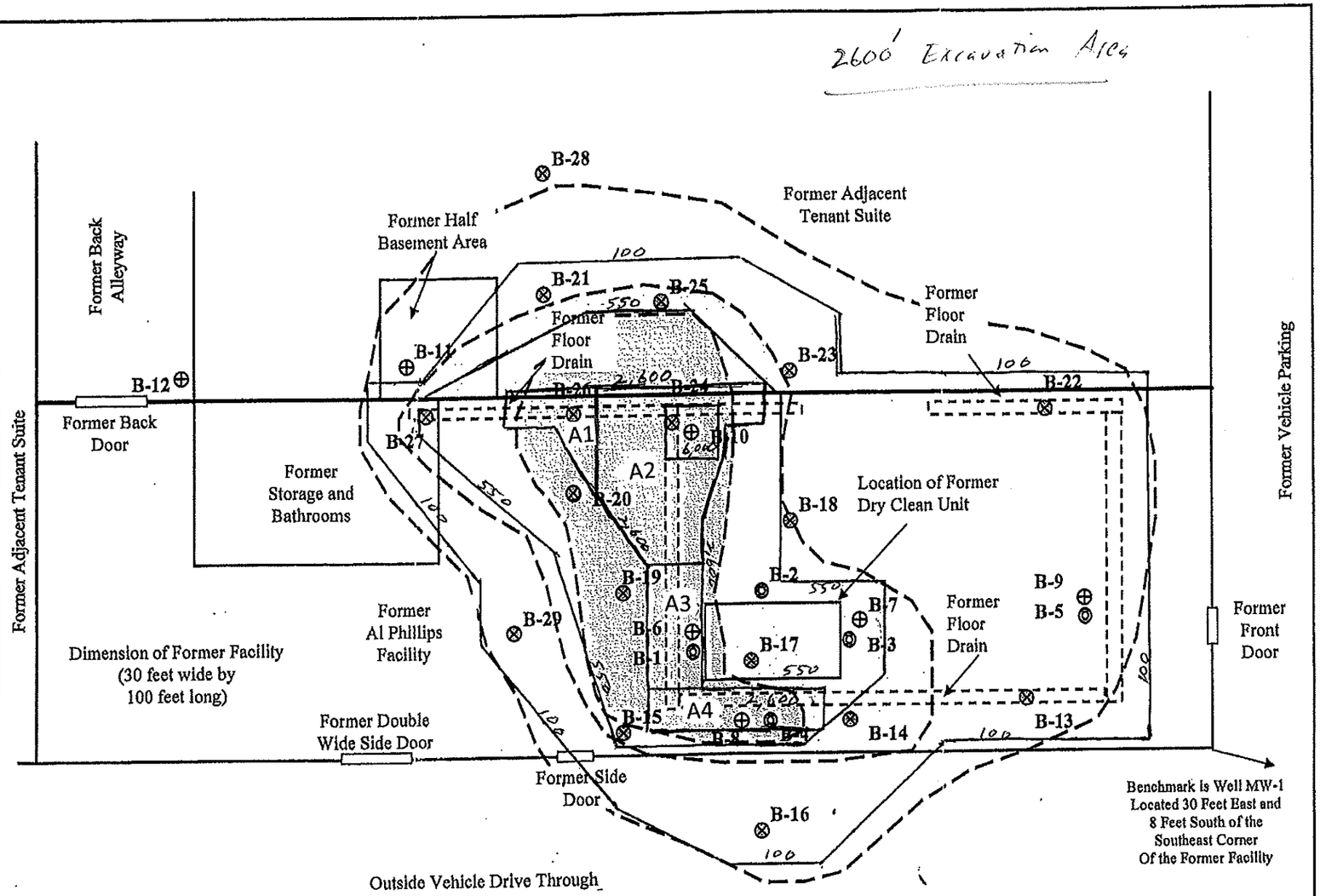
PCE Concentrations are in microgram per kilogram (ug/kg).
Elevations are in feet (ft.). ND = none detected.



Source: Field Site Sketch
Scale: 0 ——— 10 Feet

URS

N

Legend:

- ⊕ Approximate Location of Borehole Drilled by URS 2005.
- ◎ Approximate Location of Borehole Drilled by Converse.
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- Estimated Lateral Area of PCE Contaminated Soil at 100 ug/kg, 480 ug/kg, and 1,300 ug/kg.

APPROXIMATE EXTENT OF PCE CONTAMINATED SOIL

Source Area Soil Assessment
Al Phillips The Cleaner
Maryland Square Shopping Center
3661 South Maryland Parkway
Las Vegas, Nevada

January 2007
Job No. 26698724
MS Source Area Assessment Fig 8.ppt

FIGURE 8

Attachment 2

Cost Estimate Tables

Table 1
Summary of Corrective Action Alternatives Cost Estimates
Draft Soil Corrective Action Plan
Maryland Square Shopping Center

Alternative	Description	Direct Cost	Markups	Total	Total with Contingency
	Excavation, Disposal and Chemical Oxidation	$268,000	$81,000	$349,000	$436,000.00
	Alternative 2 Total with 25% Contingency				**$436,000.00**
Alternative 3	Soil Vapor Extraction (SVE)	$130,000	$60,000	$190,000	$238,000.00
	4-Years of Annual SVE O&M	$319,000	$148,000	$467,000	$584,000.00
	Alternative 3 Total with 25% Contingency				**$822,000.00**
Alternative 4	Hotspot Excavation, Disposal, Chemical Oxidation, and SVE	$245,000	$95,000	$340,000	$425,000.00
	2-Years of Annual SVE O&M	$152,000	$77,000	$229,000	$286,000.00
	Alternative 4 Total with 25% Contingency				**$711,000.00**

Notes:
Initial costs were prepared using Remedial Action Cost Engineering and Requirements (RACER), which is a system developed to estimate costs for studies, remedial design, remedial action, and related site-work for environmental restoration projects for the US Air Force and frequently used by EPA. Engineering judgment and vendor quotes were utilized to refine the RACER estimates.
O&M - operations and maintenance
SVE - soil vapor extraction

