Final Second Five-Year Review Report
Palermo Wellfield Superfund Site
Tumwater, Washington

EPA Region 10

September 2008

Parametrix

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Palermo Wellfield Superfund Site
Tumwater, Washington

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Second Five-Year Review Report

For

Palermo Wellfield Superfund Site
Tumwater, Washington
(WAD 0000026534)

September 2008

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CERTIFICATION

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ACRONYMS

AES	Architect and Engineering Services
ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
City	City of Tumwater
COC	Chemical of Concern
E&E	Ecology and Environment, Inc.
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency
gpm	Gallons per Minute
HI	Hazard Index
IC	Institutional Controls
IRIS	Integrated Risk Information System
MCL	Maximum Contaminant Level
MTCA	Model Toxics Control Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O & M	Operation and Maintenance
ORCAA	Olympic Regional Clean Air Agency
PCE	Tetrachloroethene
PIDs	Photoionization Detectors
RAC	Response Action Contract
RAOs	Remedial Action Objectives
RG	Remediation Goal
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
Site	Palermo Wellfield Superfund Site
START	Superfund Technical Assistance and Response Team
SVE	Soil Vapor Extraction
TCE	Trichloroethene
VOCs	Volatile Organic Compounds
WDOH	Washington State Department of Health
WDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

This report presents the results of the second five-year review of the Palermo Wellfield Superfund Site in Tumwater, Washington (CERCLIS ID Number WAD0000026534). The purpose of this second five-year review is to determine whether the remedial actions implemented at the Site are protective of human health and the environment. This report presents issues identified during the review process and provides recommendations for addressing these issues.

The U.S. Environmental Protection Agency (EPA) Region 10 conducted this second five-year review during the period of February 2008 through September 2008. The triggering action for this review is the inception date of the first five-year review for the Site, completed in September 2003. This second five-year review is required because the hazardous substances tetrachloroethene (PCE) and trichloroethene (TCE) remain present at the site above the remediation goal (RG) concentrations selected in the Record of Decision (ROD), preventing unlimited use and unrestricted exposure.

The Palermo Wellfield Superfund Site lies within the city limits of Tumwater, in the Puget Sound Basin of western Washington. The Site includes the Palermo Wellfield and the Palermo neighborhood, located within the Deschutes River Valley, and the adjacent uplands area to the west. Land use at the Palermo Wellfield Superfund Site currently consists of mixed commercial and residential development within the city limits of Tumwater.

PCE and TCE were found to have migrated in the direction of groundwater flow from the uplands area to the Palermo Wellfield, where TCE was detected in the municipal water supply in 1993. In addition, shallow groundwater containing PCE and TCE was found to surface near and at the base of the Palermo bluff, ponding as surface water in the yards and crawlspaces of some of the homes in the Palermo neighborhood

The selected remedy for the site includes a wellhead treatment system (using air stripping technology) at the Palermo Wellfield, a soil vapor extraction (SVE) system and institutional controls at the Southgate Dry Cleaner site, a french (subdrain) drain system in the Palermo neighborhood, and long-term groundwater monitoring.

A five-year review site inspection was conducted on May 22, 2008. The site inspection included personnel from the City of Tumwater and the Washington State Department of Ecology (Ecology). In addition, email interviews were conducted with personnel from the City of Tumwater, Ecology, and Washington Department of Health. The email interviews were supplemented with additional discussion during the site inspection.

Six issues and eight recommendations were identified through the five-year review process. A summary of the results of the second five-year review are provided in the Five-Year Review Summary Form on the following pages.

A protectiveness determination cannot be made at this time for the Palermo Wellfield site until further information is obtained. Further information will be obtained by re-evaluating the groundwater monitoring system, adding monitoring locations if necessary, conducting a capture zone analysis, and re-evaluating the conceptual site model and ability of the selected remedy to achieve remedial action objectives, including aquifer restoration. It is expected that these actions will take approximately 24 months to complete, at which time a protectiveness determination will be made.

