June 28, 2011

Maryland Square Shopping Center, LLC
Herman Kishner Trust
c/o Mr. Tom Vandenburg
Dongell Lawrence Finney LLP
707 Wilshire Boulevard, Suite 4500
Los Angeles, California 90017

RE: DRAFT WORK PLAN FOR MITIGATION OF **INDOOR AIR AND WELL WATER**
MARYLAND SQUARE SHOPPING CENTER
3661 SOUTH MARYLAND PARKWAY
LAS VEGAS, NEVADA
FACILITY ID NO. H-000086

Dear Mr. Vandenburg:

Enclosed please find three copies of the Draft Work Plan for Mitigation of Indoor Air and Well Water for the above referenced project. This document is being provided to the Nevada Division of Environmental Protection Bureau of Corrective Action (NDEP BCA) in both hard copy and electronic Adobe Acrobat format on this date, June 28, 2011. In addition, the attached table responds to comments issued by the NDEP BCA dated February 28, 2011 or confirms acknowledgement within the body of the enclosed work plan, as appropriate.

Should you have questions or require additional information, please do not hesitate to contact Robert Manriquez, Program Manager, at 619.321.6748. Thank you for your time and consideration in this matter.

Regards,

Tamara Pelham
Project Manger
CEM No. 1537, Exp. Sept. 11, 2012
Class A 60505

Enclosure(s) (3) Draft Work Plan for Mitigation of Indoor Air and Well Water (June 28, 2011)

Attachment: (1) Response to NDEP BCA comments dated February 28, 2011.

Dist: 3/Addressee
1/NDEP, Carson City, NV
Attn: Ms. Mary Siders
1/General Growth Properties, Inc.
Attn: Ms. Lynne Stella

Tetra Tech
639 Isbell Road, Suite 390 Reno, NV 89509-4967
Tel 775.322.0555 Fax 775.322.3987 www.tetratech.com

RESPONSES TO COMMENTS FROM THE STATE OF NEVADA DIVISION OF ENVIRONMENTAL PROTECTION ON THE DRAFT WORK PLAN FOR MITIGATION OF INDOOR AIR AND WELL WATER, MARYLAND SQUARE SHOPPING CENTER, DATED FEBRUARY 28, 2011

The table below contains the responses to comments received from the NDEP on the "Draft Work Plan for Mitigation Of Indoor Air and Well Water", Maryland Square Shopping Center. The comments addressed below were received from NDEP on April 27, 2011.

Comments provided from Mary Siders, Ph.D., Bureau of Corrective Actions, Nevada Division of Environmental Protection.

Comment No.	Comment	Response
	The NDEP notes the following main issues with this draft Work Plan: (1) discerning between the interim action level for tetrachloroethylene (PCE) in indoor air and the remediation standard for PCE in indoor air and (2) adhering to the four main tasks, as listed in Section III.A.I.a-d. of the Permanent Injunction (December 27, 2010). 1) As noted in the NDEP's letters of **January 11, 2011** and **February 3, 2011**, the interim-action level for PCE in residential indoor air is **not** the remediation standard for PCE in residential indoor air. The remediation standard has not yet been selected, but will consider 10^{-6} risk level as the point of departure. 2) The four main tasks described in Section IILA.I.a-d of the Permanent Injunction include: a. Provide indoor air sampling for homes that overlie the area contained within the 100 micrograms per liter (µg/L) contour of the PCE plume in groundwater b. Design, installing, and testing the efficacy of additional subslab depressurization (SSD) systems for additional homes if the indoor air sample contains concentrations of PCE that exceed the interim-action level for residential indoor air c. Maintain and monitor existing and any additional installed SSD systems "until Remediation Standards for PCE in groundwater and indoor air have been met." d. Define the downgradient extent of the PCE plume in groundwater containing more than 5 µg/L of PCE, identify any domestic wells within this plume, and take appropriate action to assure that the drinking water standards for PCE and its degradation products are not exceeded.	Accepted. The work plan has been revised to reference the 10^{-6} risk level and adhere to the four main tasks in the Permanent Injunction.

Comment No.	Comment	Response
	For Task I.a, the work plan describes an ambitious plan of vadose zone and subslab sampling, in addition to sampling indoor air. The NDEP notes that at this stage of project work, the task is not evaluating if vapor intrusion ***could be*** occurring at the site. The data collected to date clearly show that PCE vapors are intruding at significant concentrations (i.e., exceeding 10-4 risk) into some homes overlying the PCE plume in groundwater. Although the NDEP does not disagree with the statement in Section 3.3.1 of the work plan that *"Sub-slab soil vapor samples are collected to evaluate target analyte concentrations in gases occupying the pore space of engineered base material or natural soils immediately beneath a building foundation,"* indoor air is the medium of concern. The intrusion of PCE vapors from the groundwater plume is not in doubt at this site. The utility of subslab data is questionable for estimating indoor air concentrations; studies have shown extreme variability (orders of magnitude) across the slab. Additionally, empirical data show that attenuation factors also exhibit order-of-magnitude ranges. In contrast to estimating possible indoor air concentrations using an attenuation factor, a time-averaged sample of indoor air provides information on actual exposure. Work should focus on the task of collecting indoor air samples. If a question of possible in-home sources arises, then additional work may be proposed as to how to evaluate such a situation.	Accepted. The work plan has been revised to eliminate soil vapor sampling.
	Tasks 1.b and 1.c concern installation and maintenance of SSD systems; however, the work plan has incorrectly taken the interim-action level to be the remediation standard. Please keep in mind that the remediation standard for indoor air may be less than the 5 $\mu g/m^3$ detection limit of screening-level testing and Method TO-15. Establishment of the remediation standard for indoor air would begin by considering as the point of departure, the 10^{-6} risk level, which currently corresponds to a concentration of 0.41 micrograms per cubic meter (µg/m3) for PCE (U.S. Environmental Protection Agency [EPA], 2010). Analytical methods should be selected accordingly, so that detection limits are less than the possible remediation standard. Screening-level testing (5 µg/m3 detection limit) of indoor air may be used to identify additional homes that need mitigation systems installed, but should not be used to "screen out" homes from further testing.	Accepted. The revised work plan specifies that EPA TO-15 "Low Level" methodology will be used to achieve detection levels that are near or below the 10^{-6} risk level for PCE of 0.41 $\mu g/m^3$.
	For **Task I.d**, the work plan has altered the objective. The task is to define the downgradient extent of the PCE plume to the 5 µg/L concentration contour, because permitted domestic wells are (historically) installed in the area east of Eastern Avenue. Therefore, the work plan needs to propose locations east of the current wells, MW-30 and MW-31. With perhaps one exception, the lateral boundaries of the plume from the source area to the golf course are well defined or can reasonably be inferred based on data from existing wells.	Accepted. The locations of proposed monitoring wells have been revised.
	Incorrect or inappropriate technical terminology is used in the discussion of the geology and hydrogeology in Sections 1.3, which appears to be excerpted from problematic text in the Corrective Action Plan (CAP) for Groundwater. Specifically, the last paragraph in Section 1.3 needs to be reviewed and revised.	Accepted. The text has been revised.
1	Page 1-1, first Paragraph and Figure 1-1. The figure shows the **3rd quarter 2010 plume** (October, 2010 samples). **Please replace with the 4th quarter 2010 plume** figure (November 2010 samples). Also, NDEP is the Nevada **Division** of Environmental Protection.	Accepted. The plume map used both the 4th quarter 2010 and 1st quarter 2011 data and the text has been revised.

Comment No.	Comment	Response
2	Page 1-1, second paragraph. Text states that *"Characterization of the site includes defining the extent of the groundwater PCE plume and assessing PCE in indoor air and soil vapor."* The NDEP did not specifically request characterization of the soil vapor, and indeed, this would be a large and difficult task, were the lithologic heterogeneity and preferential pathways (utility corridors, etc) to be characterized across the entire site. Collecting vapor data over time by installing vapor monitoring wells should provide information on the temporal variability in tetrachloroethylene (PCE) vapor concentrations; however, the work plan should focus on the key tasks (indoor air testing, **installation/maintenance** of subslab depressurization (SSD) systems, and delineation of the downgradient extent of the PCE plume in groundwater to 5 micrograms per liter [µg/L]).	Accepted. The work plan has been revised to eliminate soil vapor sampling.
3	The tasks and objectives listed in the work plan included the following: I. *Identify the extent of the PCE groundwater plume.* *2. "Provide a plan for indoor air sampling for homes within the Site that overlie groundwater containing PCE at a concentration of 100 µg/L or more.* *3. 'provide a plan to design, install, and test the efficacy of additional subslab depressurization (SSD) systems* ***if*** *indoor air samples collected from unmitigated homes are found to contain PCE vapors at concentrations exceeding NDEP's interim-action level of 32 µg/m3, subject to homeowner approval.* *4. "Provide a plan to maintain and monitor existing SSD systems* ***until they are no longer necessary to protect human health****.* *5. Identify any domestic wells within the 5 µg/L boundary of the plume and describe appropriate actions* The NDEP notes that items 1 and 5 above relate to the single Item **III.A.1.d.** in the Permanent Injunction (December 27,2010); however, the draft Work Plan has created two parts to this item, and thereby failed to meet the objectives as stated in the Injunction. The injunction required that the downgradient extent of the plume be defined to the 5 µg/L concentration contour. The northern and southern boundaries of the plume are adequately defined, with the possible exception of the 100 µg/L contour across Mariposa Way. The NDEP required defining the downgradient extent of the plume because there are known permitted domestic wells downgradient (i.e., east of Eastern Avenue), with the possibility that some of these wells are still in use. Houses within the residential neighborhood (i.e., the golf course subdivision) are all likely served by the municipal water supply, but this should be verified. Therefore, tasks 1 and 5 need to be recombined to state the single task to "Define the downgradient extent of the groundwater plume containing more than 5 µg/L, and identify any domestic wells within the downgradient extent of this plume (see injunction Section III.A.1.a-d)	Accepted. The text has been revised.

Comment No.	Comment	Response
4	Page 1-2, second paragraph. Text states *"However, the distal and lateral extents of the PCE plume have not been determined to a concentration of 5 µg/L."* The injunction required delineation of the downgradient extent of the PCE plume. The NDEP also notes that wells with nondetect to low concentrations already constrain the lateral boundaries of the plume between the source area and the western side of the golf course. Therefore, the northern and southern boundaries of the PCE are sufficiently well-delineated, with perhaps the possible exception of the 100 µg/L contour across Mariposa Way, where the plume widens. This widening is potentially the result of interaction with changes in the groundwater flow gradient due to infiltration resulting from irrigation of the golf course.	Accepted. The test has been revised.
5	Page 1-2. fourth paragraph. Text states that *"In response, NDEP sampled indoor air in 97 homes and two schools between fall* 2007 *and winter* 2007-2008." More specifically, the NDEP collected indoor air samples in two phases, from September 2007 to March 2008. Also, these indoor air data have been kept confidential to assure the privacy of the homeowners.	Comment noted.
6	Page 1-3, second paragraph. Text states that *"Lithologic data are available in* ***borehole logs from 33 monitoring wells*** *installed at the Site during* 2000 *to 2008.* Lithologic data are also available for 16 borings installed for the soil gas study (URS, 2007a) and 29 borings in the source area (URS, 2007b). Additionally, boring BT-2 was installed between MW-32 and MW-33 to determine well placement (URS, March 2008 report). Driller's logs for the golf course irrigation wells are older (1961 and 1977) and lack specific detail.	Comment noted. The text has been deleted.
Section 2.0 DELINEATION OF THE GROUNDWATER PLUME		
7	Page 2-1, first paragraph. Text states that "the locations of these wells and the defined extent of the PCE plume as represented by the 3rd quarter 2010 data are shown on Figure 2-1." Please use 4th quarter 2010 data; the 3rd quarter data show an anomaly at MW-26, which perturbs the 500 µg/L contour. The average concentration of PCE in MW-26 (calculated using all data through 4th quarter 2010) is 830 µg/L.	Accepted. The test has been revised.

Comment No.	Comment	Response
8	Page 2-1, first paragraph. Text states that "Eight additional wells are proposed to define the lateral extent of the PCE plume to a concentration of 5 µg/L. The proposed locations for the new wells are shown on Figure 2-1." Figure 2-1. The NDEP notes that Task III.A.I.d. of the Permanent Injunction specifically requested that the 5 µg/L boundary at the downgradient extent of the plume be defined. After defining the leading edge of the plume, the next step was to evaluate whether any domestic wells (mainly east of Eastern) could be affected by the plume at its downgradient (i.e., east of Eastern Ave) extent. Homes west of Eastern Avenue and around the golf course are part of a subdivision that is likely supplied by the municipal water supply; however, this should be verified by review of Nevada Division of Water Resources (NDWR) data. Therefore, the NDEP notes the following regarding the proposed well locations that are shown on Figure 2-1 of the work plan: a) The well between MW-21 and MW-22 does not contribute to achieving the objective of delineating the downgradient extent of the plume. Moreover, data for the past two years show that concentrations of PCE in MW-21 have ranged from 11 to 20 µg/L and have been nondetectable in MW-22. The 5 µg/L contour can be quite reasonably inferred here. b) The proposed well east of MW-24 mid-way down Ottawa St does not contribute to achieving the objective of delineating the downgradient extent of the plume. Again, nondetections in MW-24 and MW-28 allow reasonable inference of the 5 µg/L boundary along the south side of the plume in this area. c) The proposed well on the corner of Spencer St and Ottawa does not contribute to achieving the objective of delineating the downgradient extent of the plume. Nondetections in well MW-28 allow reasonable inference of the 5 µg/L boundary. d) Include on this figure, the location of boring BT-2, from which a grab sample of groundwater contained 130 µg/L PCE (URS 2008). (This boring was located about 300 ft south of MW-33). e) After including boring BT-2 on the figure, consider whether the proposed wells on Cherokee or the location on Mariposa, are both needed. MW-22 and MW-33 constrain the northern boundary of the plume, and the grab sample from BT-2 provides additional data to assist in inferring the 100 µg/L boundary. f) As noted in the NDEP's letters of January 11 and February 3, 2011, the golf course irrigation well, PW-I, is incorrectly located on Figure 2-1. Please see Figure 2 in the URS report dated March 24, 2008, for the correct location of this irrigation well. *Continued…*	The text has been modified to state that: "Up to six additional wells are proposed to define the northern and eastern extents of the plume to complete plume dimensions based on a concentration of 5 µg/L PCE in the downgradient area. The proposed locations for at least three new wells, in conjunction with locations designated for three optional wells, as needed, are illustrated on Figure 2-1." a) through d): Figure 2-1 has been modified to incorporate recommended changes. e) Only one of the previously proposed wells is needed, specifically the well at the cul-de-sac of Maricopa Way located approximately 300 feet northwest of MW-32 and 240 feet west of boring BT-2. f) The location of well PW-1 has been updated per Figure 2 of the URS report dated March 24, 2008.

Comment No.	Comment	Response
8. continued	g) The proposed well located about 600 feet east of well MW-30 should be drilled and sampled first in the well installation program. If PCE is detected at a concentration greater than 5 µg/L at this location, another well should be drilled farther east, and so on. Consider and propose the sequence in which the wells will be drilled, and use grab samples and rapid turn-around analysis to "adjust" placement of the next wells to be installed. h) The effect of infiltration of the irrigation water on the depth and lateral spread of the plume along Spencer St is currently unknown, but the seasonal fluctuation in the water table can be clearly seen in the water level data for wells near the golf course (MW-26, MW-27, MW-30, etc). It may be worthwhile to deploy passive diffusion bags (PDBs) or other means in wells MW-27, MW-30, MW-31, and MW-32 (and in other site wells) to better understand the vertical distribution of PCE within each well and assist in selecting appropriate screen depths for the proposed new wells. i) Finally, please note that water tends to "rebound" in wells installed in the Las Vegas. Not recognizing this may lead to installing a well with a screen that becomes submerged (e .g., well MW-30) Installation of additional wells as proposed (see a, b, c above) that are not required to meet the objective of downgradient delineation should be carefully considered. Each well installed will be included in the ongoing monitoring program.	g) As recommended by the NDEP, the proposed well located about 600 feet east of well MW-30 will be drilled and sampled first in the well installation program. To assist in decision making on the placement of the new wells, grab groundwater samples will be collected, if feasible. h) The results of PDB sampling (Converse 2010) “did not indicate any significant trends that would demonstrate specific depths or lithologic variability such that a selected remedial method should be focused on a specific zone (depth or lithologic unit).” However, additional PDB sampling may be necessary to confirm this conclusion. The decision on deployment of PDBs in wells MW-26, MW-27, MW-30, MW-31, MW-32 and other will be based on the results of spinner-type/FloVision® surveys proposed in the CAP for groundwater, dated June 14, 2011. i) Comment noted.
9	Page 2-1, Section 2.1. The Work Notices should be submitted for NDEP review and approval. In addition to a number for NDEP, the Work Notices should include a number for a representative of the Herman Kishner Trust (Trust) responsible for overseeing field work.	Comment noted.
10	Pages 2-1 to 2-2, Section 2.2. Propose how screen depth and length be determined for each well and provide the rationale. Note item (i) in Comment 10 above.	The new monitoring wells will target the shallow groundwater zone and will be installed to a depth of approximately 37 feet bgs, where relatively low permeable materials have been encountered (clays, clayey silts). The 20-feet screens would allow both “straddling” the water table and effective monitoring of more transmissive layers within the screen interval.
11	Page 2-3, Section 2.4. Text states that "One duplicate sample and one trip blank sample will be collected for quality assurance (QA)/quality control (QC)." Does this mean one per well or one per day? How will data from the duplicate sample be used? Will the highest numbers be posted or will an average be posted or will both values be posted?	One duplicate sample and one trip blank sample will be collected each day of sampling for quality assurance (QA)/quality control (QC). Depending on the analytical results either the highest concentration of the primary and duplicate samples will be posted or both.
12	Page 2-3, last paragraph. The monitoring frequency for the new wells will be determined by the NDEP after two quarters of data have been collected.	Comment noted.