Table 2
Alternative 2 Cost Estimate

Draft Soil Corrective Action Plan

Maryland Square Shopping Center

Phase Name	Technology Name	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Markup
Excavation, Disposal and Chemical Oxidation	Excavation	12 CY Dump Truck Haul/Hour	24	HR	0.00	75.77	47.65	0.00	$2,962.10	$4,894.97
		Excavate and load, bank measure, medium material, 2 C.Y. bucket, hydraulic excavator	875	BCY	0.00	1.04	0.71	0.00	$1,532.88	$2,507.27
		Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	875	CY	8.70	1.07	0.93	0.02	$9,378.04	$11,160.14
		Organic Vapor Analyzer Rental, per Day	2	DAY	0.00	0.00	0.00	41.46	$82.93	$91.22
		Disposable Materials per Sample	22	EA	10.31	0.00	0.00	0.00	$226.81	$249.49
		Testing, purgeable organics (624, 8260)	22	EA	0.00	0.00	0.00	138.72	$3,051.74	$3,356.92
		Project Manager	4	HR	0.00	76.33	0.00	0.00	$305.32	$610.63
		Project Scientist	5	HR	0.00	77.32	0.00	0.00	$386.62	$773.24
		QA/QC Officer	1	HR	0.00	76.59	0.00	0.00	$76.59	$153.18
		Field Technician	1	HR	0.00	45.79	0.00	0.00	$45.79	$91.58
		Word Processing/Clerical	1	HR	0.00	39.37	0.00	0.00	$39.37	$78.74
		Draftsman/CADD	1	HR	0.00	43.21	0.00	0.00	$43.21	$86.42
									18,131.39	**24,053.79**
	Off-site Transportation and Waste Disposal 1	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	867	BCY	1.23	1.22	0.39	0.00	$2,461.63	$3,656.96
		Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	5338	MI	0.00	0.00	0.00	4.00	$21,350.00	$23,485.00
		Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1	EA	0.00	0.00	0.00	576.01	$576.01	$633.61
		32 Ft. Dump Truck, 6 Mil Liner, disposable	43	EA	52.18	0.00	0.00	0.00	$2,260.85	$2,486.93
		Commercial RCRA landfills, bulk waste, solid, based on 2,000 lb/CY	1138	TON	0.00	0.00	0.00	80.00	$91,040.00	$100,144.00
									117,688.49	**130,406.50**
	Professional Labor Management	Lump Sum Percentage Labor Cost	1	LS	0.00	34,940.00	0.00	0.00	$34,940.00	$69,880.00
									34,940.00	**69,880.00**
	Off-site Transportation and Waste Disposal 2	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	8	BCY	1.23	1.22	0.39	0.00	$22.73	$33.76
		Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	122	MI	0.00	0.00	0.00	4.00	$488.00	$536.80
		Minimum Charges for Bulk Shipments Requiring Treatment or Stabilization	1	EA	0.00	0.00	0.00	2,942.67	$2,942.67	$3,236.93
		Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1	EA	0.00	0.00	0.00	576.01	$576.01	$633.61
		32 Ft. Dump Truck, 6 Mil Liner, disposable	1	EA	52.18	0.00	0.00	0.00	$52.18	$57.40
		Landfill Hazardous Solid Bulk Waste Requiring Stabilizatior	11	CY	0.00	0.00	0.00	235.40	$2,542.28	$2,796.50
									6,623.86	**7,295.01**
	Chemical Oxidant Bench Scale Test	Mobilize and DeMobilize Drilling Rig & Crew	1	LS	0.00	1,460.65	854.80	0.00	$2,315.45	$3,861.58
		Organic Vapor Analyzer Rental, per Day	1	DAY	0.00	0.00	0.00	41.46	$41.46	$45.61
		Testing, purgeable organics (624, 8260)	2	EA	0.00	0.00	0.00	126.10	$252.21	$277.43
		Decontaminate Rig, Augers, Screen (Rental Equipment)	1	DAY	24.91	584.17	0.00	0.00	$609.08	$1,195.73
		Field Technician	8	HR	0.00	45.79	0.00	0.00	$366.32	$732.65
		Air Rotary, 6" Dia Borehole (Consolidated), Depth <= 100 feet	20	LF	0.00	17.39	23.88	0.00	$825.43	$1,220.97
		Split Spoon Sampling	2	LF	0.00	12.93	6.45	0.00	$38.75	$65.90
		DOT steel drums, 55 gal., open, 17C	1	EA	114.33	0.00	0.00	0.00	$114.33	$125.76
		Bench Scale Test	1	LS	0.00	0.00	0.00	6,000.00	$6,000.00	$6,600.00
									10,563.03	**14,125.63**
	Contingency Plan	Contingency Plan	1	LS	0.00	0.00	0.00	50,000.00	$50,000.00	$55,000.00
									50,000.00	**55,000.00**
	KMnO4 Placement	Excavator to Mix Oxidant	8	HR	0.00	75.77	47.65	0.00	$987.37	$1,631.66
		Project Manager	8	HR	0.00	76.33	0.00	0.00	$610.63	$1,221.26
		Project Scientist	79	HR	0.00	77.32	0.00	0.00	$6,108.57	$12,217.13
		Field Technician	158	HR	0.00	45.79	0.00	0.00	$7,234.88	$14,469.76
		Capital Expenses	1	LS	8,064.90	939.00	500.00	0.00	$9,503.90	$11,299.39
									24,445.34	**40,839.20**
		Disposable Materials per Sample	10	EA	10.31	0.00	0.00	0.00	$103.10	$113.41
		Decontamination Materials per Sample	10	EA	13.46	0.00	0.00	0.00	$134.55	$148.01
		Lysimeter accessories, nylon tubing, 1/4" OD	150	LF	0.16	0.00	0.00	0.00	$23.42	$25.76
		Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	360.30	$360.30	$396.33
		Testing, purgeable organics (624, 8260)	10	EA	0.00	0.00	0.00	138.72	$1,387.15	$1,525.87

	Groundwater Monitoring of Chemical Oxidant	Overnight delivery service, 51 to 70 lb packages	60	LB	0.00	0.00	0.00	4.61	$276.71	$304.38
		Testing, RCRA evaluations, EP toxicity analysis, metals (6010,7470)	1	EA	0.00	0.00	0.00	140.34	$140.34	$154.37
		DOT steel drums, 55 gal., closed only, 17H	3	EA	68.16	0.00	0.00	0.00	$204.47	$224.92
		Project Manager	1	HR	0.00	76.33	0.00	0.00	$76.33	$152.66
		Project Manager	2	HR	0.00	76.33	0.00	0.00	$152.66	$305.32
		Project Engineer	2	HR	0.00	67.95	0.00	0.00	$135.91	$271.81
		Project Scientist	4	HR	0.00	77.32	0.00	0.00	$309.29	$618.59
		Staff Scientist	8	HR	0.00	44.18	0.00	0.00	$353.48	$706.96
		QA/QC Officer	2	HR	0.00	76.59	0.00	0.00	$153.18	$306.36
		Field Technician	2	HR	0.00	45.79	0.00	0.00	$91.58	$183.16
		Field Technician	12	HR	0.00	45.79	0.00	0.00	$549.48	$1,098.97
		Field Technician	2	HR	0.00	45.79	0.00	0.00	$91.58	$183.16
		Word Processing/Clerical	2	HR	0.00	39.37	0.00	0.00	$78.74	$157.47
		Draftsman/CADD	2	HR	0.00	43.21	0.00	0.00	$86.42	$172.83
		Peristaltic Pump, Weekly Rental	1	WK	0.00	0.00	0.00	86.08	$86.08	$94.68
		Other Direct Costs	1	LS	329.98	0.00	0.00	0.00	$329.98	$362.98
									5,124.74	**7,508.00**
								Alternative 2 Total	**267,516.86**	**349,108.14**
								Alternative 2 Total with 25% contingency		**$ 436,385.18**

Notes:

BCY - bank cubic yard
CY - cubic yard
DOT - Department of Transportation
EA - each
gal - gallon
HR - hour
lb - pound
LF - linear feet
LS - lump sum
QA/QC - quality assurance/quality control
Qty - quantity
UOM - unit of measure
WK - week
" - inch

Alternative 2 Cost Estimate Assumptions
Draft Soil Corrective Action Plan
Maryland Square Shopping Center

Excavate soil with concentrations above 550 micrograms per kilogram (μg/kg) to groundwater -- 383 in-place cubic yards, transport and dispose of at off-site facility, bench-scale chemical oxidant study, infiltration of 3,756 pounds (lbs) of potassium permanganate ($KMnO_4$)

Technology Name

Excavation

1 Quantity to be excavated (see Appendix A). -- 583 cubic yards (CY)
2 With excess excavation and bulking of soil (1.5 times the volume), therefore assumed 875 bank cubic yards (BCY) required for disposal
3 Assumed all backfill material coming from off-site source located 5 miles away.
4 Assumed 20 confirmation samples required and 2 waste characterization samples based on California Department of Toxic Substances Control (DTSC) guidance of 1 characterization sample per 250 cubic yards.