Human Exposure Environmental Indicator Status for the Palermo Site remains "Insufficient Data" because of the need to collect and analyze more indoor air and groundwater data, which is scheduled to happen over the next *24* months.

Groundwater Migration Environmental Indicator Status for the Palermo site remains "Insufficient Data to Make a Determination" because the groundwater monitoring network may be inadequate to monitor plume migration. Additional monitoring and a capture zone analysis is scheduled to be done over the next *24* months.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name (*from WasteLAN*): Palermo Wellfield Superfund Site

EPA ID (*from WasteLAN*): WAD0000026534

Region: 10 **State**: WA **City/County**: Tumwater/Thurston

SITE STATUS

NPL status: ☒ Final ☐ Deleted ☐ Other (specify)

Remediation status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete

Multiple OUs?* ☐ YES ☒ NO | **Construction completion date**: 01/30/01

Has site been put into reuse? ☒ YES ☐ NO

REVIEW STATUS

Lead agency: ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____

Author name: Christopher Cora

Author title: Remedial Project Manager | **Author affiliation**: EPA Region 10

Review period: 10/01/03 to 9/30/08

Date(s) of site inspection: 05/22/08

Type of review:

☒ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only

☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead

☐ Regional Discretion

Review number ☐ 1 (first) ☒ 2 (second) ☐ 3 (third) ☐ Other (specify) _____

Triggering action:

☒ Actual RA On-site Construction at OU # NA ☐ Actual RA Start at OU#_____

☐ Construction Completion ☐ Previous Five-Year Review Report

☐ Other (specify)

Triggering action date *(from WasteLAN)*: 09/30/03

Due date *(five years after triggering action date)*: 09/30/08

(Form Continues)

Five-Year Review Summary Form (continued)

Issues:

1. Natural attenuation is not a significant process at the Site, so it appears the restoration timeframe in the ROD will not be met with the selected remedy.
2. The deed restriction for Southgate Dry Cleaners and the transfer of personal property and easements for monitoring has not been completed.
3. Warning signs are missing at the treatment lagoon.
4. Effectiveness of Palermo Wellfield operation at capturing and controlling contaminant migration requires further evaluation.
5. Groundwater monitoring system adequacy requires further evaluation.
6. The remediation goal (RG) for groundwater to protect against inhalation risk is unsupportable based on indoor air monitoring results.

Recommendations and Follow-up Actions:

1. Prepare and record a deed restriction at Southgate Dry Cleaners or sample SVE treated soil to determine whether actual soil concentrations require an Institutional Control.
2. Install a warning sign on the fencing along the western side of the lagoon.
3. Re-establish access to piezometers PZ-704, PZ-709, and PZ-715, which are located on the wooded Palermo bluff.
4. Conduct a capture zone analysis to assess whether or not the TCE plume is being fully captured by the operation of the Palermo Wellfield. Analysis shall assess the vertical distribution of contaminants within the aquifer. Complete an ESD or ROD amendment as appropriate.
5. Evaluate the groundwater monitoring system to assess if existing wells are adequate for monitoring plume migration and remediation and to determine if additional monitoring points are required in the downgradient portion of the Site.
6. Re-evaluate the conceptual site model and Remedial Action Objectives (RAOs) since natural attenuation is not a significant process for reducing TCE and PCE concentrations in groundwater. Complete an ESD or ROD amendment as appropriate.
7. Continue indoor air monitoring to insure concentrations remain below 1.46 $\mu g/m^3$.
8. Re-evaluate the RG for the groundwater-to-indoor-a air pathway.

(Form Continues)

Five-Year Review Summary Form (continued)

Protectiveness Statement(s):

A protectiveness determination cannot be made at this time for the Palermo Wellfield site until further information is obtained. Further information will be obtained by re-evaluating the groundwater monitoring system, adding monitoring locations if necessary, conducting a capture zone analysis, and re-evaluating the conceptual site model and ability of the selected remedy to achieve remedial action objectives, including aquifer restoration. It is expected that these actions will take approximately 24 months to complete, at which time a protectiveness determination will be made.