Comment No.	Comment	Response
13	Page 2-3, Section 2.5. The proposed schedule for completing report of field work and additional investigation work plans should be provided, and should be a certain number of days following completion of field work.	Implementation of the work plan will begin within 30 days of NDEP's approval of the work plan. A schedule for implementation will be provided prior to the onset of work activities after discussions with NDEP and key stakeholders on logistics and coordination of activities.
Section 3.0 INDOOR AIR AND SOIL VAPOR SAMPLING PLAN		
14	Page 3-1, first paragraph states that *"In addition to indoor air sampling, soil vapor sampling, including sub-slab sampling beneath homes and vadose zone sampling in the affected neighborhood, is recommended to assess the VI pathway."* NDEP does not agree that collection of soil gas data is necessary to achieve the four goals of the work, as specified in Section 1II.A.I.a-d of the Permanent Injunction. The NDEP notes that, at this stage of site work, the task is not evaluating if vapor intrusion could be occurring at the site. The data collected to date clearly show that PCE vapors are intruding at significant concentrations (i.e., exceeding risk) into some homes overlying the PCE plume in groundwater. Because the spatial heterogeneity of subslab and vadose-zone gas samples typically far exceeds the temporal variability of indoor air samples, NDEP does not agree that results of subslab and soil vapor sampling are necessary to achieve the goal of this work. Revise this plan to reflect and implement actions necessary to achieve objectives of the corrective action plan (CAP) for groundwater. Although the objective of this plan is to assess concentrations exceeding 32 micrograms per cubic meter (µg/m3) in residential indoor air, there are additional objectives for the groundwater CAP that can be met as part of this work plan. The additional objective for CAP is to determine whether indoor air concentrations exceed the indoor air concentration of PCE anticipated to result in exceedence of the remediation standard, using 1x 10-6 cancer risk as the point of departure. This value is currently 0.41 µg/m3, per USEPA's November 2010 RSL value for PCE in residential indoor air (USEPA, 2010). For purposes of completing the CAP and report for groundwater, including this additional objective eliminates the need for a multi-step approach. Collecting indoor air data that provides adequate sensitivity to meet any remediation standard, from 0.41 µg/m3 upward, will ensure that these data can be used to confirm when and where the remediation standard for indoor air is achieved.	Accepted. The text has been modified.

Comment No.	Comment	Response
15	Page 3-1, second paragraph proposes a *"multi-step approach to the indoor air sampling program,"* which proposes (1) identifying homes within the 100 µg/L boundary for PCE in groundwater, (2) collecting grab indoor air samples and performing analysis on site, and (3) collecting 24-hour integrated samples of indoor air using a 6-liter summa canister. (1) The NDEP notes that the 100 µg/L boundary should be drawn to err on side of protectiveness and include more, rather than fewer, homes in the indoor air sampling program. For purposes of the indoor air sampling program, the boundary should not be used to exclude homes from sampling that are between a well with PCE concentrations greater than 100 µg/L and a well with PCE concentrations less than 100 µg/L. (2) In proposing step 2, the work plan states that on-site analysis will be used as a *"a cost effective way to quickly eliminate from the program homes for which there is no evidence of significant impacts to indoor air"* and continues *"The screening level sampling will be followed up with collection of 24-hour time-composite SUMMA canister samples in homes that are not screened out during the initial sampling. Data from the SUMMA canister sampling will be used to develop a list of homes that have indoor air PCE concentrations above the NDEP Interim Action Level of 32, µg/m3 and should be included in the long-term indoor air monitoring program (LTIAM)* ." The on-site analysis will be useful for quickly identifying homes that may need a mitigation system; however, homes should not be "screened out" from long-term monitoring if PCE is not detected by the screening-level analysis. Homes within the 100 µg/L area of the plume should be sampled at least once, using an analytical method that meets the remediation standard for PCE in indoor air, before the groundwater remedy commences. (3) The NDEP notes that the 24-hour sample collected in a 6L summa canister is consistent with the sampling done by the NDEP in 2007-2008. However, depending on the remediation standard for PCE in indoor air, analytical method TO-15 SIM may be required to achieve sufficiently low detection rates [*sic*].	(1) Accepted. The text has been revised. (2) In accordance with agreements reached during the May 27, 2011 meeting with NDEP, Mr. Tim Swickard and Tetra Tech, the work plan has been revised to clarify that the on-site sampling and analysis will be used as follows: Homes for which indoor air grab samples contain less than 16 µg/m^3 of PCE will be resampled in 12 months using SUMMA™ canisters and TO-15 Low Level analysis under the IAM program. Homes with PCE concentrations in grab samples above 16 µg/m^3 will either be immediately resampled using SUMMA™ canisters and TO-15 Low Level analysis, or will be immediately recommended for installation of an SSD system if the grab sample concentrations are excessively high. (3) As noted above, TO-15 Low Level analysis will be used. The Low Level analysis will achieve detection levels close to 0.41 µg/m^3 for PCE, but is more cost-effective than TO-15 SIM methodology.
16	Page 3-1, second paragraph. Text states that *"A flow chart of the decision process for inclusion/exclusion of homes in the LTIAM is provided in Figure 3-1 (note that* ***the decision process illustrated in Figure 3-1 is valid only until the remediation standard for groundwater has been satisfied)"*** The above statement is incorrect: the remediation standard for indoor air must be achieved, ***as well as*** the remediation standard for groundwater (see Section III.A.I.c, of the Permanent Injunction).	Accepted. The text has been revised.

Comment No.	Comment	Response
17	Figure 3-1. A step in the left-hand side of this flow chart indicates that if the indoor air screening results are less than 16 µg/m3, the process will *"Dismiss home from /A sampling program."* Please note that there is nothing in the Injunction that indicates homes within the 100 µg/L contour should be "dismissed" from the annual indoor air monitoring program. Homes within this area should be resampled at least annually until remediation standards are attained for groundwater ***and*** indoor air. Eliminating this element regarding "dismissal" from the flow chart also eliminates the question *"Have* GW *concentrations increased by* ***>50%"***	Figure 3-1 has been revised accordance with agreements reached during the May 27, 2011 meeting with NDEP, Mr. Tim Swickard, and Tetra Tech.
18	Figure 3-1. A step in the right-hand side of this flow chart asks *"Is IA PCE concentration below 32 µg/m3?"* and leads to a decision to *"Turn off SSD system, resample indoor air"* Revise this plan to reflect and implement actions necessary to achieve objectives of groundwater CAP. Although the objective of this plan is to assess concentrations exceeding 32 µg/m3, in residential indoor air, there are additional objectives for the CAP that can be met as part of this work plan. The additional objective for groundwater CAP is to determine whether indoor air concentrations exceed the indoor air concentration of PCE anticipated to result in exceedence of $1x\ 10^{-6}$ cancer risk. This value is currently 0.41 $\mu g/m^3$, per EPA's November 2010 RSL value for PCE in residential indoor air. For purposes of completing the CAP and report for groundwater, including this additional objective eliminates the need for a multi-step approach. Collecting indoor air data that provides adequate sensitivity to meet any remediation standard, from 0.41 µg/m3 upward, will ensure that these data can be used to confirm when and where the remediation standard for indoor air is achieved. Please modify the flow chart accordingly. The SSD systems should continue to run until the remediation standards for indoor air *and* groundwater have been attained.	Figure 3-1 has been revised accordance with agreements reached during the May 27, 2011 meeting with NDEP, Mr. Tim Swickard, and Tetra Tech. As noted above, TO-15 Low Level methodology will be utilized for indoor air sampling.

Comment No.	Comment	Response
19	Page 3-1, fourth paragraph. *"Homes within the 100 µg/L PCE isoconcentration contour will be sampled for elevated indoor air concentrations; however, because this contour is not yet fully delineated, the number and location of homes that will be recommended for sampling is to be determined."* The permanent injunction (December 27, 2010) ***requires*** indoor air sampling, at least annually, for homes within the 100 µg/L PCE contour for groundwater; however, this does not ***exclude*** sampling of homes outside this boundary (see **Sections IV.A.2. and IV.A.4** of the Permanent Injunction, 2010). The NDEP may request sampling of homes outside of this contour, based on other data collected (e.g., indoor air data of adjacent or nearby homes, etc.). Also, the science and sampling methods continue to evolve. Depending on the new toxicity values for PCE (and TCE) to be published by the USEPA in 2011 or 2012, the **interim-action level** and the **remediation standard** may be modified accordingly. NDEP requests that the analytical method will be modified from TO-15 to TO-15 SIM as part of meeting objectives of the groundwater CAP. One of these objectives is to determine the **remediation standard** for PCE in indoor air. The remediation standard has not yet been selected, but is likely to be initially specified with a 10-6 goal, which may be modified to a 10-5 level. NDEP requests that the indoor air monitoring employ an analytical method with a lower detection limit, as part of developing the remediation standard under the CAP. There have been advances in quantitative passive samplers (McAlary 2010; Schumacher et al, 2011) and the NDEP does not rule out the use of these quantitative passive samplers as part of the long term indoor air monitoring program.	Comment noted. As stated above, Tetra Tech will utilize TO-15 Low Level methodology, which will achieve a detection level for PCE that is near or below 0.41 µg/m^3.
20	Page 3-1, last paragraph states: *"Once the 100 µg/L PCE isoconcentration contour has been fully delineated, plume contours will be overlaid onto a map of residential property lots within the Site. Those homes located on lots that are within the 100 µg/L contour will be recommended for inclusion in the indoor air sampling program."* The NDEP notes that, because such contours cannot be "fully delineated" and must be inferred in part, the 100 µg/L boundary should be drawn to err on side of protectiveness and include more, rather than fewer, homes in the indoor air sampling program (i.e., if the 100 µg/L contour cuts a corner of the lot; include the home in the sampling program). Most of the wells proposed for the area west of the golf course (see Figure 2-1) are not needed to reasonably infer plume boundaries at the 5 and 100 µg/L contours in the area west of the golf course.	Accepted. The text has been revised.

Comment No.	Comment	Response
21	Page 3-2, first paragraph states that *"Correspondence requesting permission to conduct indoor air sampling will be issued to those homes and homeowners recommended for inclusion in the initial sampling program. A release of liability form will be included in notification correspondence to be completed for purposes of documenting authorization to conduct subsequent indoor air sampling activities. It is assumed that* ***notification and request efforts will be conducted in collaboration with NDEP*** *and in conjunction with the Community Relations Plan."* The NDEP will be the point of contact with the homeowners, and all correspondence to the homeowners will come through the NDEP. Details of the sampling teams need to be worked out, but will include an NDEP representative (either NDEP staff or staff from NDEP's contractor, Broadbent & Associates, Inc. (BAI), who participated in all the indoor sampling done to date). All homeowners who do not respond to the initial notification will be contacted a second time. The plan should be revised to reflect these changes.	Accepted. The additional information provided by NDEP is consistent with the draft work plan; however, the text of the work plan has been revised to clarify the details provided in Comment 21.
22	Page 3-2, paragraph 5 states that *"Indoor air sampling can be regarded as a nuisance or disturbance to homeowners or occupants, Consequently, judicious efforts to thoughtfully coordinate with owners/occupants to conduct home surveys and gain access to indoor areas for sampling events will be needed. In an effort to impart credibility regarding the importance of this activity and to relieve potential concerns, NDEP participation with Tetra Tech while engaging sampling program participants is invited'* Correspondence and contact with homeowners (and government officials) will occur through the NDEP. As noted under comment 21, details of the sampling teams need to be worked out, but will include an NDEP representative (either NDEP staff or staff from NDEP's contractor, BAI, who participated in all the indoor sampling done to date). The plan should be revised to reflect these changes.	Accepted. The additional information provided by NDEP is consistent with the draft work plan; however, the text of the work plan has been revised to clarify the details provided in Comment 22.

Comment No.	Comment	Response
23	Page 3-3, fourth complete paragraph notes that *"Because the modified Method 8021 instrumentation completes sample quantification within 5 minutes, multiple samples from each home can be collected and analyzed to complete a robust VI profile of subject residences. This screening program will also enable the detection of indoor sources of target analytes. It is anticipated that two to five grab samples will be collected from each home depending upon house size and layout."* How do results from the real-time analysis of multiple samples from a single home, compare with analytical results from a summa canister? The samples analyzed in the mobile laboratory have the advantage of expediency, but are even more temporally challenged than a 24-hour time-integrated sample collected in a summa canister. Please provide a reference for the "supporting data compiled by EPA." Will the TAGA mobile laboratory be used? Can data generated using the mobile laboratory be validated at any level? The screening-level reporting level of 5 µg/m3 for PCE is approximately equal to the average reporting limit achieved using summa canisters during the NDEP's 2007-2008 sampling campaign, and will be sufficient for screening to install and monitor SSD systems. However, depending on the remediation standard selected for PCE in indoor air, a lower reporting limit may be needed to verify that the remediation standard has been achieved.	Comment noted. The reference for the EPA data is: *EPA. 2007. QA/QC Considerations for the TAGA Analysis. Presentation at Workshop on Soil-Gas Sample Collection and Analysis, AEHS, San Diego, CA. March. Presented by Mickunas, D., EPA/ERT.* A copy of the pertinent slide is attached to these responses to comments. The TAGA mobile laboratory will NOT be used for this project, it does not provide significant advantages over the proposed SW8021 approach and is prohibitively expensive (on the order of $7,000/day plus a $10,000 mobilization fee). Method 8021 is an EPA SW-846 methodology. Validation can be performed on the data generated with the SW8021 instrument. QC samples including blanks, laboratory control samples, calibration checks, and field duplicates are performed.
24	Page 3-3, last paragraph states that *"A PCE screening level concentration of 16, µg/m3 is recommended as the threshold to determine subsequent action. This concentration is equal to 50 percent of the NDEP Interim Action Level and provides a margin of error to account for potential temporal variability in indoor air concentrations. Supporting data compiled by EPA using the trace atmospheric gas analyzer (TAGA) mobile laboratory has demonstrated that grab samples tend to match 24-hour time-composite samples by less than a factor of two; therefore, the proposed screening level concentration of 16 µg/m3 is consistent with this research and provides an adequate safety factor."* The NDEP requests that references be provided to document this paragraph, specifically the USEPA data using the TAGA mobile laboratory. Is this the mobile laboratory proposed for the work at the Maryland Square PCE Site?	Please see response to Comment No. 23.