Off-Site Transportation and Waste Disposal 1

5 US Ecology Landfill in Beatty, Nevada (NV) -- 122 miles from 3661 Maryland Parkway, Las Vegas, NV
6 All assumed to be hazardous waste -- 8 require stabilization
7 Hazardous waste disposal cost assembly lowered from $155 to $80 CY based on recent invoice from landfill
8 Waste transport cost assembly raised from $2.10 to $4.00 per mile

Professional Labor Management

9 Used 15% construction markup

Off-Site Transportation and Waste Disposal 2

10 US Ecology Landfill in Beatty, NV -- 122 miles from 3661 Maryland Parkway, Las Vegas, NV
11 All assumed to be hazardous waste -- 8 CY needs stabilization to meet Land Disposal Requlations (LDR), conversion factor of 1.35 means 10.8 tons of hazardous waste
12 Disposal cost kept at approx $235 per ton for waste requiring stabilization
13 Waste transport cost assembly raised from $2.10 to $4.00 per mile

Chemical Oxidant Bench-Scale Test

14 Bench-scale test for chemical oxidant to be placed in bottom of the excavations -- $6,000

Chemical Oxidant ($KMnO_4$) placement

15 Capital costs based on discussions with vendor, assumed powder will be mixed into top few feet of saturated soil
16 2,781 lbs of $KMnO_4$ for groundwater (GW) treatment at $2.65 per pound (materials)
17 $0.25 / pound for delivery of $KMnO_4$ (labor)
18 $500 Personal protective equipment (PPE) (equipment)

Groundwater Monitoring of Chemical Oxidant

19 One groundwater sampling event of the five, downgradient, existing monitoring wells after the placement of the $KMn0_4$
20 Default numbers for 1 GW monitoring event were far too high. Changed the following hours from RACER default:
Field Tech -- 26 to 2
Project Manager -- 9 to 1
Project Engineer -- 30 to 2
Project Scientist -- 59 to 4
Staff Scientist -- 80 to 8
Quality assurance/quality control (QA/QC) -- 17 to 2
Word Processor -- 14 to 2
Draftsman -- 10 to 2

Markups

21 Assumed a markup on materials and subcontractors of 10%.
Assumed a labor multiplier of 2 for General and Administrative (G&A) costs and profit.
Assumed a 25% contingency on the total cost.

Table 3
Alternative 3 Cost Estimate
Draft Soil Corrective Action Plan
Maryland Square Shopping Center

Phase Name	Technology Name	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Markup
SVE	Soil Vapor Extraction	Mobilize and DeMobilize Drilling Rig & Crew	1	LS	0.00	1,460.65	854.80	0.00	$2,315.45	$3,861.58
		Organic Vapor Analyzer Rental, per Day	2	DAY	0.00	0.00	0.00	41.46	$82.93	$91.22
		Testing, purgeable organics (624, 8260)	10	EA	0.00	0.00	0.00	126.10	$1,261.05	$1,387.15
		In-Situ Vapor Recovery System, 5 HP, 230V, 280 SCFM	1	EA	15,853.20	1,204.55	0.00	0.00	$17,057.75	$19,847.62
		Equipment Enclosure, 8' x 15', Portable Building/Shed; lined, insulated, skid mounted, w/exhaust fan	1	EA	13,691.40	820.20	0.00	0.00	$14,511.60	$16,700.94
		Decontaminate Rig, Augers, Screen (Rental Equipment)	2	DAY	24.91	584.17	0.00	0.00	$1,218.15	$2,391.46
		Field Technician	40	HR	0.00	45.79	0.00	0.00	$1,831.62	$3,663.23
		2" PVC, Schedule 40, Well Casing	40	LF	1.24	4.87	5.20	0.00	$452.22	$672.72
		2" PVC, Schedule 40, Well Screen	60	LF	4.11	4.87	5.20	0.00	$850.55	$1,198.53
		2" PVC, Well Plug	6	EA	13.33	14.61	15.60	0.00	$261.22	$366.22
		Air Rotary, 6" Dia Borehole (Consolidated), Depth <= 100 ft	108	LF	0.00	17.39	23.88	0.00	$4,457.32	$6,593.23
		Split Spoon Sampling	20	LF	0.00	12.93	6.45	0.00	$387.54	$659.01
		Move Rig, Equipment Around Site	5	EA	91.16	209.97	122.88	0.00	$2,120.01	$3,276.87
		DOT steel drums, 55 gal., open, 17C	3	EA	114.33	0.00	0.00	0.00	$342.98	$377.28
		2" Screen, Filter Pack	70	LF	9.09	3.76	4.01	0.00	$1,180.14	$1,534.95
		2" Well, Portland Cement Grout	24	LF	1.19	0.00	0.00	0.00	$28.47	$31.32
		2" Well, Bentonite Seal	6	EA	146.52	97.12	103.72	0.00	$2,084.13	$2,816.98
		2" PVC, Schedule 80, Connection Piping	145	LF	2.32	9.51	0.00	0.00	$1,715.14	$3,127.78
		4" PVC, Schedule 80, Manifold Piping	95	LF	6.91	13.40	0.00	0.00	$1,928.69	$3,266.94
		2" PVC, Schedule 80, Tee	6	EA	11.89	60.87	0.00	0.00	$436.55	$808.89
		2" PVC, Schedule 80, 90 Degree, Elbow	6	EA	3.35	36.78	0.00	0.00	$240.77	$463.45
		4" PVC, Schedule 80, 90 Degree, Elbow	6	EA	10.03	73.78	0.00	0.00	$502.84	$951.54
		4" x 2" Reducer, PVC Schedule 80	6	EA	29.86	58.96	0.00	0.00	$532.87	$904.52
		2" PVC, Sch 80, Ball Valve	6	EA	25.75	41.46	0.00	0.00	$403.24	$667.43
		Pressure Gauge	6	EA	116.08	73.59	0.00	0.00	$1,137.97	$1,649.13
									$57,341.20	**$77,310.00**
	Carbon Adsorption (Gas)	8" Structural Slab on Grade	25	SF	6.75	4.63	0.17	0.00	$288.77	$421.80
		Air & process gas purification, carbon adsorption, vapor phase, modular carbon adsorbers	1	EA	61.36	0.00	0.00	0.00	$61.36	$67.49
		Plug, steel, malleable iron, black, threaded, 300 lb., 1/4"	2	EA	2.25	18.59	0.00	0.00	$41.67	$79.30
		Modular vapor-phase carbon adsorption system, 500 CFM, 1,400 Lb Fill, Closed Upflow, 11.5" Pressure Drop	2	EA	8,702.77	1,287.89	78.27	0.00	$20,137.86	$24,469.85
		Pressure Gauge	2	EA	116.08	73.59	0.00	0.00	$379.32	$549.71
									$20,908.98	**$25,588.16**
	Professional Labor Management	Lump Sum Percentage Labor Cost	1	LS	0.00	27,852.00	0.00	0.00	$27,852.00	$55,704.00
									$27,852.00	**$55,704.00**
	Start -Up Monitoring	Portable Air Sampler, Continuous, Daily Rental	4	DAY	0.00	0.00	0.00	91.12	$364.46	$400.91
		Disposable Materials per Sample	8	EA	10.31	0.00	0.00	0.00	$82.48	$90.72
		Testing, non-rad lab tests, tentative id of compounds GC/MS 30/5040/8240	8	EA	0.00	0.00	0.00	74.87	$598.93	$658.83
		Volatile Organic Compounds (TO-14)	8	EA	0.00	0.00	0.00	227.00	$1,816.00	$1,997.60
		Overnight delivery service, 51 to 70 lb packages	80	LB	0.00	0.00	0.00	4.61	$368.95	$405.84
									$3,230.82	**$3,553.90**
	Air Permitting	Other Direct Costs	1	LS	10,000.00	0.00	0.00	0.00	$10,000.00	$11,000.00
									$10,000.00	**$11,000.00**
	Post-SVE Confirmation Sampling	Mobilize and DeMobilize Drilling Rig & Crew	1	LS	0.00	1,460.65	854.80	0.00	$2,315.45	$3,861.58
		Organic Vapor Analyzer Rental, per Day	2	DAY	0.00	0.00	0.00	41.46	$82.93	$91.22
		Testing, purgeable organics (624, 8260)	8	EA	0.00	0.00	0.00	126.10	$1,008.84	$1,109.72
		Decontaminate Rig, Augers, Screen (Rental Equipment)	2	DAY	24.91	584.17	0.00	0.00	$1,218.15	$2,391.46
		Field Technician	24	HR	0.00	45.79	0.00	0.00	$1,098.97	$2,197.94
		Air Rotary, 6" Dia Borehole (Consolidated), Depth <= 100 ft	80	LF	0.00	17.39	23.88	0.00	$3,301.72	$4,883.88
		Split Spoon Sampling	12	LF	0.00	12.93	6.45	0.00	$232.52	$395.41
		Move Rig, Equipment Around Site	3	EA	91.16	209.97	122.88	0.00	$1,272.01	$1,966.12
		DOT steel drums, 55 gal., open, 17C	3	EA	114.33	0.00	0.00	0.00	$342.98	$377.28
									$10,873.56	**$17,274.61**
								SVE Total	**$130,206.57**	**$190,430.68**
								Alternative 3 Total with 25% contingency		**$ 238,038.35**
		Portable Air Sampler, Continuous, Daily Rental	52	DAY	0.00	0.00	0.00	91.12	$4,738.04	$5,211.84