Other Comments:

Human Exposure Environmental Indicator Status for the Palermo Site remains “Insufficient Data" because of the need to collect and analyze more indoor air and groundwater data, which is scheduled to happen over the next *24* months.

Groundwater Migration Environmental Indicator Status for the Palermo site remains “Insufficient Data to Make a Determination” because the groundwater monitoring network may be inadequate to monitor plume migration. Additional monitoring and a capture zone analysis is scheduled to be done over the next *24* months.

This Five-Year Review is a statutory review because hazardous substances remain in place above concentrations which allow unlimited use, unrestricted exposure.

1. INTRODUCTION

This report presents the results of the second five-year review of the Palermo Wellfield Superfund Site (Site) in Tumwater, Washington (CERCLIS ID Number WAD0000026534) [Figure 1-1]. The purpose of this second five-year review is to determine whether the remedial actions implemented at the Site are protective of human health and the environment.

The U.S. Environmental Protection Agency (EPA) Region 10 conducted this second five-year review during the period February 2008 through September 2008. Analysis and report preparation support for this five-year review was provided to EPA Region 10 by Parametrix, Inc. (Parametrix) under EPA Architect and Engineering Services (AES) Contract No. 68-S7-03-04.

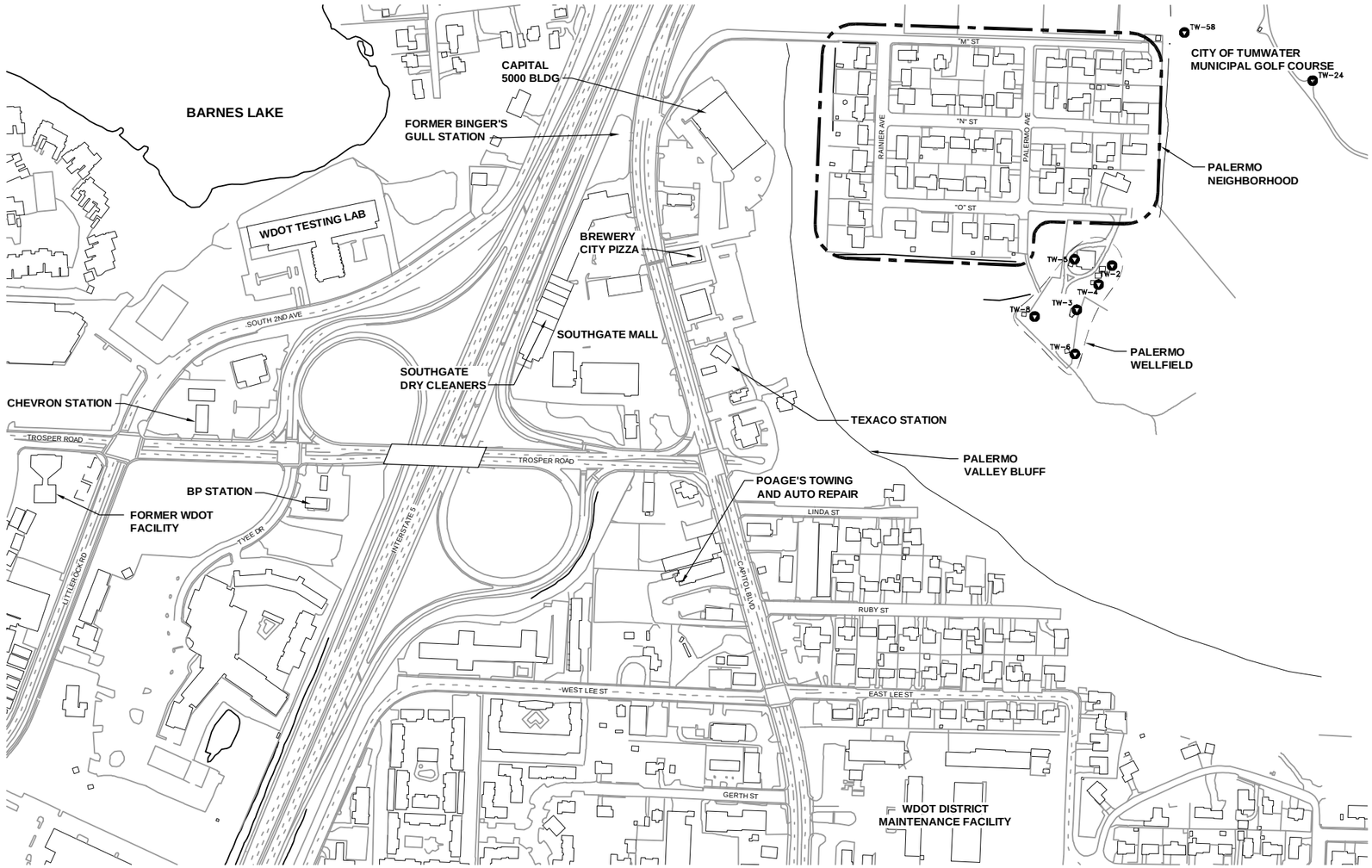
EPA Region 10 conducted this five-year review pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