Comment No.	Comment	Response
25	Page 3-4, first paragraph states that *"Homes where breathing air samples do not exceed 16 µg/m3 will be dismissed from the indoor air sampling program (Figure* **3-1***)."* The NDEP notes that the purpose of the air sampling is not only to trigger installation of SSD systems at 32 µg/m3, but to assure that PCE concentrations decline to the **remediation standard** over the course of groundwater remediation. This will need to be addressed in the indoor air sampling, so consider how the selection of a remediation standard will affect the analytical methods used in the LTIAM program. For example, if the remediation standard is 3.2 µg/m3, then method TO-15 SIM would be needed instead of method TO-15. The NDEP does **not** concur with dismissing any home from the indoor air sampling program at this time. Homes within the 100 µg/L contour of the PCE plume in groundwater must be sampled at least annually for indoor air.	Accepted. The text has been revised.
26	Page 3-5, third paragraph states that *"Homes that do not have PCE concentrations in breathing air above 32 µg/m3 will be dismissed from the indoor air sampling program."* See NDEP comments above. Homes must be monitored until the remediation standards for both groundwater and indoor air are attained.	Accepted. The text has been revised.
27	Page 3-5, fourth paragraph. *"Homes that are determined during the Phase 11 sampling to have indoor air PCE concentrations above* ***32*** *µg/m3 and homes within the 100 µg/L PCE groundwater contour that have existing SSD systems will be included in the LTIAM program (Figure 3-1). Sampling for the LTIAM program will be conducted on an annual basis.*	Comment noted.
28	Page 3-5, last full paragraph. *"For homes where PCE concentrations in indoor air have been mitigated below 32 µg/m3 the groundwater concentrations in the vicinity of the homes, as determined from the groundwater LTM program, will be used to guide the decision steps. If groundwater concentrations in the vicinity of the home fall below 100 µg/L (i.e., the home is no longer within the 100, µg/L isoconcentration contour), then the home will no longer meet the criterion for indoor air sampling and it will be dismissed from the LTIAM program and the SSD system will be disabled."* The NDEP does not concur with the proposal to use the 100 µg/L criterion to eliminate homes from mitigation and monitoring. Those homes with a SSD system will continue to be sampled annually until remediation standards for both groundwater and indoor air are attained. *Any* shutdown of any SSD system must be followed by indoor air monitoring to assure that the remediation standard for indoor air has been met.	Accepted. The work plan has been revised in accordance with the agreements reached during the May 27, 2011 meeting with NDEP, Mr. Tim Swickard, and Tetra Tech. The revised work plan does not specify when or how homes might be dismissed from the IAM program at this time. It is anticipated that the IAM program will be refined and optimized based on analysis and interpretation of the larger data set compiled after the proposed sampling event. It was agreed that cited or proposed decision criteria will be reviewed as site specific data become available. Tetra Tech concurs that shutdown of an SSD system must be followed by indoor air monitoring to verify that the unmitigated air is below the remediation standard. This is clarified in the revised work plan.

Comment No.	Comment	Response
29	Page 3-6, first full paragraph *"Sub-slab soil vapor samples are collected to evaluate target analyte concentrations in gases occupying the pore space of engineered base material or natural soils immediately beneath a building foundation. Collection of* ***sub-slab soil vapor samples*** *can be useful in determining whether target analytes detected in indoor air are attributable to VI or not. Due to the multiple potential sources of target analytes in a home, the presence of target analytes in indoor air does not necessarily indicate that VI is occurring.* There is no compelling need to evaluate ***if*** homes in the neighborhood are affected by vapor intrusion; the key question to satisfy the objectives prescribed in the Injunction is, how many homes are affected and to what extent? To answer this, indoor air data are needed. Testing (and resources) should focus on evaluating indoor air. If data suggest that in-home background sources are contributing to the concentrations of VOCs in indoor air, then additional testing (such as subslab sampling) may be recommended. At this site, homes with PCE concentrations in indoor air that exceeded the mitigation standard exhibited a spatial association. Likewise, homes where PCE was not detected in indoor air also exhibited a spatial association. This spatial distribution of results for the indoor air samples collected in 2007 - 2008 provides additional support to the determination that elevated concentrations of PCE within the homes **are** the result of vapor intrusion related to the underlying PCE plume in groundwater. The NDEP notes that discerning background contributions from vapor intrusion may become more difficult as the screening level or remediation standard is set below typical background values. A study by the Massachusetts Department of Environmental Protection (MassDEP) (2008) determined that 4.1 µg/m3 PCE was the 90th percentile of background for PCE in residential indoor air. The NDEP addressed the issue of background sources within the home during the previous phases of indoor air sampling by conducting an in-home survey, having in-home meetings and discussions with the homeowner, and performing screening with a part-per-billion (ppb) photoionization detector (PID). The NDEP also notes that concentration of gases in the subslab environment tends to be highly spatially heterogeneous and may range by three orders of magnitude across the slab, even for a small residence (McAlary, 2010). In contrast, indoor air is fairly well-mixed. Although temporal variation is possible, the amount of this variability under climatic conditions in Las Vegas may likely be less than the temporal/seasonal variability seen for vapor intrusion sites in the northern US, where concentrations are greatest during the winter season (effects of furnaces operating, snow on ground, soil moisture high, etc.). Detailed studies have also shown that houses "breathe," and air from sources in the house can actually migrate into and contaminate the subslab environment (Johnson et al 2011). Johnson et al bought a house near the edge of a solvent plume, then collected indoor and subslab samples, and used **SF6** as a tracer gas. **SF6** was detected in subslab samples from 0 to >700 parts per billion by volume (ppbv). *Continued…*	Accepted. The work plan has been revised to eliminate soil vapor sampling. Tetra Tech acknowledges that NDEP conducted interviews with homeowners during previous indoor air sampling efforts; however, owner provided information is unreliable in evaluating the potential for indoor sources.

Comment No.	Comment	Response
29 continued	The NDEP considered collecting subslab samples at the Maryland Square PCE Site, but decided against doing so because (1) it is even more intrusive to be drilling through a resident's floor than setting up a summa canister in a living room; (2) data from other studies showed extreme spatial heterogeneity in subslab vapors (i.e., at least several samples collected across the slab would be required to even begin to characterize the subsurface); (3) NDEP conducted in-home surveys and discussed sampling and the issue of background sources, and provided instructions to homeowners; and (4) upon evaluating the indoor air data collected in 2007, the spatial distribution of results showed that the homes containing high concentrations of PCE vapors (i.e., > 32 µg/m3) were grouped together in one area.	
30	Page 3-6, penultimate paragraph. *"An additional objective will be to collect sub-slab samples from homes located over the silty soils generally found between MW-23 and* MW-25 *and homes located over the gravelly sands found east of* MW-25 *and in the vicinity of MW-18 (URS 2007)."* This "additional objective" is not one of the tasks listed in Section III.A.I of the Permanent Injunction, and the NDEP does not consider that this proposed subslab sampling would contribute to fulfilling the tasks listed in the Injunction. The NDEP notes that the grading and building pads for the homes, along with short-range heterogeneity of the alluvial deposits and building-specific factors, will likely confound any attempt to correlate vapor concentrations with soil type based on lithologic descriptions for monitoring wells and borings that are tens or hundreds of feet distant. If background sources in the home are suspected, then subslab sampling could be considered.	Accepted. The work plan has been revised to eliminate soil vapor sampling.
31	Page 3-7, fourth complete paragraph states that vadose-zone samples *"are important in characterizing the site as they provide data on vapor concentrations immediately above the groundwater source and on the rate of vertical attenuation. Like sub-slab samples, they* ***can be*** *useful in* ***assessing whether*** *chemicals detected in indoor air are a result of VI."* The NDEP does not disagree that vadose-zone gas samples can provide "data on the rate of vertical attenuation;" however, there is no compelling need to evaluate ***if*** homes in the neighborhood are affected by vapor intrusion; the question is, how many homes are affected and to what extent? To answer this, indoor air data are needed. Testing (and resources) should focus on evaluating indoor air. If data suggest that background sources are contributing to the observed concentrations in indoor air, then additional testing (such as subslab sampling) may be recommended.	Accepted. The work plan has been revised to eliminate soil vapor sampling.
32	Page 3-8, first complete sentence states *"Recent groundwater elevation data (Tetra Tech 201 0) indicate groundwater depths along the plume transect ranging from approximately I3 feet bgs (MW-18) to 2 1 feet bgs (MW-2.5); thus, the deep probes will be installed at depths of approximately 10 to 18feet bgs."* Please note that groundwater at MW-18 has been measured as shallow as 8.7 feet below ground surface (bgs) (May 2005 water-level measurement), so please plan accordingly.	Comment noted.
Section 4.0	MONITORING SUB-SLAB DEPRESSURIZATION SYSTEMS	

Comment No.	Comment	Response
33	Page 4-1, first paragraph states that *"If indoor air PCE concentrations at a home are found to exceed 32 µg/m3, the SSD system will be evaluated and optimized as necessary to bring the indoor air concentrations into compliance. If an SSD system is adjusted due to the detection of elevated PCE concentrations, indoor air in the home will be resampled after 1 month of making the adjustments to verify that it is back in compliance with Interim Action Level."* The NDEP concurs with the Trust maintaining the efficacy of SSD systems, as described in Section 4. The Trust should propose individuals who will be available to answer homeowner's questions and inspect systems as requested by homeowners to the NDEP.	Comment noted.
Section 5.0	IDENTIFICATION AND SAMPLING OF DOMESTIC WELLS	
34	Page 5-1, first paragraph "A survey will be conducted to identify all domestic wells located within the 5 *µg/*L PCE plume. The extent of the area for the evaluation will be finalized after completion of the investigation presented in Section 2. O. Homes within 100 feet of the delineated extent of the 5 *µg/*L plume area will be included in the evaluation. Based on the results of the 2010 groundwater monitoring events, this survey may include 120 to 130 homes." There seems to be a misunderstanding of this task. The NDEP notes that Task 1I1.A.1.d. of the Permanent Injunction specifically requests defining the downqradient extent of the plume at the 5 *µg/*L boundary. This task was intended to define the leading edge of the plume and to determine if any domestic wells (mainly in the area east of Eastern Ave) could be affected at the downgradient extent of the PCE plume. Homes west of Eastern Ave and around the golf course are part of a subdivision that is likely supplied by the municipal water supply; however, this should be verified by researching the NDWR files.	Accepted. The text has been modified.
35	Page 5-1. second paragraph "Letters will then be sent to each address within the area of concern to request information on any water wells on the property and requesting information on well construction and usage. It is assumed that NDEP and a legal representative of the homeowners will support Tetra Tech in developing and distributing the information request letters, and that the letters will be printed on NDEP letterhead." A search of the DWR database, with detailed cross-checking, is anticipated to result in only a handful of domestic wells in the area. Field checks of these wells may be required. Figure 1. The APNs shown in the following sketch cover the area east of Spencer St and east of Eastern Ave. Figure 2. This map shows the approximate locations of wells originally in the NDWR database for this area. Not all the locations shown may still be active wells because, in Nevada, water rights may be sold separately from the property, and may then be relocated within the basin. Note that the irrigation wells on the golf course are listed as recreational wells in the NDWR database.	Comment noted.
36	Page 6-1, Section 6.0. The schedule should be revised to include a project chart or table that indicates the number of weeks and completion targets anticipated for key milestones (e.g., start, duration and completion of field work, submittal of reports, etc.). This is needed as part of outreach efforts for residents and coordination of planning and resources for the NDEP.	
PART B: CORRECTIONS AND SUGGESTED REVISIONS		

Comment No.	Comment	Response
37	Page 1-2, last paragraph. NDWR is the Nevada Division of Water Resources.	Accepted. The text has been modified.
38	38. Page 1-3, second paragraph. Text states that "The geology of the Site consists of interbedded sequences of sand, sandy silt, sandy clay, and silty clay with frequent zones of caliche and intermixed gravel scattered throughout (Figure 1-6). The depth to groundwater generally varies between 9 and 28 feet below ground surface (bgs) across the Site." "Sequence" has specific definitions in geology and is incorrectly used here; please restate as "interbedded layers and lenses of sand, sandy silt...". "Frequent zones of caliche" is incorrect; describe instead as "scattered, discontinuous layers and lenses of caliche." And "intermixed gravel scattered throughout" does not properly convey the concept that there are "deposits of gravely silty sand and scattered lenses of gravely sand and sandy gravel." This description of the geology suffers from some of the same problems as those noted in NDEP's comments on the second Draft CAP for Groundwater (February 28, 2011). The terms "vary" and "range" are not synonymous. Correct usage of these words would be lithe depth to water ranges from 9 to 28 feet across the site, but varies annually within each well"	Accepted. The text has been modified
39	Page 3-1, third paragraph. The NDEP concurs with the plan to protect the privacy of individual homeowners.	Comment noted.
40	Figure 3 -2. Please fade out the background photo on this and all other such maps, so that the posted information can be seen.	Accepted. The figure has been modified.
41	Figure 3-2. The golf course well PW-I is incorrectly located on this figure. See NDEP's comment letters dated January 11, 2010 and February 3, 2011; both of which pointed out that the golf course irrigation well, PW-I, has been incorrectly located in Tetra Tech's reports for the site.	Accepted. The figure has been modified.
OTHER NOTES		
•	Vertical delineation of PCE in wells: this may be needed to evaluate the vertical variability in PCE concentrations in groundwater and compare this to the temporal variability in PCE concentrations in groundwater samples collected quarterly. Consider that irrigation on the golf course may be loading a layer of clean water atop the plume, such that the distribution of PCE may increase toward the bottom of wells MW-30 and MW-31.	Comment noted. Vertical delineation was described in Appendix C of the Corrective Action Plan for Groundwater dated June 14, 2011.
•	Quantitative passive samplers, have these been considered as part of the LTIAM program?	Comment noted. Please see Appendices C and E of the Corrective Action Plan for Groundwater dated June 14, 2011.
•	Statistical testing for concentration trends in groundwater, use 80% confidence as "likely increasing" evaluate effect of vertical variability in well and depth of sample collection from quarter to quarter)	Comment noted.
•	The purpose of the air sampling is not only to trigger installation of SSD systems at the interim-action level of 32 $\mu g/m^3$, but to assure that PCE concentrations decline to the remediation standard for indoor air over the course of groundwater remediation. The Trust will need to address this latter aspect of the indoor air sampling program and how the selection of a remediation standard will affect the long-term indoor air monitoring program.	Comment noted.

DRAFT WORK PLAN FOR MITIGATION OF INDOOR AIR AND WELL WATER

MARYLAND SQUARE PCE SITE
3661 SOUTH MARYLAND PARKWAY
LAS VEGAS, NEVADA

SUBMITTED TO

NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
901 SOUTH STEWART STREET, SUITE 4001
CARSON CITY, NEVADA 89701-5249

PREPARED FOR

HERMAN KISHNER TRUST C/O
MR. TOM VANDENBERG, ESQ.
707 WILSHIRE BOULEVARD, 45TH FLOOR
LOS ANGELES, CALIFORNIA 90017

PREPARED BY

TETRA TECH EM, INC.
639 ISBELL ROAD, SUITE 390
RENO, NEVADA 89509

JUNE 2011

SIGNATURE PAGE

DRAFT WORK PLAN FOR MITIGATION OF INDOOR AIR AND WELL WATER

Maryland Square PCE Site
3661 South Maryland Parkway
Las Vegas, Nevada

For the services provided and described in this document, the following language is from NAC 459:

> *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.*

June 28, 2011

Tamara Pelham
Project Manager
Nevada Certified Environmental Manager
CEM # 1537, Exp. September 11, 2012

TABLE OF CONTENTS

1.0 INTRODUCTION.....1
1.1 OBJECTIVES.....1
1.2 SITE HISTORY.....2
1.3 PHYSICAL SETTING AND SITE HYDROGEOLOGY.....2
2.0 DELINEATION OF THE GROUNDWATER PLUME.....4
2.1 PERMITS AND SITE PREPARATION.....4
2.2 WELL CONSTRUCTION.....4
2.3 WELL DEVELOPMENT.....5
2.4 SAMPLING OF THE NEW WELLS AND SPINNER/FLOVISION® LOGGING.....6
2.5 REPORTING.....7
3.0 INDOOR AIR AND SOIL VAPOR SAMPLING PLAN.....8
3.1 SELECTION OF TARGET HOMES.....8
3.1.1 Identification of Homes Within the 100 µg/L Isoconcentration Contour.....8
3.1.2 Requests to Conduct Indoor Air Sampling.....9
3.2 INDOOR AIR SAMPLING.....9
3.2.1 Home Surveys.....9
3.2.2 Phase I: Real-time Grab Sampling and Analysis.....10
3.2.3 Phase II: 24-Hour Composite Sampling and Off-site Analysis.....11
3.2.4 Phase III: Long-Term Indoor Air Monitoring.....12
3.2.5 IAM Decision Steps.....13
4.0 PRELIMINARY CONCEPTUAL PROTOCOL FOR HUMAN HEALTH RISK ASSESSMENT INHALATION EXPOSURE PATHWAY.....14
5.0 MONITORING SUB-SLAB DEPRESSURIZATION SYSTEMS.....15
6.0 IDENTIFICATION AND SAMPLING OF DOMESTIC WELLS.....16
7.0 SCHEDULE.....17
8.0 REFERENCES.....18

APPENDICES

Appendix A – Indoor Air Quality Assessment Building Survey Form
Appendix B – Sub-Slab Depressurization System Inspection Checklist

FIGURES

1-1 Maryland Square PCE Plume
1-2 Soil Vapor PCE Concentrations at Ottawa Drive and the Boulevard Mall (URS 2007)
1-3 Soil Vapor PCE Concentrations Along Spencer Street (URS 2007)
1-4 Generalized Geologic Cross Section of the Las Vegas Valley
1-5 Hydrogeologic Units of the Las Vegas Valley
1-6 Geologic Cross Section A-A'
1-7 Shallow Groundwater Potentiometric Map
2-1 Proposed Well Locations
3-1 Indoor Air Sampling Program Decision Flow Chart

1.0 INTRODUCTION

The Maryland Square Tetrachloroethene (PCE) Site (the Site) is located near downtown Las Vegas, Nevada. The Site contains a dissolved PCE plume that extends from the location of the former Al Phillips the Cleaners (APTC), in the former Maryland Square Shopping Center at 3661 South Maryland Parkway, to more than 4,000 feet east (downgradient) (Figure 1-1). The central area of the plume is beneath a residential neighborhood. The Nevada Division of Environmental Protection (NDEP) has installed subslab ventilation systems under several of the homes in the neighborhood to mitigate elevated concentrations of PCE in indoor air.