Table 3
Alternative 3 Cost Estimate
Draft Soil Corrective Action Plan
Maryland Square Shopping Center

Phase Name	Technology Name	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Markup
SVE O&M	Operations and Maintenance	Disposable Materials per Sample	52	EA	10.31	0.00	0.00	0.00	$536.10	$589.71
		Coal-based, 4 mm Pellet, for Solvent Recovery less than 10,000 Lb	16800	LB	1.16	0.00	0.00	0.00	$19,571.49	$21,528.64
		Load Spent Carbon Containers onto Truck	12	EA	0.00	143.68	0.00	0.00	$1,724.14	$3,448.27
		Carbon Acdceptance Fee	1	EA	0.00	0.00	0.00	400.00	$400.00	$440.00
		Transportation to regeneration facility (177 miles to Parker, AZ)	2124	MI	0.00	0.00	0.00	4.37	$9,285.36	$10,213.90
		Minimum Charges for Drummed Shipments	1	EA	0.00	0.00	0.00	694.97	$694.97	$764.47
		DOT steel drums, 55 gal., closed only, 17H	10	EA	68.16	0.00	0.00	0.00	$681.57	$749.72
		Wastewater Disposal Fee	500	gal	0.00	0.00	0.00	2.53	$1,267.05	$1,393.76
		Project Manager	8	HR	0.00	76.33	0.00	0.00	$610.63	$1,221.26
		Project Scientist	65	HR	0.00	77.32	0.00	0.00	$5,026.04	$10,052.07
		QA/QC Officer	5	HR	0.00	76.59	0.00	0.00	$382.95	$765.91
		Field Technician	13	HR	0.00	45.79	0.00	0.00	$595.27	$1,190.55
		Word Processing, Clerical	13	HR	0.00	39.37	0.00	0.00	$511.79	$1,023.58
		Treatment System Operator	223	HR	0.00	31.39	0.00	0.00	$7,000.89	$14,001.79
		Other Direct Costs	1	LS	353.19	0.00	0.00	0.00	$353.19	$388.51
		Electrical Charge	5585	KWH	0.07	0.00	0.00	0.00	$402.46	$442.70
		Electrical Charge	107786	KWH	0.07	0.00	0.00	0.00	$7,767.06	$8,543.76
		Electrical Charge	5585	KWH	0.07	0.00	0.00	0.00	$402.46	$442.70
								Annual O&M Cost	**$61,951.46**	**$82,413.15**
	Air Monitoring	Portable Air Sampler, Continuous, Daily Rental	12	DAY	0.00	0.00	0.00	91.12	$1,093.39	$1,202.73
		Disposable Materials per Sample	12	EA	10.31	0.00	0.00	0.00	$123.71	$136.09
		Volatile Organic Compounds (TO-14)	12	EA	0.00	0.00	0.00	227.00	$2,724.00	$2,996.40
		Overnight delivery service, 51 to 70 lb packages	120	LB	0.00	0.00	0.00	4.61	$553.42	$608.76
		Project Manager	18	HR	0.00	76.33	0.00	0.00	$1,373.92	$2,747.84
		Project Engineer	30	HR	0.00	67.95	0.00	0.00	$2,038.58	$4,077.16
		Project Scientist	71	HR	0.00	77.32	0.00	0.00	$5,489.98	$10,979.95
		Staff Scientist	80	HR	0.00	44.18	0.00	0.00	$3,534.79	$7,069.59
		QA/QC Officer	18	HR	0.00	76.59	0.00	0.00	$1,378.63	$2,757.27
		Field Technician	96	HR	0.00	45.79	0.00	0.00	$4,395.88	$8,791.75
		Word Processing, Clerical	16	HR	0.00	39.37	0.00	0.00	$629.90	$1,259.79
		Other Direct Costs	1	LS	363.42	0.00	0.00	0.00	$363.42	$399.76
								Annual System Monitoring Cost	**$23,699.63**	**$43,027.10**
			See Yearly Cost Table for Total Estimates							