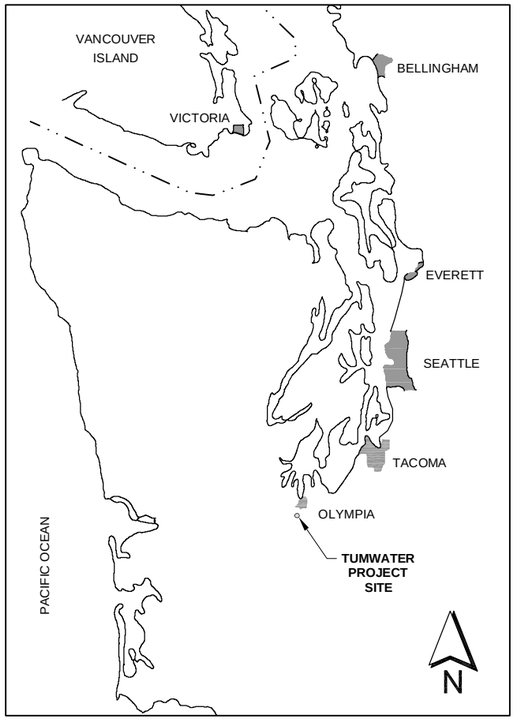
EPA interpreted this requirement further in the NCP as stated in 40 CFR §300.430(f)(4)(ii):

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This is the second five-year review for the Palermo Wellfield Superfund Site. The triggering action for this review is the inception date of the first five-year review for the Site, performed during the period of June 2003 to September 2003. This second five-year review is required because the hazardous substances remain at the site above levels that allow for unlimited use and unrestricted exposure.



APPROXIMATE AREA OF PALERMO WELLFIELD SUPERFUND SITE
TUMWATER, WASHINGTON



VICINITY MAP
NO SCALE

LEGEND
- ROADS/HIGHWAY
- BUILDINGS
- TW-8 DRINKING WATER WELL

Parametrix **DATE:** 06/16/08 3:11pm **FILE:** B2328007P041TFR01F-04

N

0 400'
SCALE IN FEET

LEGEND
- PALERMO NEIGHBORHOOD BOUNDARY

SOURCE:
QUALITY ASSURANCE PROJECT PLAN
SAMPLING AND ANALYSIS FOR O&M OF SUBDRAIN SYSTEM
(URS, 2000)

Figure 1-1
Palermo Wellfield Superfund Site
Second Five-Year Review
Project Location Map

2. SITE CHRONOLOGY

The chronology of key Site events is summarized in Table 2-1. The impetus for initial action at the Site was the detection of trichloroethene (TCE) in routine water samples collected in 1993 from the City of Tumwater's municipal wellfield (named the Palermo Wellfield), at a concentration exceeding the federal maximum contaminant level (MCL). Later in 1993, investigations by the City of Tumwater and the Washington State Department of Ecology (Ecology) identified one source area as Southgate Dry Cleaners, where tetrachloroethene (PCE) had been disposed of in a drywell. Subsequent investigations identified a plume of both TCE and PCE in groundwater, emanating from multiple sources upgradient of the Palermo Wellfield.