1.1 OBJECTIVES

This work plan describes the procedures that will be used to characterize, control, mitigate, and abate threats to human health via the vapor intrusion (VI) pathway. This work plan and the described scope of work are intended to:

1. Characterize breathing air inside residences over the PCE plume and to implement mitigation measures at homes with indoor air PCE concentrations that exceed the NDEP Interim Action Level for residential indoor air;

2. Complete the groundwater PCE plume delineation; and,

3. Establish a protocol for the completion of a baseline human health risk assessment (HHRA) that will be completed using data obtained from the indoor air monitoring program.

The schedule for submittal of this work plan and implementation of the work described will be in accordance with the schedule outlined in the Permanent Injunction Governing the Clean Up of Hazardous Substances at and Emanating from Maryland Square Shopping Center, dated December 27, 2010, issued in the U.S District Court, District of Nevada, Case No. 2:08-cv-01618 RCJ (GWF). The tasks and objectives of the work plan are listed below.

1. Define the downgradient extent of the groundwater plume containing more than 5 µg/L and identify any domestic wells within the downgradient extent of the plume.

2. Take appropriate action to assure that the drinking water standards for PCE and its degradation products are not exceeded in domestic wells identified within the 5 µg/L boundary of the plume.

3. Provide indoor air sampling for homes within the Site that overlie groundwater containing PCE at a concentration of 100 micrograms per liter (µg/L) or more.

4. Design, install, and test the efficacy of additional subslab depressurization (SSD) systems if indoor air samples collected from unmitigated homes are found to contain PCE vapors at concentrations exceeding NDEP's Interim-Action Level (32 micrograms per cubic meter [$\mu g/m^3$] PCE), subject to homeowner approval.

5. Maintain and monitor existing SSD systems until they are no longer necessary to protect human health.

This work plan specifically provides for Items 1, 3 and 5 (defining the extent of the groundwater plume and monitoring indoor air and SSD systems). An amendment to the work plan will be prepared at the conclusion of these initial tasks to address Item 2, to mitigate potential exposure associated with domestic supply wells, and Item 4, which involves design and installation of SSD systems.

1.2 SITE HISTORY

The APTC location was developed in 1969 as a dry cleaning operation in the Maryland Square Shopping Center. APTC assumed operation of the site later that same year, and continued to operate the dry cleaning facility until 2000. During a Phase II Environmental Site Assessment in 2000 as part of a property transaction, PCE was detected in shallow groundwater at the southeast corner of the APTC facility (Converse Consultants [Converse] 2000). A follow-up investigation identified PCE in soils beneath the operation area of the former APTC facility (Converse 2002).

Additional groundwater investigations through 2008 delineated the PCE plume over 4,000 feet east under the Boulevard Mall and a residential neighborhood that extends into the Las Vegas National Golf Course. By 2008, the investigations had defined the estimated extent of the plume that exceeds 100 µg/L in the downgradient area (Figure 1-1). However, the distal and lateral extents of the PCE plume have not been sufficiently well defined to a concentration of 5 µg/L in two areas: (1) near Maricopa Way, where the PCE plume appears to widen and (2) at the golf course, east of existing monitoring wells MW-30 and MW-31.

In 2007, an investigation evaluated the potential for PCE to volatilize from the shallow groundwater water and migrate into homes that overlie groundwater containing PCE (URS Corporation [URS] 2007). The maximum PCE soil vapor concentration detected at the top of the groundwater table was 170,000 µg/m^3 (Figure 1-2), and the highest concentration detected along Spencer Street was 46,000 µg/m^3 at a depth of 5 feet bgs (Figure 1-3).

In response, NDEP sampled indoor air in 97 homes and two schools between fall 2007 and winter 2007-2008. Of the homes sampled, 15 homes had indoor air with PCE concentrations greater than the NDEP indoor air Interim-Action Level of 32 µg/m^3 (Broadbent 2010). SSD systems were installed at 14 of these homes, which were subsequently retested to assure that the systems were successfully mitigating PCE vapor concentrations. If indoor air concentrations remained above the NDEP interim action level, the SSD systems underwent performance testing (e.g., testing of in-home pressure differential) and were modified to achieve PCE concentrations less than 32 µg/m^3 in indoor air. Subsequent sampling confirmed that all homes with the SSD systems exhibited PCE concentrations less than 32 µg/m^3 in indoor air (Broadbent 2010).

1.3 PHYSICAL SETTING AND SITE HYDROGEOLOGY

The Site is located in the central eastern portion of the Las Vegas Valley. Precipitation on the Valley floor averages 4.16 inches per year as reported by the Western Region Climate Center (WRCC 2010). Most precipitation occurs during the months of July and August and during the

winter (Wild 1990). Potential evapotranspiration ranges from 1 to 19 inches per month from winter to summer months (Shevenell 1996).

Las Vegas Valley is a structural basin filled with 3,000 to 15,000 feet of sediments in the Basin and Range Province of the northern Mojave Desert (Langenheim and others 1998). In the east central valley area, including the Site, coarser-grained deposits interfinger with layers and lenses of sandy silt, silty sand, clayey sand, sandy clay, and caliche (Figure 1-4) (Plume 1989, Leising 2004). Coarser-grained deposits generally serve as aquifers, whereas silts, clays, and caliche often act as confining layers (Zikmund 1996). The upper unit of heterogeneous sand, silt, and clay sediments is termed the Las Vegas Wash Aquitard (Figure 1-5). Based on well logs on file with Nevada Division of Water Resources (NDWR), this unit may be 100 feet thick in the area of the Site. The shallow groundwater system that has been investigated to define the distribution of the PCE within the Site is within the upper 30 to 50 feet of the Las Vegas Wash Aquitard.

The geology of the Site consists of interbedded layers and lenses of sand, sandy silt, sandy clay, and silty clay, along with scattered, discontinuous layers and lenses of caliche, silty sand and gravelly sand (Figure 1-6). Lithologic data are available for borehole logs from 33 monitoring wells installed at the Site between 2000 and 2008. Additional lithologic information was obtained from 29 soil borings drilled for characterization of source area soils (URS 2007a), and from borings installed for active soil-gas sampling in and adjacent to the residential neighborhood (URS 2007b). In addition, generalized driller's logs (746 and 620 feet deep) are available for irrigation wells PW-1 (DWR #5675) and PW-2 (DWR #16296) at the Las Vegas National Golf Course. The depths for monitoring wells at the Site range between 20 and 50 ft, although most wells are completed at depths between 30 and 35 feet.

Groundwater beneath the Site is hosted in predominantly silty and clayey layers, with the amount of clay increasing in the eastern portion (Figure 1-6). Lower permeability clays and silts (silty clay, sandy clay, clayey silt, and sandy silt) dominate the saturated zone of the shallow groundwater system across most of the Site; however, the upper few feet of this zone consists of sands and silty sands in the source area and extending eastward across the Boulevard Mall property, and into the western portion of the Site. This mainly sandy zone may represent portions of a paleochannel within the alluvial deposits.

The depth to groundwater generally ranges from 9 to 28 feet below ground surface (bgs) across the Site. Based on water level data obtained in June 2010, shallow groundwater flows east with a gradient that ranges from 0.0124 to 0.0132 feet/foot (Figure 1-7) (Tetra Tech 2010). Historical groundwater elevations indicate the water table has varied by about 5 feet throughout the monitoring period (2000 to 2011).

Groundwater in the Las Vegas Wash Aquitard is generally brackish and considered non-potable, with total dissolved solids (TDS) ranging from 900 to 4,300 mg/L in monitoring wells installed across the Site (Tetra Tech, Inc. [Tetra Tech] 2011). Water quality in the Las Vegas Wash Aquitard generally degrades in an easterly, downgradient direction with increasing concentrations of TDS, sulfate, and sodium. The elevated salinity results from evapotranspiration, dissolution of saline minerals in soils and rocks, and infiltration of irrigation water (Zikmund 1996). The groundwater in the Las Vegas Wash Aquitard in the area of the Site is a calcium-magnesium-sulfate water with a lesser bicarbonate component (Leising 2004).

2.0 DELINEATION OF THE GROUNDWATER PLUME

Currently, 33 monitoring wells have been installed at the Site to characterize the extent of PCE in shallow groundwater. The locations of these wells and the defined extent of the PCE plume (as represented by the 4th quarter 2010 and 1st quarter 2011 data) are shown on Figure 2-1. The plume begins at the former APTC location at 3661 South Maryland Parkway and extends approximately 4,000 feet east to the area of the Las Vegas National Golf Course. Up to six additional wells are proposed to define the northern and eastern extents of the plume to a concentration of 5 μg/L PCE. The proposed locations for at least three new wells, in conjunction with locations designated for three optional wells, as needed, are illustrated on Figure 2-1. The optional wells will be installed if sampling indicates additional wells are needed to complete delineation of the 5 μg/L PCE plume extent (see Section 2.4).

2.1 PERMITS AND SITE PREPARATION

Prior to commencement of field work, the drilling contractor will file a *Notice of Intent* to drill along with an *Affidavit of Intent to Abandon (monitor well)* with NDWR. A Right-of-Way encroachment permit and traffic control approval will be obtained from Clark County Development Services Department – Civil Engineering Division (County). Also, Work Notices will be prepared and distributed to nearby residences two weeks in advance of the work to notify and explain to residents the scope of work and potential parking restrictions. A toll-free number for NDEP's public relations officer will also be provided for any questions the residents might have. "No Parking" signs will be placed in designated areas as specified in the approved traffic control plans at least 48 hours prior to the start of drilling. Work activities will comply with County standards for traffic control signage and will ensure that post-drilling street clean-up of the drilling location is adequate.

Proposed drilling locations in public right-of-way areas will be identified using paint or wooden survey stakes with colored flagging. Underground Services Alert will be given at least 48 hours notice prior to commencement of field activities to identify potential aboveground and underground utility and service lines in the vicinity of the drilling locations. Proposed drilling locations on privately owned land will be identified by using paint or wooden survey stakes with colored flagging.

Utility locations will be surveyed and identified by a contracted underground clearance company. All utilities will be marked in paint or pin flags on the surface by each responsible entity. Immediately before drilling begins, poly sheeting and sand bags will be placed in the drilling and sampling area to protect the street surface from cuttings and liquids, and poly sheeting and sand bags will be placed over all nearby manhole lids/storm drain openings to preclude fluids from entering the subgrade systems. All work will be conducted as required under Occupational Safety and Health Administration (OSHA) Standards *Code of Federal Regulations* Title 29, Labor, Part 1910.120.

2.2 WELL CONSTRUCTION

New groundwater monitoring wells will be installed using 8-inch-diameter hollow stem augers. Drilling equipment will be decontaminated by the contracted driller prior to arrival at the site and

between holes. All borings will be drilled to a depth of approximately 37 feet bgs and continuously sampled using a split barrel or split spoon sampler. Core lithology will be recorded on the borehole logs.

Wells will be constructed using ASTM International (ASTM)-rated Schedule 40, 4-inch-diameter PVC pipe (Type 1, Grade 1, NSF certified, threaded, flush joint TriLoc or similar material). Screens will be 20 feet of No. 10 slot (0.010 inch) 4-inch-diameter slotted pipe. A 1-foot sump will be placed on each well as a sediment trap. The wells will be completed at grade with a traffic-rated well vault.

Sand packs will likely be constructed using clean (Monterey) #3 sand (12/20 sieve), but may be re-specified in the field based on observed lithologic conditions. Sand pack will extend to 2 feet above the top of the well screen. After placement of the sand, the well will be pre-developed by gently surging across the screen interval to settle the sand pack. Additional sand will be added to bring the sand pack to design specifications. Bentonite pellets will be placed above the filter pack and hydrated to form a minimum 2-foot-thick well seal, and a bentonite/cement slurry grout will be placed in the annulus above the bentonite seal up to within 2 feet bgs. A tremie pipe is to be worked around the hole to make sure that the annular space is free of voids. A locking, expanding well cap will be installed on each well and secured with a Masterlock, or equivalent. For monitor wells completed at grade, the surface completion will include a bolted access cover on a traffic-rated vault. Traffic barriers will be placed about the well for at least 24 hours to allow the grout to set. Each well will be surveyed for location and elevation by a registered professional surveyor.

All waste will be containerized in drums and transported to the fenced APTC site for temporary storage until waste characterization is complete and the waste can be transported for off-site disposal.

2.3 WELL DEVELOPMENT

The new wells will be developed no sooner than 24 hours following installation. Well development will remove the residual sediments remaining in the well and maximize flow of groundwater through the filter pack and well screen. Wells will be developed using a combination of bailing, surging, and pumping. The well will initially be bailed until most of the sediment has been removed. The depth to the bottom of the well will be measured using a water level meter to confirm the total depth of the well. After allowing adequate time for the water level to recover in the well after bailing, the well will be surged using a surge block to flush fine-grained materials from the filter pack. Surging will be conducted across the entire saturated screen interval for at least 5 minutes per 10-foot section.

After surging of the screened interval, the fine-grained materials that accumulate inside the well casing will be bailed until most of the settleable solids are removed. The water level recharge rate will then be measured using a stopwatch and water level meter. A minimum of three surge and bailing cycles will be conducted in each well. After three surge and bailing cycles are completed, a submersible pump will be placed inside the well, and the well will be pumped at a sustained rate. Pumping rates will be measured using a stopwatch and a graduated container.

For wells installed in intervals where silt and clay strata are present, less vigorous surging will be employed to avoid introducing fine-grained materials from the formation into the filter pack material. During pumping, water level and water quality parameters consisting of pH, temperature, electrical conductivity (EC), dissolved oxygen (DO), and turbidity will be monitored and recorded on a well development field data sheet. Water quality parameters should stabilize according to the following standards:

- pH: ± 0.1 pH units
- Electrical Conductance: ± 5 percent of previous readings
- Temperature: ±1 degree Celsius (°C)
- DO: ±0.3 mg/L
- Turbidity ≤100 NTUs, although 25 NTUs will be attempted.

If turbidity goals have not been met, development will continue with surging, bailing, and pumping. After water quality parameters have stabilized, development will be considered complete. Well development will not exceed more than 4 hours per well. If a well bails or pumps dry, development will be attempted by allowing the well to recharge to at least 80% of pre-development capacity before continuing with surging and bailing/pumping; no more than two recharge/development events will be attempted for a low production well. NDEP will be notified within 1 business day of wells that cannot be fully developed due to limited production capacity. The total volume (in gallons) produced during development will be calculated and recorded on each well development field data sheet.

All development water will be contained and transported to the fenced APTC site for temporary storage until waste characterization is complete and the waste can be transported for disposal.

2.4 SAMPLING OF THE NEW WELLS AND SPINNER/FLOVISION® LOGGING

Three proposed wells are shown on Figure 2-1: (1) the well at the north cul-de-sac of Maricopa Way located approximately 300 feet northwest of MW-32), (2) the well at the cul-de-sac on Cochise Lane located approximately 250 feet north of MW-31, and (3) the well on Tioga Way located approximately 600 feet east of MW-30. These wells will be sampled approximately 24 hours after development, by purging 3 well volumes and collecting a sample. If the sample from the well on Maricopa Way has PCE at or above 5 µg/L, then data from well MW-33 will be used to define 5 µg/L contour of the PCE plume in this area. If the sample north of MW-31 exhibits a PCE concentration at or above 5 µg/L, then the optional well in the cul-de-sac of Pueblo Circle will be installed. An additional optional well may be installed on Pueblo Way, approximately 250 feet west from South Eastern Avenue, if needed. If the groundwater sample east of MW-30 has PCE at or above 5 µg/L, then the optional well can be installed 300 feet east at the fork of golf cart roads or nearly 1,000 feet east at the South Eastern Avenue.