Notes:

BCY - bank cubic yard	LS - lump sum
CY - cubic yard	O&M - operations and maintenance
DOT - Department of Transportation	QA/QC - quality assurance/quality control
EA - each	Qty - quantity
gal - gallon	UOM - unit of measure
HR - hour	WK - week
LB or lb - pound	" - inch
LF - linear feet	KWH - Kilowatt hour

Table 4
Alternative 3 Operations and Maintenance (O&M) Cost Estimate
Draft Soil Corrective Action Plan
Maryland Square Shopping Center

SVE O&M Yearly Costs		2011	2012	2013	2014	Total
Without Markup	Operations and Maintenance	$61,951	$59,001	$56,192	$53,516	**$230,661**
	SVE System Monitoring	$23,700	$22,571	$21,496	$20,473	**$88,240**
						$318,900
With Markup	Operations and Maintenance	$82,413	$78,489	$74,751	$71,192	**$306,845**
	SVE System Monitoring	$43,027	$40,978	$39,027	$37,168	**$160,201**
						$467,045

Notes:
Assumed annual discount factor of 5% for net present value calculations.
O&M - operations and maintenance
SVE - soil vapor extraction

Alternative 3 Cost Estimate Assumptions
Draft Soil Corrective Action Plan
Maryland Square Shopping Center

Soil vapor extraction (SVE) system -- 5 wells at 40 cubic feet per minute (cfm), two granular activated carbon (GAC) modules with 1,400 pound (lb) carbon, change lead vessel once a month

Technology Name

Soil Vapor Extraction

1 Surface area of contamination greater than 550 parts per billion (ppb) is estimated to be 1,200 square feet (sf)
2 Plume extends to groundwater at roughly 18 feet below ground surface (bgs), SVE wells to extend to 17 feet bgs
3 Wells drilled with air rotary, split spoon used for lithologic logging, 2 soil samples collected per well
4 6 wells required to cover plume area, spaced average of 17 feet apart (radius of influence [ROI] 15 feet),
5 Wells constructed with 2-inch (") Schedule 40 polyvinyl chloride (PVC)
6 Average well flow rate 40 CFM, for 200 CFM total

Carbon Adsorption (Gas)

7 Two Modular Carbon Adsorbers in Series -- 500 CFM with 1,400 lbs carbon each
8 Assumed flow rate of 300 CFM for design purposes

Professional Labor Management

9 Used 15% construction markup

Air Permitting

10 Assumed $10,000 for all air permitting activities -- applications for emissions and dust permits

Site Characterization Sampling

11 Post remediation -- 4 boreholes with 2 samples each

SVE Operations and Maintenance (O&M)
O&M and system monitoring for 4 years of operations

Technology Name

Operations and Maintenance

12 O&M of SVE and GAC -- Minimum O&M labor, Professional labor not included
13 Weekly effluent sampling for VOCs with flame ionization detector (FID)
14 Eliminated lab costs and overnight shipping from cost assembly
15 Reduced project scientist hours from 130 to 65 due to lack of data analysis
16 GAC changeout of lead vessel every months or 12 times per year, for total of 16,800 lbs per year.
17 Disposal of 1,400 lbs of used GAC every month

System Monitoring

18 First year -- 1 sample per event, 16 events to account for 4 mobilizations first month
19 Following seven years -- 1 sample per event, 1 event per month, 12 months a year
20 The cost table only shows the first year costs and not the following 7 years.
21 Analysis for VOCs cost assembly changed to $227 per sample ($165 for analysis, $32 for summa, $30 for flow controller) from SW
22 One field duplicate per 10 samples; one split sample per 10 samples; no matrix spike/matrix spike duplicate (MS/MSD)
23 Standard monitoring plan and monitoring report, Stage 1 lab review

Markups

24 Assumed a markup on materials and subcontractors of 10%.
25 Assumed a labor multiplier of 2 for general and administrative (G&A) and profit.
26 Assumed a 25% contingency on the total cost.