The Site was added to the National Priorities List (NPL) on April 1, 1997. Initial removal actions included installation of a soil vapor extraction (SVE) system at Southgate Dry Cleaners, which began operation on March 24, 1998, and installation of a wellhead treatment system at the Palermo Wellfield, which began operation in February 1999.

The remedial investigation and feasibility study (RI/FS) were completed by June 30, 1999, and the Record of Decision (ROD) was signed on November 16, 1999. The remedy selected in the ROD included continued operation of the SVE and wellhead treatment systems, as well as construction of a third remedy component. This third component consisted of a french (subdrain) drain and treatment lagoon designed to lower contaminated groundwater elevation within the Palermo residential neighborhood. Construction notice to proceed was issued on July 25, 2000, with construction performed between August 8, 2000 and January 9, 2001. Final construction acceptance occurred on January 30, 2001.

EPA operated the subdrain system during a one-year performance validation period and transferred operation and maintenance of the system to the State of Washington in February 2002. Consistent with the Operation and Maintenance (O & M) Plan (URS 2000, 2002) and Addendum (Ecology 2003), the Washington State Department of Ecology (Ecology) has been conducting semi-annual monitoring and sampling of the subdrain system and treatment lagoon with few difficulties.

Although operation and maintenance of specific remedy components have been transferred from EPA to state and local agencies, EPA is currently conducting long-term monitoring of groundwater beneath the Site and has been conducting groundwater monitoring on a semi-annual basis since August 2001. Since March 2001, EPA has also conducted several air monitoring events to assess indoor air quality in the living spaces and crawlspaces of targeted residences.

In 2005, the United States initiated a cost recovery case against the responsible parties at the Site: Washington Department of Transportation (WDOT) and Southgate Development Co. In 2007, the Court entered a settlement between the United States and Southgate and a judgment against WDOT.

Table 2-1. Chronology of Site Events

Event	Date
Initial discovery of TCE exceeding the maximum contaminant level at the Palermo Wellfield	1993
Pre-National Priorities List investigations and responses	1993 to 1997
Listed on National Priorities List	April 1, 1997
SVE removal action at Southgate Dry Cleaners	March 24, 1998
Wellhead treatment removal action (construction complete)	February 1999
Remedial investigation/feasibility study complete	June 30, 1999
Record of Decision signed	November 16, 1999
Subdrain and treatment lagoon remedial design start	November 1999
SVE system shutdown	June 2000
Subdrain and treatment lagoon remedial design complete	June 9, 2000
Subdrain and treatment lagoon remedial action construction notice to proceed	July 25, 2000
Subdrain and treatment lagoon construction dates (start and finish)	August 8, 2000 to January 9, 2001
Subdrain and treatment lagoon construction acceptance date	January 30, 2001
Preliminary closeout report signed	February 22, 2001
EPA performs 1-year validation period on subdrain and treatment system lagoon	February 2001- January 2002
EPA begins semi-annual long-term groundwater monitoring of the site with periodic indoor air monitoring	August 2001
Ecology begins semi-annual O&M of subdrain and treatment lagoon, transferring some responsibilities to the City of Tumwater	February 2002
Previous five-year review	September 2003

3. BACKGROUND

The Palermo Wellfield Superfund Site lies within the city limits of Tumwater, in the Puget Sound Basin of western Washington (see Figure 1-1). The Site includes the Palermo Wellfield and the Palermo neighborhood, located within the Deschutes River Valley, and the adjacent uplands area to the west. The elevation of the uplands area is approximately 60 feet higher than the river valley. The Deschutes River Valley trends north-south with river flow to the north-northwest towards Puget Sound.