After development of all the wells, velocity surveys using spinner-type/FloVision® instrumentation will be conducted in each well. The spinner/FloVision® logs will be compared to the lithologic core descriptions to aid in identifying if the groundwater flow media consists of massive beds or if there are more permeable intervals within the units.

The newly installed wells will be sampled no sooner than one week after completion of development. If multiple permeable zones are found during lithologic characterization of the bore hole, groundwater samples will be collected at each permeable interval (up to 2 intervals/well) using low-flow sampling techniques and after initial purging at least 4 gallons (at a purge rate of 0.5 gallons per minute [gpm]) from the sample intervals. If a high permeable zone is not identified, then a single groundwater sample will be collected from the well from the middle of the saturated interval of screen using the low-flow method (with 4 gallon purging) as described above.

Groundwater samples will be collected after measuring stabilized water quality parameters including: pH, temperature, EC, DO, oxidation-reduction potential (ORP) and turbidity. Water quality samples will be analyzed for PCE, TCE, *cis*-1,2-DCE and vinyl chloride using EPA Method 8260B. One duplicate sample and one trip blank sample will be collected each day of sampling for quality assurance (QA)/quality control (QC). The samples will be packed and shipped for analyses to Advanced Technology Laboratories in Las Vegas under chain of custody and following EPA SW-846 protocols.

2.5 REPORTING

Copies of well logs for each of the newly installed monitoring wells will be submitted to NDWR by the drilling contractor within 30 days of completion.

Upon complete delineation of the lateral extent of the 5 µg/L PCE plume in groundwater, a report will be prepared documenting the installation and development of all monitoring wells that were installed during the investigation. If evaluation of the analytical results indicates that the extent of the 5 µg/L PCE plume is not delineated, the final report will be delayed and a letter addendum to this work plan will be submitted to NDEP requesting additional investigation to complete the delineation. The final investigation report will include the well boring and construction logs, the well development records, the analytical results of the initial sampling event, and a PCE contaminant plume map based on the sampling results and the most recent quarterly groundwater monitoring event.

The new wells will be incorporated into the Site groundwater monitoring program.

3.0 INDOOR AIR AND SOIL VAPOR SAMPLING PLAN

Homes located over groundwater containing PCE at a concentration of 100 µg/L or more will be assessed to evaluate whether PCE is present in indoor air at concentrations over the Interim Action Level of 32 µg/m^3. The following sections detail the work that will be performed to assess impacts to indoor air in homes located over the PCE groundwater plume.

A multi-step approach to the indoor air sampling program is proposed. The first step will be identification of homes to be included in the sampling program based on refined groundwater isoconcentration contours (Section 2.0). Once a list of homes for inclusion in the program has been developed, targeted homes will be initially screened using indoor air grab samples and on-site analysis. Replicate indoor air samples will be collected using SUMMA™ canisters in at least 10 percent of the homes as a quality control confirmation to correlate grab sample analytical results with SUMMA™ canister analytical results.

Initial analytical screening is proposed to provide a cost effective way to efficiently identify homes with PCE concentrations in indoor air that exceed the Interim Action Level. In homes where the screening data are inconclusive or data suggest elevated indoor air concentration greater than 32 µg/m^3, screening level sampling will be followed by collection of 24-hour, time-composite SUMMA™ canister samples. SSD Systems will be installed, pending owner approval, at homes determined to have indoor air PCE concentrations that exceed the NDEP Interim Action Level of 32 µg/m^3. For the initial indoor air sampling event, homes within the 100 µg/L PCE groundwater concentration contour will be included in the indoor air monitoring program (IAM). A flow chart of the decision process for inclusion/exclusion of homes in the IAM is provided in Figure 3-1. Based on an evaluation and interpretations of data and information obtained during the initial sampling and analysis effort (year 1), the monitoring program (as diagramed in the Figure 3-1) may be revised and optimized.

3.1 SELECTION OF TARGET HOMES

3.1.1 Identification of Homes Within the 100 µg/L Isoconcentration Contour

In order to protect the privacy of individual homeowners, the locations and addresses of homes targeted for sampling will be kept confidential and not specified in this Work Plan or in any subsequent plans or reports. Each home will be assigned a randomly generated number and will be identified only by that number in plans and reports. Individual homeowners will be informed of the identification number assigned to their home and NDEP will be provided with a cross-reference table providing all of the identification numbers.

Indoor air will be sampled at homes where the residential property, in whole or in part, is determined to be within the 100 µg/L PCE isoconcentration contour. The number and location of homes that will be recommended for sampling be subsequently proposed to NDEP for concurrence based on the most recent groundwater data available upon work plan approval. Based on the results of the 1st quarter 2011 groundwater monitoring event (Tetra Tech 2011), 60 to 100 homes may reside over portions of the plume exhibiting PCE concentrations of 100 µg/L or more (Figure 2-1).

Once the 100 µg/L PCE isoconcentration contour has been delineated, plume contours will be overlaid onto a map of residential property lots within the Site. Those homes located on lots that lie or cross within the 100 µg/L contour will be recommended for inclusion in the indoor air sampling program. In accordance with NDEP requirements, identification of homes inside the 100 µg/L contour will err on the side of protectiveness. Prior to residential notification and sampling activities, Tetra Tech will submit to NDEP (for review and concurrence) the overlay map illustrating the monitoring well locations and data used to define the isoconcentration contours, along with a list of addresses recommended for inclusion in the indoor air sampling program.

3.1.2 Requests to Conduct Indoor Air Sampling

Correspondence requesting permission to conduct indoor air sampling will be issued to those homes and homeowners recommended for inclusion in the initial sampling program. NDEP will be the point of contact for the homeowners/residents and all correspondence with them will be through NDEP. A release of liability form will be included in the notification correspondence for purposes of documenting authorization to conduct subsequent indoor air sampling activities.

Homes for which permission to sample indoor air is denied will be monitored via the Site groundwater monitoring program. If groundwater PCE concentrations in the vicinity of a home are observed to be increasing, NDEP may choose to send a second request to sample indoor air to the homeowner re-iterating Site conditions and relevant information that should be carefully reconsidered (Figure 3-1).

3.2 INDOOR AIR SAMPLING

The indoor air sampling program will consist of four primary elements: (1) home surveys to identify potential indoor and background sources of PCE, (2) grab sampling to quickly identify homes with evidence of significant VI, (3) SUMMA™ canister sampling at homes with inconclusive grab sampling results, and (4) the IAM program.

Indoor air sampling can be regarded as a nuisance or disturbance to homeowners or occupants. Consequently, judicious efforts to thoughtfully coordinate with owners/occupants to conduct home surveys and gain access to indoor areas for sampling events will be needed. All contacts and correspondence with homeowners/residents will be through NDEP, and sampling teams will include a representative of NDEP.

3.2.1 Home Surveys

Prior to collecting samples, each home included in the indoor air sampling program will be inspected and the occupants interviewed in an effort to identify potential indoor or background sources of PCE. A draft version of the home-survey form that will be used is provided in Appendix A. NDEP representatives will conduct the home surveys with assistance from Tetra Tech staff as needed. Tetra Tech staff will be present during home surveys to ensure the surveys are complete and the interests of the Kishner Trust are protected.

If potential indoor PCE sources are identified, reasonable steps will be taken to remove or otherwise mitigate interfering sources prior to sampling. Review and interpretation of indoor air

sample results will be conducted in the context of identified potential indoor and/or background sources of PCE.

3.2.2 Phase I: Real-time Grab Sampling and Analysis

The initial phase of sampling will consist of grab sampling and on-site analysis using a mobile laboratory. Multiple grab samples will be collected from various locations in each home. Sampling locations will be home-specific and will be selected based on information obtained from the home survey. Samples will be collected from regularly occupied areas such as living rooms, family rooms, and bedrooms. The objective of the sampling will be to assess likely exposure concentrations that residents might experience in regularly occupied areas. In addition, grab samples may be collected at suspected indoor sources to assess relative contributions to indoor air concentrations.

Indoor air grab samples will be collected in ground glass syringes with vapor-tight lab-cocks or Tedlar bags. Glass syringes are preferred because the sample can be readily and directly introduced into the analytical instrument; however, the samples must be analyzed within 10 minutes of collection. If sample analysis cannot be completed within 10 minutes, samples will be collected in Tedlar bags, which have a holding time of up to 2 hours prior to analysis.

Duplicate indoor air samples will be collected at a rate of 5 percent (1 per 20) for quality assurance/quality control (QA/QC) purposes. At least one ambient (outdoor) air grab sample will be collected each day from a location upwind of the sampled homes to assess the presence of PCE and its daughter compounds in ambient air. If specific ambient sources of PCE are suspected (e.g., an upwind business that uses PCE), targeted grab samples of ambient air may also be collected.

Grab samples will be analyzed using a modified version of EPA SW-846 Method 8021 (EPA 1996b) for PCE and its daughter products trichloroethene (TCE), *cis*-1,2-dichloroethene (DCE), and *trans*-1,2-DCE. Method 8021 is a gas chromatography method that typically uses a photoionization detector (PID) and a Hall Detector (electrolytic conductivity detector). For this program, the instrumentation will be modified to use an electron capture detector (ECD) in place of the Hall Detector to achieve low reporting levels. Reporting levels for the target analytes will be:

- PCE 5 $\mu g/m^3$
- TCE 10 $\mu g/m^3$
- *cis*-1,2-DCE 50 $\mu g/m^3$
- *trans*-1,2-DCE 50 $\mu g/m^3$

Because the modified Method 8021 instrumentation completes sample quantification within 5 minutes, multiple samples from each home can be collected and analyzed to complete a robust VI profile of subject residences. This screening program will also enable the detection of indoor sources of target analytes. It is anticipated that two to five grab samples will be collected from each home depending upon house size and layout. Additional samples will be collected and quantified as necessary depending upon initial results.

A PCE screening level concentration of 16 µg/m^3 is recommended as the threshold to determine subsequent action. This concentration is equal to 50 percent of the NDEP Interim Action Level and provides a margin of error to account for potential temporal variability in indoor air concentrations. Supporting data compiled by EPA using the trace atmospheric gas analyzer (TAGA) mobile laboratory has demonstrated that grab samples tend to match 24-hour time-composite samples by less than a factor of two (EPA 2007); therefore, the proposed screening level concentration of 16 µg/m^3 is consistent with this research and provides an adequate safety factor.

At a minimum of 10 percent of the homes sampled, 24-hour time-integrated indoor air samples will be collected in 6-liter SUMMA™ canisters on the same day as the grab sampling and submitted to an off-site laboratory for analysis using EPA method TO-15 Low Level. The objective of these "replicate" samples is to verify the results of the grab sampling and ensure that indoor air PCE concentrations are not under- or over-estimated.

At the conclusion of screening sampling, Tetra Tech will prepare a brief report summarizing field sampling activities, sampling results, and recommended actions for each home. If the breathing air at a home does not contain PCE at concentrations exceeding 16 µg/m^3 in the grab samples (or 32 µg/m^3 in a replicate SUMMA™ sample), no further action will be taken at that home until the next round of annual indoor air sampling, at which time the indoor air will be re-sampled. Homes with indoor air grab sample concentrations above 16 µg/m^3 will be resampled using SUMMA™ canisters to determine whether 24-hour time-integrated samples exceed the Interim Action Level, as described in more detail in Section 3.2.3 below. If excessively high grab sample PCE concentrations are identified at a home, with NDEP concurrence, the home may be recommended for installation of a SSD system without the verification sampling using SUMMA™ canisters.

3.2.3 Phase II: 24-Hour Composite Sampling and Off-site Analysis

Homes that have indoor air PCE concentrations above 16 µg/m^3 based on the first phase of sampling will be re-sampled using SUMMA™ canisters equipped with 24-hour flow controllers. The 24-hour composite samples will be analyzed off-site at a fixed-facility laboratory using EPA Method TO-15 Low Level (EPA 1999).

The objective of this sampling is to determine, using conventional sampling and analytical methods, whether PCE is present in indoor air at concentrations exceeding the NDEP Interim Action Level of 32 µg/m^3. A minimum of one sample will be collected from each home. Additional samples may be collected depending on the size and configuration of the residence. Samples will be collected from rooms in which the residents spend the majority of time (i.e., living rooms, family rooms).

Indoor air samples will be collected in individually certified SUMMA™ canisters provided by the selected analytical laboratory. Canisters will be equipped with flow controllers calibrated to sample over a 24-hour period. Duplicate samples will be collected at a rate of 5 percent of field samples for QA/QC purposes.

SUMMA™ canisters must be placed in secure, stationary locations in order to accurately sample interior ambient conditions. Consequently, NDEP, with support from Tetra Tech as requested, will coordinate with homeowners/occupants to arrange a convenient time to place and retrieve canisters and will educate residents regarding the necessary sampling protocol. While placing and retrieving the canisters, the indoor air will be scanned using a ppb RAE or similar high-sensitivity direct reading instrument to identify indoor sources of target analytes that may have been introduced since the screening level sampling. If indoor sources are identified, reasonable steps will be taken to remove them prior to sample collection.

Canisters will be positioned so that the intake port is approximately 2 to 6 feet above the floor (i.e., typical breathing level), and will be placed as near to the center of the room as possible and away from heating, ventilation, and air conditioning (HVAC) system registers. Steps will be taken to detect unauthorized tampering with the canisters (either deliberate or accidental). The start and finish times, date, and vacuum of each canister will be recorded in field notes, along with meteorological conditions including temperature, barometric pressure, and wind speed and direction.

At least one outdoor ambient air sample will be collected for each day of sampling to assess potential target analytes in ambient air. Ambient air samples will be collected from secure outdoor locations following the same procedures and within the same timeframe as the indoor air samples.

Sample details will be recorded on chain-of-custody forms and the samples submitted to the selected laboratory for analysis using EPA Method TO-15. TO-15 is the industry standard analytical methodology for the analysis of volatile chemicals, such as PCE, in ambient air. Samples will be analyzed for PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and vinyl chloride. TO-15 "Low Level" methodology will be used in order to achieve detection levels that are close to, or below, the 10^{-6} risk level for PCE in residential air of 0.41 $\mu g/m^3$ (EPA 2011).

At the conclusion of the Phase II sampling, Tetra Tech will prepare a brief report summarizing the field sampling activities and results, and providing the recommended action for each home. As illustrated on Figure 3-1, homes identified as having indoor air PCE concentrations above 32 $\mu g/m^3$ in SUMMA™ canister 24-hour composite samples will be recommended for design and installation of a SSD system. Homes that do not have SUMMA™ canister 24-hour composite sample PCE concentrations above 32 $\mu g/m^3$ may be re-sampled during the next annual sampling event if they remain within the 100 µg/L PCE groundwater concentration contour (see Section 3.2.4.1 for details).

3.2.4 Phase III: Long-Term Indoor Air Monitoring

Homes that are within the 100 µg/L PCE groundwater contour are expected to be included in a long-term or continued air monitoring program (Figure 3-1). As this program is developed based on initial and more complete sampling data, long-term monitoring will be conducted on an annual basis. Under this program, at least one sample will be collected from each home during each monitoring event using the method described for the Phase II sampling program. These iterative samples will provide data to verify that indoor air PCE concentrations in unmitigated homes remain below the Interim Action Level of 32 $\mu g/m^3$ or the (to be determined)

Remediation Standard and that the SSD systems are reducing indoor air PCE concentrations below the applicable standard in homes that have mitigation systems. An annual Indoor Air Monitoring Report will be prepared following each sampling event. The report will include a description of the sampling activities, a SUMMA™ry of the sampling results, data interpretation, and recommendations.

3.2.5 IAM Decision Steps

There are a variety of possible outcomes from the indoor air and groundwater monitoring program sampling events. Figure 3-1 illustrates the decision steps described below.

If a home equipped with an SSD system is found to have PCE concentrations in indoor air above the Interim Action Level of 32 µg/m^3 or the (to be determined) Remediation Standard, the SSD system will be evaluated and adjustments made, as warranted, to lower the PCE concentrations. If a home has indoor air PCE concentrations above 32 µg/m^3, but the owner has declined to have a SSD system installed, NDEP may choose to reiterate the recommendation for installation of a system.