Table 5

Alternative 4 Cost Estimate

Draft Soil Corrective Action Plan

Maryland Square Shopping Center

Phase Name	Technology Name	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Markup
Hotspot Excavation, Disposal, Chemical Oxidation and SVE	Soil Vapor Extraction	Mobilize and DeMobilize Drilling Rig & Crew	1	LS	0.00	1,460.65	854.80	0.00	$2,315.45	$3,861.58
		Organic Vapor Analyzer Rental, per Day	2	DAY	0.00	0.00	0.00	41.46	$82.93	$91.22
		Testing, purgeable organics (624, 8260)	10	EA	0.00	0.00	0.00	126.10	$1,261.05	$1,387.15
		In-Situ Vapor Recovery System, 5 HP, 230V, 280 SCFM	1	EA	15,853.20	1,204.55	0.00	0.00	$17,057.75	$19,847.62
		Equipment Enclosure, 8' x 15', Portable Building/Shed; lined, insulated, skid mounted, w/exhaust fan	1	EA	13,691.40	820.20	0.00	0.00	$14,511.60	$16,700.94
		Decontaminate Rig, Augers, Screen (Rental Equipment)	2	DAY	24.91	584.17	0.00	0.00	$1,218.15	$2,391.46
		Field Technician	31	HR	0.00	45.79	0.00	0.00	$1,419.50	$2,839.00
		2" PVC, Schedule 40, Well Casing	35	LF	1.24	4.87	5.20	0.00	$395.69	$588.63
		2" PVC, Schedule 40, Well Screen	50	LF	4.11	4.87	5.20	0.00	$708.80	$998.77
		2" PVC, Well Plug	5	EA	13.33	14.61	15.60	0.00	$217.68	$305.18
		Air Rotary, 6" Dia Borehole (Consolidated), Depth <= 100 feet	90	LF	0.00	17.39	23.88	0.00	$3,714.43	$5,494.36
		Split Spoon Sampling	20	LF	0.00	12.93	6.45	0.00	$387.54	$659.01
		Move Rig/Equipment Around Site	4	EA	91.16	209.97	122.88	0.00	$1,696.01	$2,621.50
		DOT steel drums, 55 gal., open, 17C	3	EA	114.33	0.00	0.00	0.00	$342.98	$377.28
		2" Screen, Filter Pack	60	LF	9.09	3.76	4.01	0.00	$1,011.55	$1,315.67
		2" Well, Portland Cement Grout	20	LF	1.19	0.00	0.00	0.00	$23.72	$26.10
		2" Well, Bentonite Seal	5	EA	146.52	97.12	103.72	0.00	$1,736.78	$2,347.48
		2" PVC, Schedule 80, Connection Piping	131	LF	2.32	9.51	0.00	0.00	$1,552.49	$2,831.18
		4" PVC, Schedule 80, Manifold Piping	88	LF	6.91	13.40	0.00	0.00	$1,776.43	$3,009.03
		2" PVC, Schedule 80, Tee	5	EA	11.89	60.87	0.00	0.00	$363.79	$674.07
		2" PVC, Schedule 80, 90 Degree, Elbow	5	EA	3.35	36.78	0.00	0.00	$200.64	$386.21
		4" PVC, Schedule 80, 90 Degree, Elbow	5	EA	10.03	73.78	0.00	0.00	$419.04	$792.95
		4" x 2" Reducer, PVC Schedule 80	5	EA	29.86	58.96	0.00	0.00	$444.06	$753.76
		2" PVC, Sch 80, Ball Valve	5	EA	25.75	41.46	0.00	0.00	$336.03	$556.19
		Pressure Gauge	5	EA	116.08	73.59	0.00	0.00	$948.31	$1,374.28
									$54,142.40	**$72,230.64**
	Carbon Adsorption (Gas)	8" Structural Slab on Grade	25	SF	6.75	4.63	0.17	0.00	$288.77	$421.80
		Air & process gas purification, carbon adsorption, vapor phase, modular carbon adsorbers	1	EA	61.36	0.00	0.00	0.00	$61.36	$67.49
		Plug, steel, malleable iron, black, threaded, 300 lb., 1/4'	2	EA	2.25	18.59	0.00	0.00	$41.67	$79.30
		Modular vapor-phase carbon adsorption system, 500 CFM, 1,400 Lb Fill, Closed Upflow, 11.5" Pressure Drop	2	EA	8,702.77	1,287.89	78.27	0.00	$20,137.86	$24,469.85
		Pressure Gauge	2	EA	116.08	73.59	0.00	0.00	$379.32	$549.71
									$20,908.98	**$25,588.16**
	Professional Labor Management	Lump Sum Percentage Labor Cost	1	LS	0.00	35,309.00	0.00	0.00	$35,309.00	$70,618.00
									$35,309.00	**$70,618.00**
	Excavation	12 CY Dump Truck Haul/Hour	5	HR	0.00	75.77	47.65	0.00	$617.10	$1,019.79
		Excavate and load, bank measure, medium material, 3/4 C.Y. bucket, hydraulic excavator	206	BCY	0.00	3.39	1.11	0.00	$923.92	$1,643.08
		Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	206	CY	8.70	1.07	0.93	0.02	$2,202.50	$2,621.04
		Disposable Materials per Sample	21	EA	10.31	0.00	0.00	0.00	$216.50	$238.15
		Testing, purgeable organics (624, 8260)	21	EA	0.00	0.00	0.00	138.72	$2,913.03	$3,204.33
		Project Manager	5	HR	0.00	76.33	0.00	0.00	$381.64	$763.29
		Project Scientist	3	HR	0.00	77.32	0.00	0.00	$231.97	$463.94
		QA/QC Officer	1	HR	0.00	76.59	0.00	0.00	$76.59	$153.18
		Field Technician	1	HR	0.00	45.79	0.00	0.00	$45.79	$91.58
		Word Processing, Clerical	1	HR	0.00	39.37	0.00	0.00	$39.37	$78.74
		Draftsman, CADD	1	HR	0.00	43.21	0.00	0.00	$43.21	$86.42
									$7,691.62	**$10,363.53**
	Off-site Transportation and Waste Disposal 1	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	206	BCY	1.23	1.22	0.39	0.00	$583.80	$867.29
		Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	1254	MI	0.00	0.00	0.00	4.00	$5,014.20	$5,515.62
		Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipmen	1	EA	0.00	0.00	0.00	576.01	$576.01	$633.61
		32 foot Dump Truck, 6 Mil Liner, disposable	7	EA	52.18	0.00	0.00	0.00	$365.28	$401.81
		Commercial RCRA landfills, bulk waste, solid, based on 2,000 lb/CY	174	TON	0.00	0.00	0.00	80.00	$13,936.00	$15,329.60
									$20,475.30	**$22,747.93**
	Off-site Transportation and Waste Disposal 2	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	8	BCY	1.23	1.22	0.39	0.00	$22.73	$33.76
		Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	122	MI	0.00	0.00	0.00	4.00	$488.00	$536.80
		Minimum Charges for Bulk Shipments Requiring Treatment or Stabilization	1	EA	0.00	0.00	0.00	2,942.67	$2,942.67	$3,236.93
		Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipmen	1	EA	0.00	0.00	0.00	576.01	$576.01	$633.61