The most likely scenario is that the SSD systems will successfully lower PCE concentration below the applicable standard. For homes where PCE concentrations in indoor air have been mitigated below the applicable standard, the groundwater concentrations in the vicinity of the homes, as determined from the groundwater monitoring program, will be used to guide the decision steps. If groundwater concentrations decrease such that a home is no longer within the 100 µg/L isoconcentration contour, with the owner's permission the SSD system will be shut down and the unmitigated air will be sampled to verify PCE concentrations. If unmitigated air is below the (pending) remediation standard, then the home will be dismissed from the IAM program, and the owner will be given the option to have the SSD system removed. A home owner may choose to retain the SSD system as personal property, independently operated. If the unmitigated indoor air concentration is found to exceed the remediation standard, the SSD system will, with the owner's permission, be re-started and the home will be retained in the IAM program.

If indoor air PCE concentration in a home without an SSD system are below the remediation standard and groundwater concentrations decrease such that that home is no longer within the 100 µg/L isoconcentration contour, then the home will be dismissed from the IAM program.

The decision criteria outlined above are the baseline criteria to be applied during the first year of the IAM program. As monitoring results are obtained the decision criteria will, in consultation with NDEP, be reassessed and potentially revised based on site-specific data and empirical conclusions.

In all cases, the right of the homeowner to be involved in the decision process will be respected. If requested by the homeowner, an SSD system will be shut-down or removed and/or a home will be dismissed from the IAM program if requested.

4.0 PRELIMINARY CONCEPTUAL PROTOCOL FOR HUMAN HEALTH RISK ASSESSMENT INHALATION EXPOSURE PATHWAY

Indoor air concentrations of PCE and daughter products trichloroethylene (TCE), 1,2-cis-dichloroethylene, and vinyl chloride will be monitored by collecting air samples from individual homes located over the PCE plume to assess human health risk associated with indoor air exposure. Required data includes:

- Collecting indoor air samples from homes in accordance with the proposed (and presumably pending concurrence) Indoor Air Monitoring Program;
- Collecting background (i.e., upwind) ambient samples for the same time period; and
- Performing an in-home survey of activities/hobbies and checking for indoor sources of the four compounds.

Each measured concentration will be compared to applicable EPA Risk Screening Levels (RSLs) for indoor air. Calculated risk for each home will be based on the maximum measured concentration using the RSL exposure assumptions, where the measured concentration of PCE will be divided by 0.41 (i.e., the RSL for PCE) and multiplied by 10^{-6} to calculate the cancer risk. The same methodology will also be employed to calculated cancer risks for the daughter products.

The Johnson and Ettinger (J&E) model will be used to back calculate the target ground water remediation goal using PCE at 41 $\mu g/m^3$ (10^{-4} risk factor) and 0.41 $\mu g/m^3$ (10^{-6} risk factor) inputs to assess the range of related PCE concentrations in groundwater (i.e., the remedial clean-up goal). This will also be performed for daughter products of PCE.

Site specific data will be used as model inputs where available and appropriate (e.g., depth to groundwater, groundwater temperature), otherwise, conservative model default parameters will be used.
Concentrations in the Boulevard Mall will be modeled with the J&E model using modified air exchange rates for commercial/industrial buildings, commercial/industrial exposure scenario, and estimated indoor air volume of the Mall.

5.0 MONITORING SUB-SLAB DEPRESSURIZATION SYSTEMS

Monitoring of the SSD systems will be conducted as part of the annual IAM sampling rounds. The IAM sampling data will provide the primary means of monitoring the efficacy of the SSD systems by demonstrating whether or not indoor air PCE concentrations have been mitigated below the NDEP Interim Action Level of 32 $\mu g/m^3$ and, ultimately, below the Remediation Standard. If indoor air PCE concentrations at a home are found to exceed the Interim Action Level of 32 $\mu g/m^3$ or the remediation standard (once established), the SSD system will be evaluated and optimized as necessary to bring the indoor air concentrations into compliance. If an SSD system is adjusted due to the detection of elevated PCE concentrations, indoor air in the home will be resampled after 1 month of making the adjustments to verify that it is back in compliance.

In addition, each SSD system will be inspected during every IAM sampling round to verify system integrity and proper function. The preferred approach to verifying proper function is to measure the vacuum in the suction pipe. Based on information available to Tetra Tech, the existing SSD systems do not have manometers. Manometers will be installed on the existing systems and will be included in any new systems that are to be installed. This will provide an added level of assurance and a cost-effective means to measure system performance. Homeowners/occupants will be requested to keep a log of monthly manometer readings during the first year of operation (or the first year after a manometer is installed on an existing system). The monthly readings will provide baseline data for future system inspections. In addition, residents will be requested to notify NDEP if they believe the system vacuum is significantly lower than normal.

Components that will be checked during the IAM sampling rounds include the manometer, exposed piping, the slab, and slab penetrations. An SSD System Inspection Checklist will be followed for each home (Appendix B). If problems are noted during the inspection, they will be promptly corrected. Indoor air in homes will be re-sampled after corrections only if PCE concentrations in indoor air were above the Interim Action Level of 32 $\mu g/m^3$ or the remediation standard prior to the corrections. The system will be allowed to operate for 1 month before re-sampling a home.

6.0 IDENTIFICATION AND SAMPLING OF DOMESTIC WELLS

When the leading edge of the PCE plume in groundwater is sufficiently defined at the 5 µg/L boundary, a survey will be conducted to identify domestic wells located to the east of the plume, mainly in the area east of south Eastern Avenue (Ave.). The extent of the area for the evaluation will be finalized after completion of the investigation presented in Section 2.0. In addition, the NDWR files will be researched to identify domestic wells located west of south Eastern Ave. and around the golf course, located within 100 feet of the delineated extent of the 5 µg/L plume area.

Initially, a record search will be conducted of the well log database of the NDWR to identify wells within the plume area and east of south Eastern Ave. Letters will then be sent to each address within the area of concern to request information on any water wells on the property, and requesting information on well construction and usage. It is assumed that NDEP and a legal representative of the homeowners will support Tetra Tech in developing and distributing the information request letters, and that the letters will be printed on NDEP letterhead. The letters will request a follow-up interview with the resident or property owner at a community meeting, by telephone, or through a direct visit with the homeowner or his/her representative to verify the information and collect any additional information that may be missed by the survey. It is assumed that a NDEP representative will be present at these interviews.

The information request letters will include a request for permission to sample the well at the wellhead, prior to any storage tank, and to sample the well water at a point of use (i.e., the water faucet). Whenever possible, the wells will be allowed to pump sufficiently to purge at least one volume of the water in the well bore prior to sampling; for point of use sampling, the water will be allowed to run long enough to flush the pipes. Whenever possible, sampling will be conducted at a low controlled flow to prevent or minimize turbulent flow and volatilization of dissolved organic compounds. The samples will be analyzed for PCE, TCE, *cis*-1,2-DCE and vinyl chloride using EPA Method 8260B. Duplicate samples will be collected at a rate of 10% (1 duplicate for 10 samples) and trip blanks will accompany each cooler used to transport samples. The samples will be packed and shipped for analyses to Advanced Technology Laboratories in Las Vegas under chain of custody and following EPA SW-846 protocols.

After completion of the domestic well survey and sampling events, a report will be provided to NDEP with the results. The report will include recommendations for mitigating risks associated with the domestic wells that produce water with greater than 5 µg/L PCE. The monthly status of the survey will be included in the project monthly status report.

7.0 SCHEDULE

Implementation of the work plan will begin within 30 days of NDEP's approval of the work plan. A schedule for implementation will be provided prior to the onset of work activities after discussions with NDEP and key stakeholders on logistics and coordination of activities.

8.0 REFERENCES

Broadbent. 2010. *Indoor Air Mitigation and Sampling Report, for the Maryland Square PCE Site, Las Vegas, Nevada*. March.

Converse Consultants (Converse). 2000. *Limited Phase II Subsurface Assessment. Maryland Square Shopping Center, 3661 South Maryland Parkway, Las Vegas Nevada.* August 22.

Converse. 2002. *Additional Soil and Groundwater Investigation*. November 13.

Langenheim, V.E., J. Grow, J. Miller, J.D. Davidson, and E. Robinson. "Biodegradation of Disinfection Byproducts as a Potent Removal Process During Aquifer Storage and Recovery." *Journal of the American Water Resources Association*. 36(4): 861-867.

Leising, J.F. 2004. *Chemical Conditions in the Primary Producing Aquifers and Portions of the Shallow Groundwater System of the Las Vegas Valley in 2000*. Southern Nevada Water Authority. March.

Plume, R.W. 1989. *Ground-Water Conditions in Las Vegas Valley, Clark County, Nevada: Part I. Hydrogeologic Framework*. U.S. Geological Survey Water Supply Paper 2320-A. 14 pages.

Shevenell, L. 1996. *Statewide Potential Evapotranspiration Maps for Nevada*. Nevada Bureau of Mines and Geology, Report 48. Mackay School of Mines, University of Nevada – Reno. 32 pages.

Tetra Tech, Inc. (Tetra Tech). 2010. *Quarterly Groundwater Monitoring Report, Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada, 2nd Quarter 2010*. July 23.

Tetra Tech. 2010. Quarterly Groundwater Monitoring Report, 3rd Quarter 2010, Maryland Square Shopping Center, 3661 South Maryland Parkway, Las Vegas Nevada. October.

URS Corporation (URS). 2007. Report of Off-Site Soil Vapor Assessment, Former Al Phillips Facility, Maryland Square Shopping Center, 3661 Maryland Parkway, Las Vegas, Nevada. April.

U.S. Environmental Protection Agency (EPA). 1996a. Method 8000B – Determinative Chromatographic Separations. Test Methods for Evaluating Solid Waste (SW-846). Office of Solid Waste and Emergency Response (OSWER), Washington, D.C. December.

EPA. 1996b. Method 8021B – Aromatic and Halogenated Volatiles by Gas Chromatography Using Photoionization and/or Electrolytic Conductivity Detectors. Test Methods for Evaluating Solid Waste (SW-846). OSWER, Washington, D.C. December.

EPA. 1996c. Method 8260B – Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS). Test Methods for Evaluating Solid Waste (SW-846). OSWER, Washington, D.C. December.

EPA. 1999. Method TO-15 – Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. 2nd Edition. EPA 600/625/R-96/010b. Research Triangle Park, North Carolina. January.

EPA. 2007. QA/QC Considerations for the TAGA Analysis. Presentation at Workshop on Soil-Gas Sample Collection and Analysis, AEHS, San Diego, CA. March. Presented by Mickunas, D., EPA/ERT.

EPA. 2011. Human Health Regional Screening Levels (RSLs). Available online at: http://epa.gov/region09/superfund/prg/index.html

Western Regional Climate Center (WRCC). 2010. On-line address: http://www.wrcc.dri.edu/

Wild, S.W., Jr. 1990. Hydrogeology and Hydrogeochemistry of the Shallow Alluvial Aquifer Zone, Las Vegas, Nevada, Department of Geoscience, M.S. Thesis, University of Nevada, Las Vegas. 203 pages.

Zikmund, K.S. 1996. Extent and Potential use of the Shallow Aquifer and Wash Flow in Las Vegas Valley, Nevada. Southern Nevada Water Authority.

FIGURES

Legend

- Monitoring Well Location
- Production Well Location
- 1100 PCE Concentration (ug/L)
- NS Not Sampled
- ND Non-detect
- ug/L Micrograms per Liter

PCE Contour (ug/L)

- 100
- 500
- 1000
- 1500
- 2000
- 2500

Notes: 1. Contours do not recognize unusually low PCE concentrations quantified at MW-19 and MW-20.
2. PCE data and contours are from the November 2010 monitoring event.

N W E S

0 250 500 Feet

Approximate Scale in Feet

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

FIGURE 1-1
MARYLAND SQUARE PCE PLUME

TETRA TECH

S:\Projects Directory\Private Sector - Other Offices\Maryland Square\Work Plan\Figure 1-1.mxd troy.fegter

Summary of PCE Soil Vapor Concentrations

Sample Number	Sample Depth(1)	Soil Type	Soil Vapor Concentrations ug/L	ug/m(3)	ppbv
SVB-07-05	5	Silty Sand (Af)	11	11,000	1,623
SVB-08-05	5	Silty Sand (Af)	2.7	2,700	398
SVB-08-10	10	Silty Sand	7.1	7,100	1,047
SVB-08-910(2)	10	Silty Sand	15	15,000	2,213
SVB-09-05	5	Silty Sand (Af)	9.0	9,000	1,328
SVB-09-10	10	Gravelly Sand	23	23,000	3,393
SVB-10-05	5	Sand	42	42,000	6,196
SVB-10-10	10	Sand	27	27,000	3,983
SVB-11-10	10	Sandy Silt	0.5	500	74
SVB-11-910(2)	10	Sandy Silt	0.4	400	59
SVB-11-15	15	Sandy Silt	ND	ND	ND
SVB-12-05	5	Gravelly Sand (Af)	ND	ND	ND
SVB-12-10	10	Gravelly Sand	3.0	3,000	433
SVB-13-05	5	Gravelly Sand (Af)	24	24,000	3,541
SVB-13-10.5	10.5	Gravelly Sand (Af)	37	37,000	5,458
SVB-13-910.5(2)	10.5	Gravelly Sand (Af)	45	45,000	6,639
SVB-13-20	20	Sandy Silt	35	35,000	5,163
SVB-14-10	10	Silt	87	87,000	12,835
SVB-14-20	20	Silty Sand	170	170,000	25,079
SVB-15-15	15	Silt	ND	ND	ND
SVB-15-20	20	Silt	0.2	200	30
SVB-16-05	5	Gravelly Sand (Af)	ND	ND	ND
SVB-16-10	10	Gravelly Sand	ND	ND	ND
SVB-16.20.5	20.5	Silt	0.6	600	89

Legend

- Approximate Location of Monitoring Well Installed by Converse Showing Concentration (ug/L) of PCE in Groundwater. ND is Non-detect, NS is Not Sampled. Analytical Data from December 2006.
- Approximate Location of Monitoring Well Installed by URS Showing Concentration (ug/L) of PCE in Groundwater. Analytical Data from October and December 2006.
- Approximate Location of Soil Vapor Sampling Borehole Showing Concentration (ug/m3 and ppbv) of PCE in Soil Vapor Collected from Shallow and Deeper Soil Above Groundwater.
- Approximate Concentration Contour of PCE in Groundwater

PCE tetrachloroethene

ND Analyte not detected at or above the reporting limit

ug/L Micrograms per liter

ug/m3) Micrograms per cubic meter

ppbv Parts per billion by volume

(1) Depth in feet (ft) below ground surface

(2) Soil Samples SVB-08-910, SVB-11-910, and SVB-13-910.5 are duplicates for samples SVB-08-10, SVB-11-10, and SVB-13-10.5 respectively

N
W E
S

0 50 100 Feet

Approximate Scale in Feet

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

FIGURE 1-2
SOIL VAPOR PCE CONCENTRATIONS ALONG OTTAWA DRIVE AND THE BOULEVARD MALL

TETRA TECH

Sources: Clark County Assessors Web Site, URS 2007

S:\Projects Directory\Private Sector - Other Offices\Maryland Square\Groundwater Cap\Figure 3.mxd troy.fegter

Summary of PCE Soil Vapor Concentrations

Sample Number	Sample Depth[1]	Soil Type	Soil Vapor Concentrations ug/L	ug/m[3]	ppbv
SVB-01-05	5	Silty Sand (Af)	2.5	2,500	369
SVB-02-04	4	Silty Sand (Af)	3.0	3,000	443
SVB-02-10	10	Silty Sand	ND	ND	ND
SVB-03-05	5	Silty Sand (Af)	46	46,000	6,786
SVB-03-12	12	Silty Sand	0.8	800	118
SVB-04-05	5	Sand (Af)	0.4	400	59
SVB-04-12	12	Silty Sand	1.0	1,000	148
SVB-05-08	8	Silty Sand	25	25,000	3,688
SVB-05-98[2]	8	Silty Sand	17	17,000	2,508
SVB-05-13	13	Silty Sand	1.1	1,100	162
SVB-06-08	8	Silty Sand	ND	ND	ND
SVB-06-12	12	Silty Sand	12	12,000	1,770

Legend

- Approximate Location of Monitoring Well Installed by URS Showing Concentration (ug/L) of PCE in Groundwater. Analytical Data from October and December 2006.
- Approximate Location of Soil Vapor Sampling Borehole Showing Concentration (ug/m3 and ppbv) of PCE in Soil Vapor Collected from Shallow and Deeper Soil Above Groundwater.
- Approximate Concentration Contour of PCE in Groundwater

PCE tetrachloroethene
ND Analyte not detected at or above the reporting limit
ug/L Micrograms per liter
ug/m3 Micrograms per cubic meter
ppbv Parts per billion by volume
(1) Depth in feet (ft) below ground surface
(2) Soil Sample SVB-05-98 is a duplicate for sample SVB-05-08

N W E S

0 50 100 Feet
Approximate Scale in Feet

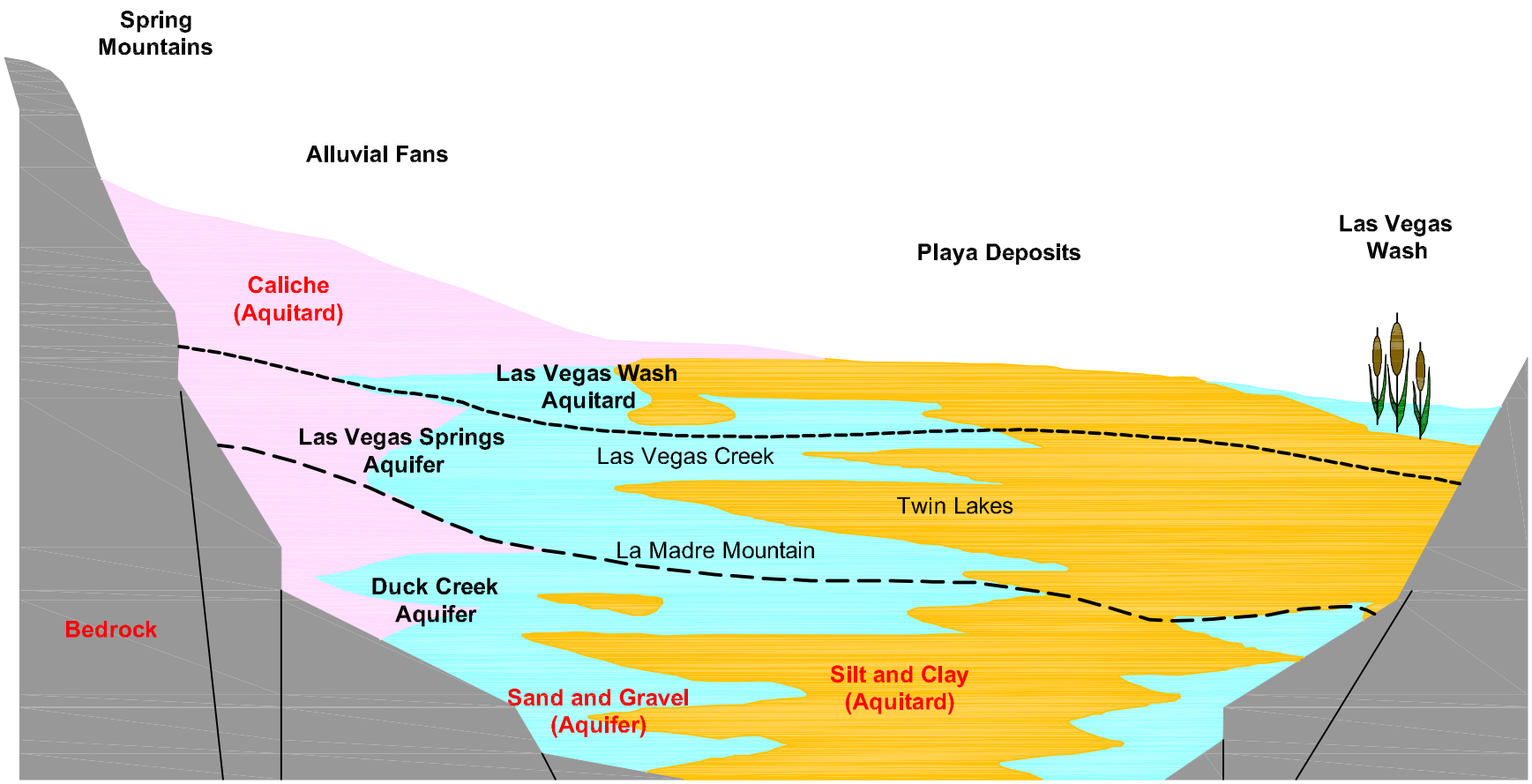
MARYLAND SQUARE SHOPPING CENTER
3661 South Maryland Parkway
Las Vegas, Nevada

FIGURE 1-3
SOIL VAPOR PCE CONCENTRATIONS ALONG SPENCER STREET

TETRA TECH

Sources: Clark County Assessors Web Site, URS 2007

S:\Projects Directory\Private Sector - Other Offices\Maryland Square\Groundwater Cap\Figure 14.mxd troy.fegter



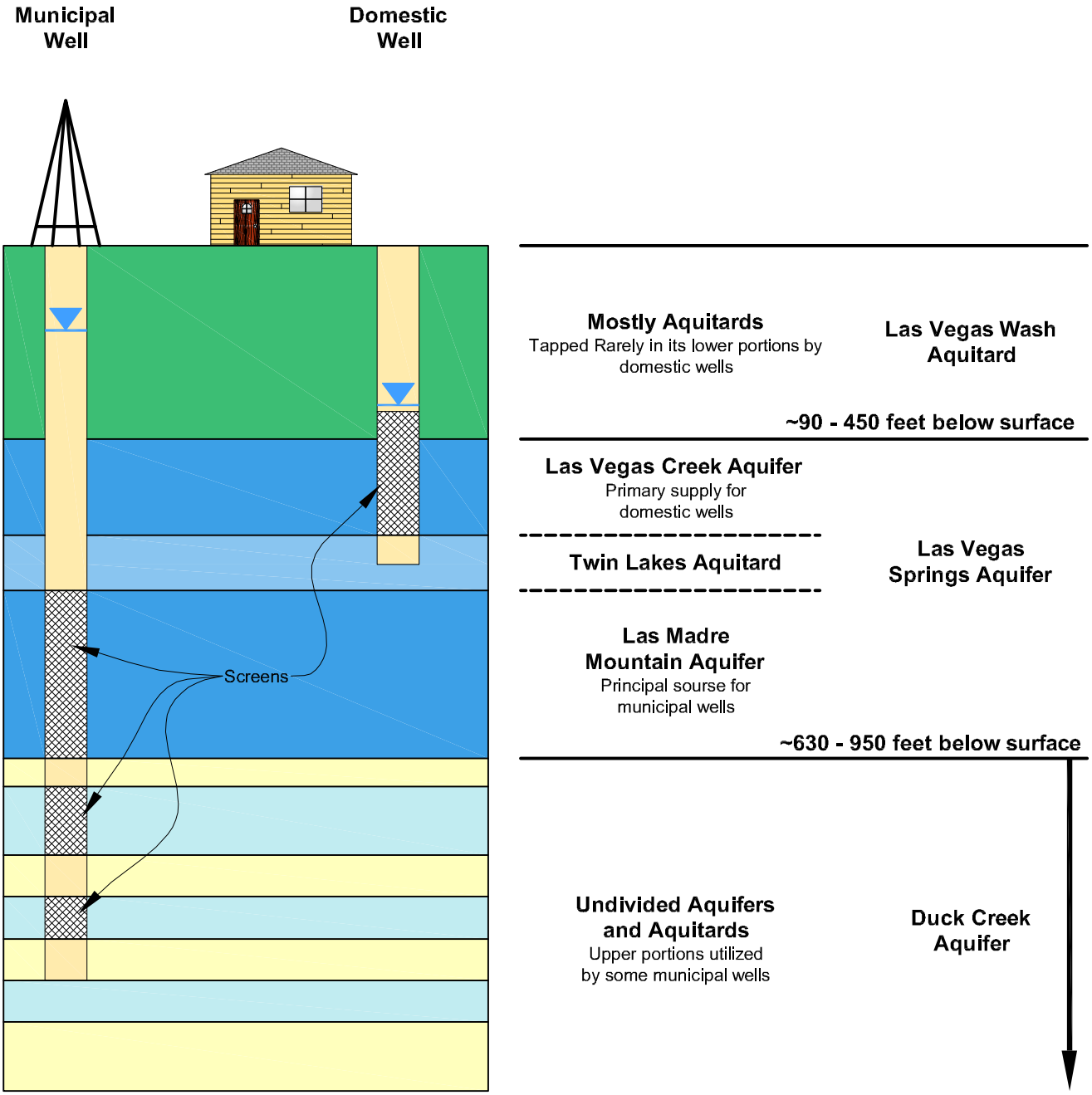
Not to Scale

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

FIGURE 1-4
GENERALIZED CROSS SECTION OF THE LAS VEGAS VALLEY

TETRA TECH

Source: Leising 2004



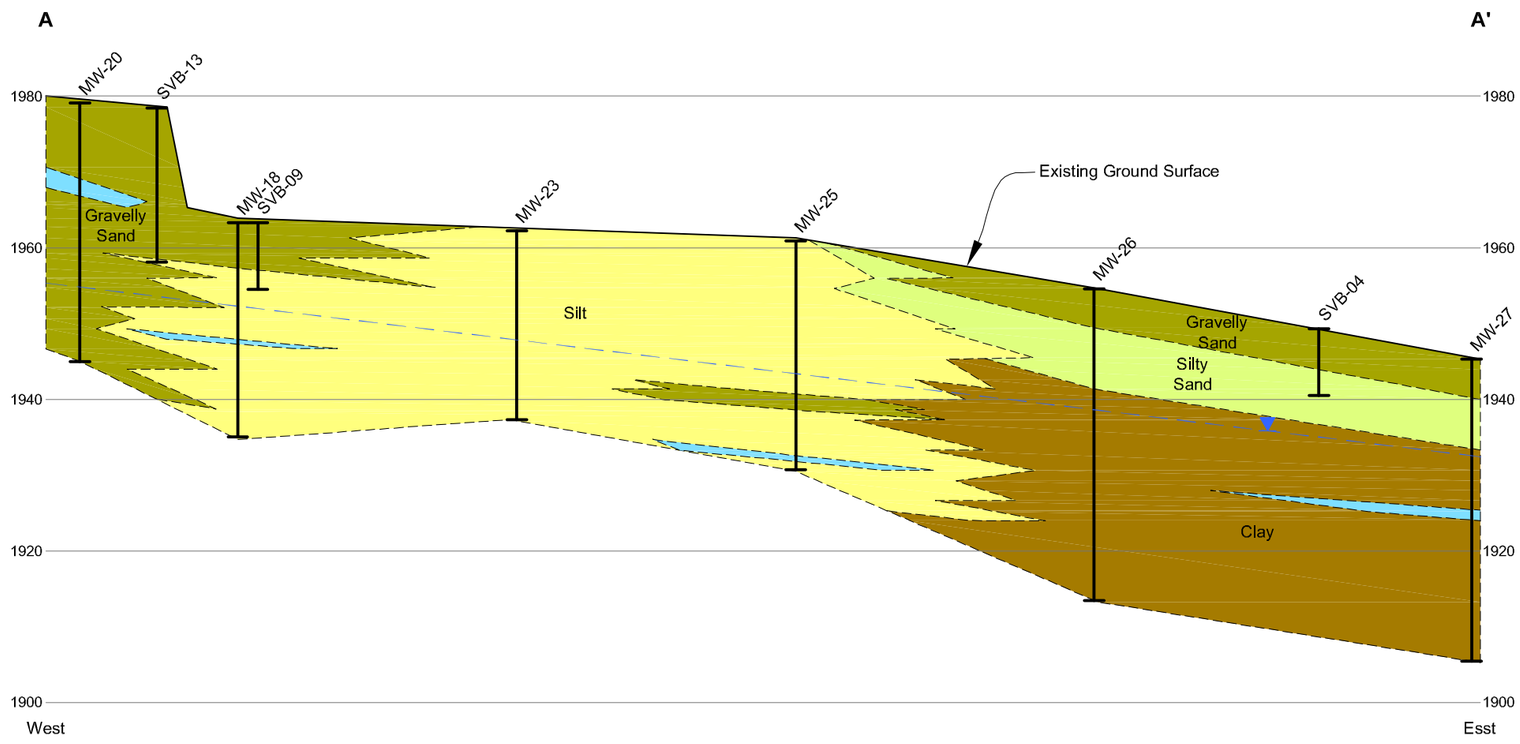
Not to Scale

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

FIGURE 1-5
HYDROGEOLOGIC UNITS OF THE LAS VEGAS VALLEY

TETRA TECH

Source: Modified from Leising 2004



Legend

- Approximate April 2007 Groundwater Surface
- Gravelly Sand
- Caliche
- Silty Sand
- Silt
- Clay

0 100 200
Horizontal Scale in Feet

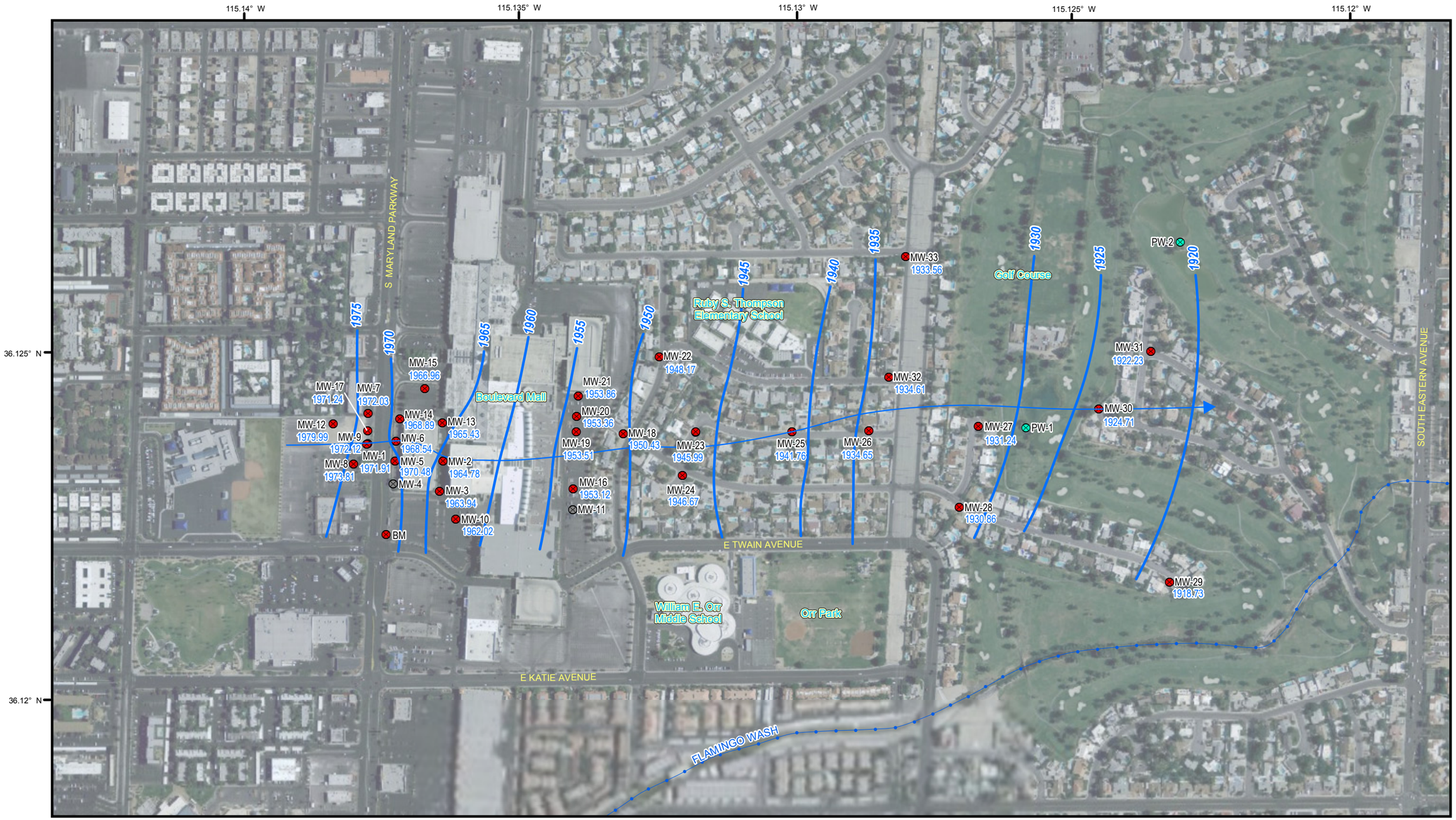
0 10 20
Vertical Scale in Feet

Source: URS 2007

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

FIGURE 1-6
GEOLOGIC CROSS SECTION A - A'

TETRA TECH



Legend

- Monitoring Well Location
- Production Well Location
- Groundwater Elevation Contour (5 ft Intervals)
- Direction of Groundwater Flow
- 1971.91 Groundwater Elevation (ft amsl)
- NM Not Measured
- ft amsl Feet Above Mean Sea Level

Elevations measured February 28th - March 2nd of 2011.