Table 5

Alternative 4 Cost Estimate

Draft Soil Corrective Action Plan

Maryland Square Shopping Center

Phase Name	Technology Name	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Markup
		32 foot Dump Truck, 6 Mil Liner, disposable	1	EA	52.18	0.00	0.00	0.00	$52.18	$57.40
		Landfill Hazardous Solid Bulk Waste Requiring Stabilizatior	11	CY	0.00	0.00	0.00	235.40	$2,542.28	$2,796.50
									$6,623.86	**$7,295.01**
	Chemical Oxidant Bench-Scale Test	Mobilize and DeMobilize Drilling Rig & Crew	1	LS	0.00	1,460.65	854.80	0.00	$2,315.45	$3,861.58
		Organic Vapor Analyzer Rental, per Day	1	DAY	0.00	0.00	0.00	41.46	$41.46	$45.61
		Testing, purgeable organics (624, 8260)	2	EA	0.00	0.00	0.00	126.10	$252.21	$277.43
		Decontaminate Rig, Augers, Screen (Rental Equipment)	1	DAY	24.91	584.17	0.00	0.00	$609.08	$1,195.73
		Field Technician	8	HR	0.00	45.79	0.00	0.00	$366.32	$732.65
		Air Rotary, 6" Dia Borehole (Consolidated), Depth <= 100 feet	20	LF	0.00	17.39	23.88	0.00	$825.43	$1,220.97
		Split Spoon Sampling	2	LF	0.00	12.93	6.45	0.00	$38.75	$65.90
		DOT steel drums, 55 gal., open, 17C	1	EA	114.33	0.00	0.00	0.00	$114.33	$125.76
		Bench Scale Test	1	LS	0.00	0.00	0.00	6,000.00	$6,000.00	$6,600.00
									$10,563.03	**$14,125.63**
	Contingency Plan	Contingency Plan	1	LS	0.00	0.00	0.00	50,000.00	$50,000.00	$55,000.00
									50,000.00	**55,000.00**
	KMnO4 Placement	Excavator to Mix Oxidant	8	HR	0.00	75.77	47.65	0.00	$987.37	$1,631.66
		Project Manager	8	HR	0.00	76.33	0.00	0.00	$610.63	$1,221.26
		Project Scientist	80	HR	0.00	77.32	0.00	0.00	$6,185.89	$12,371.78
		Field Technician	161	HR	0.00	45.79	0.00	0.00	$7,372.25	$14,744.50
		Capital Expenses	1	LS	2,408.70	186.00	500.00	0.00	$3,094.70	$3,571.57
									$18,250.84	**$33,540.77**
	Air Permitting	Other Direct Costs	1	LS	10,000.00	0.00	0.00	0.00	$10,000.00	$11,000.00
									$10,000.00	**$11,000.00**
	Post-SVE Confirmation Sampling	Mobilize and DeMobilize Drilling Rig & Crew	1	LS	0.00	1,460.65	854.80	0.00	$2,315.45	$3,861.58
		Organic Vapor Analyzer Rental, per Day	2	DAY	0.00	0.00	0.00	41.46	$82.93	$91.22
		Testing, purgeable organics (624, 8260)	8	EA	0.00	0.00	0.00	126.10	$1,008.84	$1,109.72
		Decontaminate Rig, Augers, Screen (Rental Equipment)	2	DAY	24.91	584.17	0.00	0.00	$1,218.15	$2,391.46
		Field Technician	24	HR	0.00	45.79	0.00	0.00	$1,098.97	$2,197.94
		Air Rotary, 6" Dia Borehole (Consolidated), Depth <= 100 feet	80	LF	0.00	17.39	23.88	0.00	$3,301.72	$4,883.88
		Split Spoon Sampling	12	LF	0.00	12.93	6.45	0.00	$232.52	$395.41
		Move Rig, Equipment Around Site	3	EA	91.16	209.97	122.88	0.00	$1,272.01	$1,966.12
		DOT steel drums, 55 gal., open, 17C	4	EA	114.33	0.00	0.00	0.00	$457.30	$503.04
									$10,987.89	**$17,400.37**
								Capital Costs Total	**$244,952.93**	**$339,910.05**
								Alternative 4 Total with 25% contingency		**$ 424,887.57**
	Operations and Maintenance	Portable Air Sampler, Continuous, Daily Rental	104	DAY	0.00	0.00	0.00	91.12	$9,476.07	$10,423.68
		Disposable Materials per Sample	52	EA	10.31	0.00	0.00	0.00	$536.10	$589.71
		Coal-based, 4 mm Pellet, for Solvent Recovery less than 10,000 Lb	8400	LB	1.16	0.00	0.00	0.00	$9,785.75	$10,764.32
		Load Spent Carbon Containers onto Truck	6	EA	0.00	143.68	0.00	0.00	$862.07	$1,724.14
		Carbon Acdceptance Fee	1	EA	0.00	0.00	0.00	400.00	$400.00	$440.00
		Transportation to regeneration facility (177 miles to Parker, AZ)	1062	MI	0.00	0.00	0.00	4.37	$4,642.68	$5,106.95
		Load Drums on Disposal Vehicle	10	EA	0.00	5.53	1.71	0.00	$72.43	$129.49
		Minimum Charges for Drummed Shipments	1	EA	0.00	0.00	0.00	694.97	$694.97	$764.47
		DOT steel drums, 55 gal., closed only, 17H	10	EA	68.16	0.00	0.00	0.00	$681.57	$749.72
		Wastewater Disposal Fee	500	KGA	0.00	0.00	0.00	2.53	$1,267.05	$1,393.76
		Project Manager	8	HR	0.00	76.33	0.00	0.00	$610.63	$1,221.26
		Project Scientist	65	HR	0.00	77.32	0.00	0.00	$5,026.04	$10,052.07
		QA/QC Officer	5	HR	0.00	76.59	0.00	0.00	$382.95	$765.91
		Field Technician	13	HR	0.00	45.79	0.00	0.00	$595.27	$1,190.55
		Word Processing, Clerical	13	HR	0.00	39.37	0.00	0.00	$511.79	$1,023.58
		Treatment System Operator	223	HR	0.00	31.39	0.00	0.00	$7,000.89	$14,001.79
		Other Direct Costs	1	LS	353.19	0.00	0.00	0.00	$353.19	$388.51
		Startup Costs	1	LS	16.78	41.96	25.18	0.00	$83.92	$130.07
		Electrical Charge	5585	KWH	0.07	0.00	0.00	0.00	$402.46	$442.70
		Electrical Charge	5585	KWH	0.07	0.00	0.00	0.00	$402.46	$442.70
		Electrical Charge	107786	KWH	0.07	0.00	0.00	0.00	$7,767.06	$8,543.76
								Annual O&M Cost	**$51,555.35**	**$70,289.14**
		Portable Air Sampler, Continuous, Daily Rental	12	DAY	0.00	0.00	0.00	91.12	$1,093.39	$1,202.73
		Disposable Materials per Sample	12	EA	10.31	0.00	0.00	0.00	$123.71	$136.09
		Volatile Organic Compounds (TO-14)	12	EA	0.00	0.00	0.00	227.00	$2,724.00	$2,996.40
		Overnight delivery service, 51 to 70 lb packages	120	LB	0.00	0.00	0.00	4.61	$553.42	$608.76

Table 5

Alternative 4 Cost Estimate

Draft Soil Corrective Action Plan

Maryland Square Shopping Center

Phase Name	Technology Name	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost	Markup
SVE O&M		Project Manager	18	HR	0.00	76.33	0.00	0.00	$1,373.92	$2,747.84
		Project Engineer	30	HR	0.00	67.95	0.00	0.00	$2,038.58	$4,077.16
		Project Scientist	71	HR	0.00	77.32	0.00	0.00	$5,489.98	$10,979.95
		Staff Scientist	80	HR	0.00	44.18	0.00	0.00	$3,534.79	$7,069.59
		QA/QC Officer	18	HR	0.00	76.59	0.00	0.00	$1,378.63	$2,757.27
		Field Technician	96	HR	0.00	45.79	0.00	0.00	$4,395.88	$8,791.75
		Word Processing, Clerical	16	HR	0.00	39.37	0.00	0.00	$629.90	$1,259.79
		Other Direct Costs	1	LS	363.42	0.00	0.00	0.00	$363.42	$399.76
							Annual System Monitoring Cost		$23,699.63	$43,027.10
	Groundwater Sampling	Disposable Materials per Sample	10	EA	10.31	0.00	0.00	0.00	$103.10	$113.41
		Decontamination Materials per Sample	10	EA	13.46	0.00	0.00	0.00	$134.55	$148.01
		Lysimeter accessories, nylon tubing, 1/4" OD	150	LF	0.16	0.00	0.00	0.00	$23.42	$25.76
		Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	360.30	$360.30	$396.33
		Testing, purgeable organics (624, 8260)	10	EA	0.00	0.00	0.00	138.72	$1,387.15	$1,525.87
		Overnight delivery service, 51 to 70 lb packages	60	LB	0.00	0.00	0.00	4.61	$276.71	$304.38
		Testing, RCRA evaluations, EP toxicity analysis, metals (6010,7470)	1	EA	0.00	0.00	0.00	140.34	$140.34	$154.37
		DOT steel drums, 55 gal., closed only, 17H	3	EA	68.16	0.00	0.00	0.00	$204.47	$224.92
		Project Manager	1	HR	0.00	76.33	0.00	0.00	$76.33	$152.66
		Project Manager	2	HR	0.00	76.33	0.00	0.00	$152.66	$305.32
		Project Engineer	2	HR	0.00	67.95	0.00	0.00	$135.91	$271.81
		Project Scientist	4	HR	0.00	77.32	0.00	0.00	$309.29	$618.59
		Staff Scientist	8	HR	0.00	44.18	0.00	0.00	$353.48	$706.96
		QA/QC Officer	2	HR	0.00	76.59	0.00	0.00	$153.18	$306.36
		Field Technician	12	HR	0.00	45.79	0.00	0.00	$549.48	$1,098.97
		Field Technician	2	HR	0.00	45.79	0.00	0.00	$91.58	$183.16
		Field Technician	8	HR	0.00	45.79	0.00	0.00	$366.32	$732.65
		Word Processing, Clerical	2	HR	0.00	39.37	0.00	0.00	$78.74	$157.47
		Draftsman, CADD	2	HR	0.00	43.21	0.00	0.00	$86.42	$172.83
		Peristaltic Pump, Weekly Rental	1	WK	0.00	0.00	0.00	86.08	$86.08	$94.68
		Other Direct Costs	1	LS	329.98	0.00	0.00	0.00	$329.98	$362.98
									$5,399.49	$8,057.48
			See Yearly Cost Table for Total Estimates							