N W E S

0 250 500 Feet

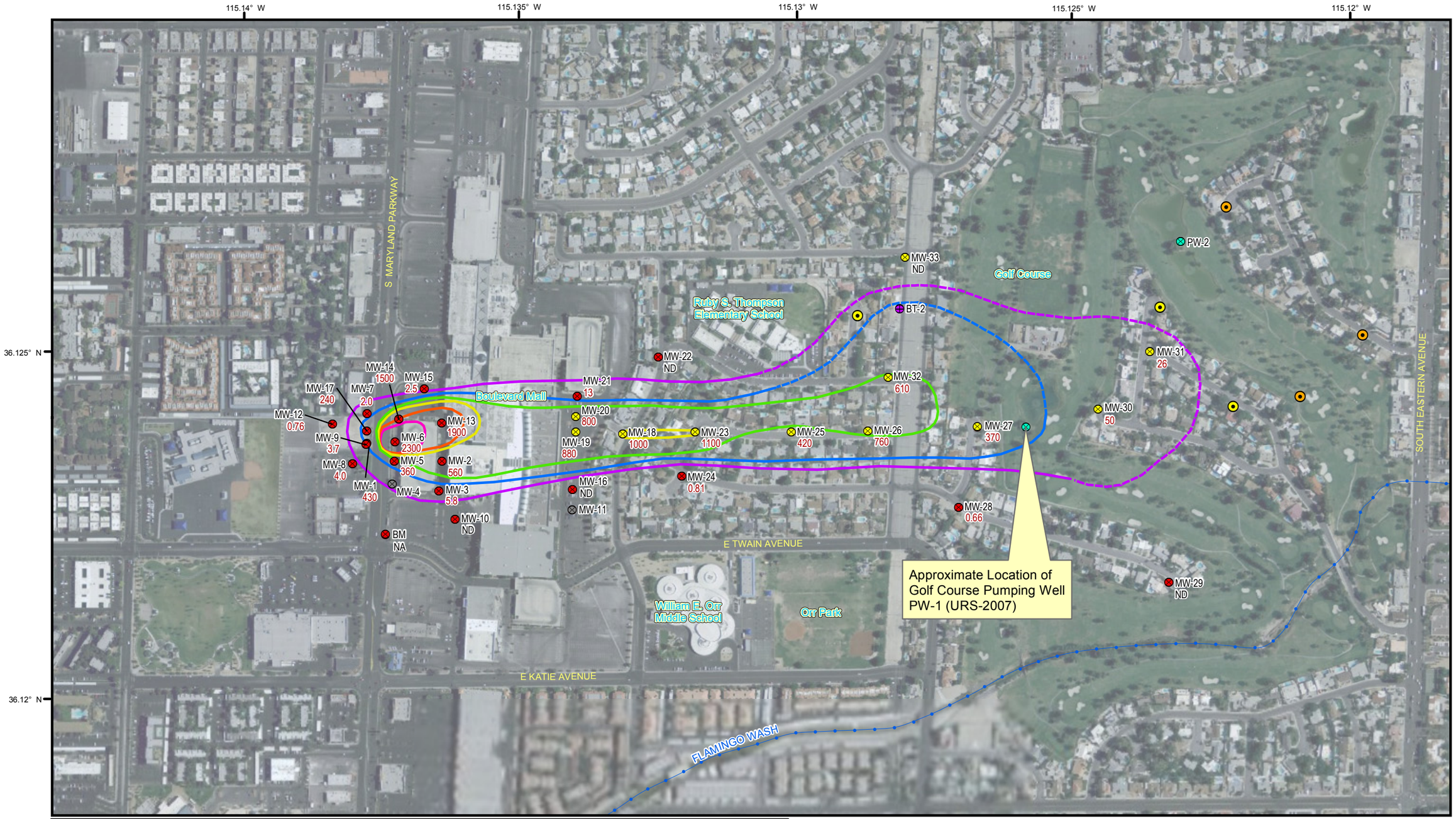
Approximate Scale in Feet

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

FIGURE 1-7
Shallow Groundwater Potentiometric Surface Map
February 28 - March 2, 2011

TETRA TECH

Path: S:\Projects Directory\Private Sector - Other Offices\Maryland Square\Work Plan\Figure 1-7061711.mxd



Legend

- Proposed Well Location
- Optional Proposed Well Location
- Soil Boring Location
- Production Well Location
- Monitoring Well Location (Sampled November 2010)
- Monitoring Well Location (Sampled March 2011)
- Monitoring Well Location (Not Sampled)

- 2500 ug/L PCE Contour
- 2000 ug/L PCE Contour
- 1500 ug/L PCE Contour
- 1000 ug/L PCE Contour
- 500 ug/L PCE Contour
- 100 ug/L PCE Contour
- 5 ug/L PCE Contour (Dashed Where Inferred)

ug/L	Micrograms Per Liter
NA	Not Analyzed
ND	Not Detected
NS	Not Sampled
PCE	Tetrachloroethylene
PQL	Practical Quantitation Limit
URS	URS Corporation

PCE PQL = 0.5 ug/L

N W E S

0 250 500 Feet

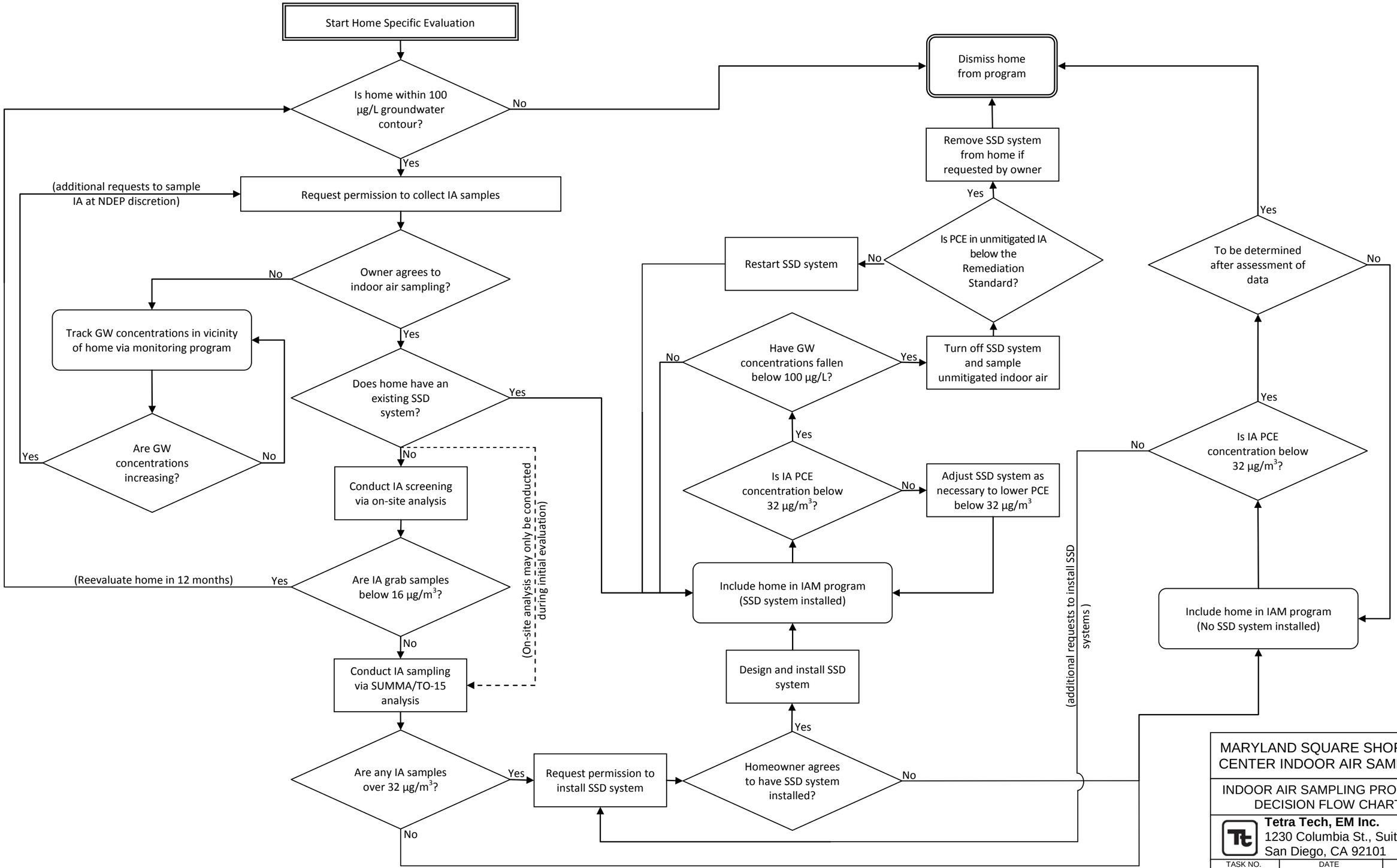
Approximate Scale in Feet

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

FIGURE 2-1
PROPOSED WELL LOCATIONS

TETRA TECH

Path: S:\Projects Directory\Private Sector - Other Offices\Maryland Square\Work Plan\Figure 2-1061711.mxd



MARYLAND SQUARE SHOPPING CENTER INDOOR AIR SAMPLING

INDOOR AIR SAMPLING PROGRAM DECISION FLOW CHART

Tetra Tech, EM Inc.
1230 Columbia St., Suite 1000
San Diego, CA 92101

TASK NO.	DATE	FIGURE
103P172811	6/28/11	3-1

APPENDIX A

Indoor Air Quality Assessment Building Survey Form

TETRA TECH

INDOOR AIR QUALITY ASSESSMENT
BUILDING SURVEY FORM

Project Information

Preparer's name: _____ Date: _____

Project Number: _____ Phone #: _____

Site Name: _____

Part I – Occupant Information

Building Address: _____

Property Contact:_____Owner / Renter / other: _____

Contact's Phone: home ( )_____ work ( )_____ cell ( )_____
(Check primary number if more than one supplied)

Number of building occupants: Children under age 13 _____ Children age 13-18 _____Adults _____

Part II – Building Characteristics

1) Building type:
residential / multi-family residential / mixed use residential / office / strip mall / commercial / industrial

2) Describe building: _____

_____

3) Building use:

Floor	**General use of each floor (e.g., family room, bedroom, workshop, storage)**
Basement:	
Ground floor:	
2nd Floor:	
3rd Floor:	
4th Floor:	

4) Municipal Zoning:_____ Year constructed: _____

5) Number of floors below grade:_____ (includes full basement / crawl space / slab on grade)

6) Number of floors at or above grade: _____

7) Depth of basement below grade surface: _____ft. Basement size: _____ ft^2

This questionnaire was prepared using guidelines published by the California Department of Toxic Substances Control, the New Jersey Department of Environmental Protection, the New York State Department of Health, and the Oregon Department of Environmental Quality (CADTSC 2005, NJDEP 1997; ORDEQ 2010; NYSDOH 2005)

8) Basement and Construction Characteristics (Circle all that apply):

Above Grade Construction:	Wood frame	Concrete	Brick	Other_____
Basement type:	Full	Crawlspace	Slab	Other_____
Basement Floor:	Bare earth	Concrete	Stone	Other:_____
Concrete floor (slab on grade):	Unsealed	Sealed	Seal Material:_____	
Foundation walls:	Poured	Block	Stone	Other:_____
Foundation wall finish	Unsealed	Sealed	Seal Material:_____	
The basement is:	Unfinished	Finished	Partially finished:_____	
The basement is :	Wet	Damp	Dry	Moldy
Sump present?	Yes	No	If yes is water present? Y/N/Not accessible	

9) If the basement is finished or partially finished does it include a bathroom or half-bath? Yes / No

10) Type of heating system(s) (circle all that apply):

hot air circulation	hot air radiation	subfloor radiant	steam radiation
heat pump	hot water radiation	kerosene heater	electric baseboard

other (specify): _____

11) Where is the furnace/boiler located?_____

12) Type of ventilation system(s) (circle all that apply):

central air conditioning	mechanical fans	bathroom ventilation fans	outside air intake
individual AC units	kitchen range hood fan	other (specify):_____	

_____

13) Are there whole house fans, kitchen fans, or bath fans? List each if present and where it is vented:_____

_____

_____

14) Types of heating / cooking fuel utilized (circle all that apply):

Natural gas / electric / fuel oil / wood / coal / kerosene / other:_____

15) Is a private irrigation or drinking water well on site? Yes / Yes (but not used) / No

16) Taste and/or odor problems noticed with water? Yes / No

If yes, describe taste/odor:_____

_____

If yes, how long has it been present?_____

17) Is the water chlorinated, brominated, or ozonated? Yes / No _____

18) Is there a septic system? Yes / Yes (but not used) / No

Distance of septic system from building/home:_____

Distance of septic system from site water well (if present): _____

19) Type of ground cover outside of building: grass / concrete / asphalt / other (specify)

_____

20) Is an existing subsurface depressurization (radon) system in place? Yes / No If yes: active / passive

21) Is a sub-slab vapor/moisture barrier in place? Yes / No
If yes, type of barrier: _____

Part III - Outside Contaminant Sources

22) Regulated contaminated site (1000-ft. radius): _____

23) Other stationary sources nearby (gas stations, emission stacks, etc.): _____

24) Heavy vehicular traffic nearby (or other mobile sources): _____

Part IV – Miscellaneous

25) Do any occupants of the building smoke? Yes / No How often? _____
Last time someone smoked in the building? _____hours / days ago

26) Does the building have an attached garage directly connected to living space? Yes / No
If so, is a car usually parked in the garage? Yes / No
Are gas-powered equipment/machines stored in the garage? Yes / No
If yes, what types (mower, ATV, PWC, etc.):_____
Are cans of gasoline/fuels stored in the garage? Yes / No
Are paints or chemicals stored in the garage? Yes / No
Does the garage have a separate heating system? Yes / No

27) Do the occupants of the building have their clothes dry cleaned? Yes / No
If yes, how often? weekly / monthly / 3-4 times a year

28) Do any of the occupants use solvents or volatile chemicals in their workplace? Yes / No
If yes, what types of solvents are used? _____
If yes, where are their clothes washed? At work At home Other:_____

29) Has the building/home been fumigated for termites/other pests within the last 12 months? Yes / No
If yes, when and which chemicals? _____
_____

30) Have any pesticides/herbicides been applied around the building or in the yard? Yes / No
If yes, when and which chemicals? _____
_____

31) Has there ever been a fire in the building? Yes / No If yes, when? _____

32) Has painting or staining been done in the building (including basement) within the last 6 months? Yes / No
If yes, when _____and where? _____

33) Are new carpets, drapes, other textiles, or upholstered furniture in the building? Yes / No
If yes, when _____and where? _____

34) Have cleaning chemicals been used in the building recently? Yes / No
If yes, what types? _____

35) Have cosmetic products been used in the building recently? Yes / No
If yes, what types? _____

36) Have air fresheners been used in the building recently (including basement)? Yes / No
If yes, what types? _____

37) Have any "hobby" chemicals (glues, paints) been used in the building recently (including basement)? Yes / No
If yes, what types? _____

38) Have any other chemicals been used in the building recently (including basement)? Yes / No
If yes, what types? _____

Part V – General Observations

Provide any additional information that may be pertinent to the survey and may assist in the data interpretation process below, and include floor plan(s) on a separate sheet.

Part VI – Indoor Contaminant Sources

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to commencement of the indoor air sampling event.

Potential Sources	Location(s)	Volatile Ingredients in Product, Container Type, and Size	Removed (Yes/No/NA)
Gasoline storage cans			
Gas-powered equipment			
Kerosene storage cans			
Paints / thinners / strippers			
Cleaning solvents			
Oven cleaners			
Carpet / upholstery cleaners			
Other house cleaning products			
Moth balls			
Polishes / waxes			
Insecticides			
Furniture / floor polish			
Nail polish / polish remover			
Hairspray			
Cologne / perfume			
Air fresheners			
Fuel tank (inside building)			NA
Wood stove or fireplace			NA
New furniture / upholstery			
New carpeting / flooring			NA
Hobbies - glues, paints, etc.			

Floor Plan

Building Address:_____Floor:_____

APPENDIX B

Sub-Slab Depressurization System Inspection Checklist

SUB-SLAB DEPRESSURIZATION SYSTEM INSPECTION CHECKLIST

Inspection Item	Yes	No	NA	Comment
System Operation				
Is the manometer or pressure gauge indicating a vacuum?				Vacuum:_____inH_2O
Pipe Integrity				
Is the piping free of any visible damage?				
Do pipe joints appear to be sealed?				
Slab-Integrity				
Is the seal around the pipe penetrating the slab intact?				
Is the slab free of visible cracks or other damage?				

Note:

NA Not applicable

If a leak is suspected, perform a smoke test to confirm.