Notes:

BCY - bank cubic yard
CY - cubic yard
DOT - Department of Transportation
EA - each
gal - gallon
HR - hour
lb - pound
LF - linear feet
LS - lump sum
O&M - operations and maintenance
QA/QC - quality assurance/quality control
Qty - quantity
UOM - unit of measure
WK - week
" - inch
OD - outer diameter

Table 6
Alternative 3 Operations and Maintenance Cost Estimate
Draft Soil Corrective Action Plan
Maryland Square Shopping Center

Hotspot Excavation, Disposal, Chemical Oxidation and SVE				
		2011	2012	Total
Without Markup	Operations and Maintenance	$51,555	$49,100	**$100,656**
	SVE System Monitoring	$23,700	$22,571	**$46,271**
	Groundwater Sampling	$5,399	$0	**$5,399**
				$152,326
With Markup	Operations and Maintenance	$70,289	$66,942	**$137,231**
	SVE System Monitoring	$43,027	$40,978	**$84,005**
	Groundwater Sampling	$8,057	$0	**$8,057**
				$229,294

Notes:
Assumed annual discount factor of 5% for net present value calculations.
O&M - operations and maintenance
SVE - soil vapor extraction

Alternative 4 Cost Estimate Assumptions
Draft Soil Corrective Action Plan
Maryland Square Shopping Center

Excavation of 137 cubic yards (CY) - transport to off-site disposal, bench-scale chemical oxidant study, placement of 744 pounds (lbs) of potassium permanganate (KMnO4). Soil vapor extraction (SVE) system with 5 wells, two GAC modules of 1,400 lbs each rotated and switched out every 2 months.

Technology Name

Soil Vapor Extraction

1 Surface area of contamination greater than 550 parts per billion (ppb) is estimated to be 1,200 square feet
2 Plume extends to groundwater at roughly 18 feet below ground surface (bgs), SVE wells to extend to 17 feet bgs
3 Wells drilled with air rotary, split spoon used for lithologic logging, 2 soil samples collected per well
4 5 wells required to cover plume area, spaced average of 17 feet apart (radius of influence [ROI] 17 feet),
5 Wells constructed with 2" Schedule 40 polyvinyl chloride (PVC)
6 Average well flow rate 40 cubic feet per minute (CFM), for 200 CFM total

Carbon Adsoprtion (Gas)

7 Two Modular Carbon Adsorbers in Series -- 500 CFM with 1,400 lbs of carbon each
8 Assumed flow rate of 300 CFM for design purposes

Professional Labor Management

9 Used 15% construction markup

Excavation

10 Quantity to be excavated is in Appendix A.
11 Assumed that the excavation would not be sloped and that the excavator could reach a depth of 17 feet bgs from the side. This was necessary so that the SVE wells around the perimeter could be installed.
12 Cost assembly for seeding is currently in the estimate but may be removed.
13 Assumed all backfill material coming from off-site source located 5 miles away.
14 Assumed 20 confirmation samples required and 1 waste characterization samples based on California Department of Toxic Substance Control (DTSC) guidance of 1 characterization sample per 250 cubic yards.

Off-Site Transportation and Waste Disposal 1

15 US Ecology Landfill in Beatty, Nevada (NV) -- 122 miles from 3661 Maryland Parkway, Las Vegas, NV
16 All assumed to be Hazardous Waste -- 129 cubic yards (cy) where stabilization is not needed, used 1.35 conversion factor equaled 174.2 tons hazardous waste
17 Hazardous waste disposal cost assembly lowered from $155 to $80 per cubic yard
18 Waste transport cost assembly raised from $2.10 to $4.00 per mile

Off-Site Transportation and Waste Disposal 2

19 US Ecology Landfill in Beatty, NV -- 122 miles from 3661 Maryland Parkway, Las Vegas, NV
20 All assumed to be hazardous waste -- 8 cy where stabilization is needed, used conversion factor 1.35 equals 10.8 tons of hazardous waste requiring stabilization
21 Disposal cost of $235 per ton kept for small amount of waste requiring stabilization
22 Waste transport cost assembly raised from $2.10 to $4.00 per mile

Chemical Oxidant Bench-Scale Test

23 Bench-scale test for chemical oxidant to be placed in bottom of the excavations -- $6,000 estimate

KMnO4 placement

24 Capital costs based on vendor cost estimate:
744 lbs of potassium permanganate ($KMnO_4$) for groundwater (GW) treatment at $2.65 per pound (materials)
$0.25 per pound for delivery of $KMnO_4$ (labor)
$500 Personal protective equipment (PPE) (equipment)

Air Permitting

25 Assumed $10,000 for all air permitting activities -- applications for emissions and dust permits

Site Characterization Sampling

26 One post-SVE sampling
27 Post remediation -- 4 boreholes with 2 samples each

Operations and maintenance (O&M) and system monitoring for 4 years of operations plus 1 GW sampling event

Technology Name

Operations and Maintenance

28 O&M of soil vapor extraction (SVE) and granular activated carbon (GAC) -- Minimum O&M labor, professional labor not included
29 Weekly effluent sampling for volatile organic compounds (VOC) with flame ionization detector (FID)
30 Eliminated lab costs and overnight shipping from cost assembly
31 Reduced project scientist hours from 130 to 65 due to lack of data analysis
32 GAC changeout every 2 weeks or 26 times per year, assumed switched only 1 of 2 1,400 lbs vapor phase carbon adsorbers for total of 36,400 lbs per year.
33 Disposal of 1,400 lbs of used GAC (approximately 2.4 cubic yards) every other month

SVE System Monitoring

34 First year -- 1 sample per event, 16 events to account for 4 mobilizations first month
35 Following 3 years -- 1 sample per event, 1 event per month, 12 months per year
36 The cost table only shows the first year costs and not the costs for the following 3 years
37 Analysis VOCs cost assembly changed to $227 per sample ($165 for analysis, $32 for summa, $30 for flow controller) from SW
38 One field duplicate per 10 samples; one split sample per 10 samples; no MS/MSD
39 Standard monitoring plan and monitoring report, Stage 1 lab review

Groundwater Monitoring

40 Default numbers for 1 GW monitoring event were too high. Changed the following hours from RACER default:
Field Tech -- 26 to 2
Project Manager - 9 to 1
Project Engineer -- 30 to 2
Project Scientist -- 59 to 4
Staff Scientist -- 80 to 8
Quality assurance/quality control (QA/QC) -- 17 to 2
Word Processor -- 14 to 2
Draftsman -- 10 to 2

Markups

42 Assumed a markup on materials and subcontractors of 10%.
Assumed a labor multiplier of 2 for G&A and profit.
Assumed a 25% contingency on the total cost.