Land use at the Palermo Wellfield Superfund Site currently consists of mixed commercial and residential development within the city limits of Tumwater. This land use is not expected to change substantially in the foreseeable future. Detailed descriptions of the physical characteristics, contaminant sources, contaminant concentrations, contaminant distribution, and cleanup alternatives evaluated for the Site as a whole are included in the RI report (EPA 1999c) and the FS report (URS 1999b) for the Site. The RI indicated that the primary site contaminants were PCE and TCE. The sources for these contaminants are several facilities located in the uplands area, including the Southgate Dry Cleaners and two locations (one former and one current) of the Washington State Department of Transportation (WDOT) Materials Testing Laboratory (see Figure 1-1). PCE and TCE were found to have migrated in the direction of groundwater flow from the uplands area to the Palermo Wellfield, where TCE was detected in the municipal water supply in 1993. The ROD (EPA 1999a) reports an estimated volume of contaminated groundwater in the range of 53 to 196 million gallons. Receptors for this plume of contaminated groundwater included the human users of the drinking water supply and aquatic receptors in the Deschutes River. In spring 1999, the EPA began the operation of an air-stripping treatment system at the Palermo Wellfield to remove PCE and TCE contamination from the water supply. Operation of this system was assumed by the City of Tumwater (City). The FS concluded that this air-stripping system would eventually remediate the contaminated groundwater at the Site.

In addition to the TCE detected at the Palermo Wellfield, shallow groundwater containing PCE and TCE was found to surface near and at the base of the Palermo bluff, ponding as surface water in the yards and crawlspaces of some of the homes in the Palermo neighborhood. Ponded water in the crawlspaces poses a potential risk to human health because of the potential for PCE and TCE to volatilize from the water into the air inside homes. In 2000, in accordance with the remedy selected in the ROD, EPA installed a subdrain system and treatment lagoon to collect and treat this shallow groundwater. The subdrain system was installed west of the residences located along the western side of Rainier Avenue. The purpose of the subdrain system is to lower the groundwater table to prevent water containing PCE and TCE from collecting in the crawlspaces below the residences along Rainier Avenue.

The collected water is transported to a treatment lagoon located at the City of Tumwater Municipal Golf Course. The water is treated by surface aeration, and the treated water ultimately discharges to the Deschutes River via an existing watercourse.

Although operation and maintenance of specific remedy components have been transferred from EPA to state and local agencies, EPA is currently providing for long-term monitoring of groundwater beneath the Site.

4. REMEDIAL ACTIONS

This section describes the ROD-established remedial action objectives (RAOs) and the selected remedy for the Palermo Wellfield Superfund Site.

4.1 REMEDY SELECTION

The ROD (EPA 1999a) established the following RAOs for the Site:

- Clean up the groundwater aquifer.
- Prevent ingestion of, or exposure to, groundwater containing carcinogens in excess of applicable or relevant and appropriate requirements (ARARs) and total excess cancer risk no greater than 10^{-6}.
- Prevent inhalation of chemical of concern (COC) vapors from surface water in residential crawlspaces at concentrations that result in a total excess cancer risk of greater than 10^{-6}.
- Prevent discharge of groundwater containing COCs to the Deschutes River at concentrations in excess of ARARs or resulting in an ecological hazard index (HI) greater than 1.
- Reduce the potential for PCE in soils under the Southgate Dry Cleaners to reach the groundwater.

The description of the selected remedy in the ROD is as follows:

1. The air-stripping system constructed by EPA will be operated and maintained by the City of Tumwater to treat contaminated groundwater at the Palermo Wellfield for distribution into the municipal drinking water system. Water will be treated to levels no greater than MCLs for TCE and PCE.
2. A french (subdrain) drain will be installed west of the residences located along the west side of Rainier Avenue. The subdrain will be designed to lower the water table to a depth of 18 inches below the bottom of the crawlspaces under the residences along the west side of Rainier Avenue. Lowering the water table will reduce modeled indoor air concentrations of TCE and PCE to below the Model Toxics Control Act (MTCA) Method B air cleanup values of 1.46 micrograms per cubic meter ($\mu g/m^3$) for TCE and 4.38 $\mu g/m^3$ for PCE. The drain will collect shallow groundwater and route it to the Tumwater Municipal Golf Course, where it will be treated by surface aeration in a lagoon. Treated water will drain through the existing stormwater ditch, eventually discharging to the Deschutes River. The aerated lagoon will be designed to treat water such that the water in the stormwater ditch meets water quality standards for COCs prior to discharge into the Deschutes River. The water quality standards are based on National Toxics Rule standards, which are protective of human consumption of water and aquatic organisms. The standards are 0.8 and 2.7 micrograms per liter ($\mu g/L$) for PCE and TCE, respectively.
3. An evaluation of the standing water in the Palermo community will be made. If standing water is found in the crawlspace under any home east of Rainier Avenue, it will be sampled and analyzed for PCE and TCE. If PCE or TCE is found in crawlspace water, the risk to residents of those houses will be assessed by the same methodology used in the RI human health risk assessment. If unacceptable risks are

found, remedial action will be taken by either lowering the water table beneath the house or by venting the crawlspace. The choice between these two remedies will be made based upon cost effectiveness.

4. The SVE system at the Southgate Dry Cleaners will continue to operate until the soil cleanup goal for PCE is met. The cleanup goal is 0.0858 milligrams per kilogram (mg/kg) and is based on the MTCA Method B soil cleanup level for the protection of groundwater. Attainment of the soil RG goal will be evaluated based on PCE concentrations in vapor discharged from the remediation system. The change in the PCE concentrations in vapor from the initial concentration to the most recent concentration will be used to establish the present PCE concentration in soil based on the initial PCE concentration in soil. When compliance is determined, the SVE system will be shut down and removed from the site, and the extraction wells will be abandoned in accordance with ARARs. Soil samples will be collected to confirm that soil RGs have been attained. If these confirmatory soil samples indicate that soil RGs have not been attained at the time of system shutdown, a deed restriction will be put in place on the Southgate Dry Cleaners property to reduce potential for site work that could encourage the transfer of contaminants from soil to groundwater.
5. A long-term groundwater monitoring system will be developed using existing wells. Wells that are not needed for the long-term monitoring program will be abandoned in accordance with ARARs. Groundwater monitoring will track the contaminant plume until levels of TCE and PCE are consistently less than their MCLs throughout the aquifer at the site. Groundwater samples will be analyzed for PCE, TCE and breakdown products.
6. A sampling program will be developed and implemented to determine the effectiveness of the subdrain system. This program will focus on monitoring depth to groundwater to demonstrate that a minimum 18-inch depth of dewatering is maintained.
7. A monitoring system will be developed and implemented for the discharge from the aerated lagoon. The monitoring will confirm that the water in the lagoon meets water quality standards prior to discharge to the Deschutes River.
8. Notification will be provided to property owners, well drillers, and local officials regarding the specific location of the groundwater contaminant plume. The notification will advise that the groundwater in this area is not safe for domestic use without treatment. In the FS report, the mechanism for prevention of the use of contaminated groundwater was anticipated to be a City ordinance. Because this mechanism would be difficult to implement, and because there is very little incentive for individuals to drill new domestic wells in this fully developed area, public education was selected as a more appropriate mechanism.
9. Monitoring of trends in TCE and PCE concentrations in groundwater and surface water, the effects of natural attenuation, and the effectiveness of the treatment systems. Natural attenuation will be monitored both to assess its effectiveness as part of the overall remedy, and to assess any changes in the occurrence of breakdown chemicals such as vinyl chloride.

4.2 REMEDY IMPLEMENTATION

This section discusses the implementation of the remedy by component. The remedy components are discussed according to the numbering in Section 4.1.

4.2.1 Component 1 – Wellhead Treatment Air Strippers

The components of the wellhead treatment system include two air-stripper towers with associated blowers, an underground clearwell, and pumps and piping. The treatment system was designed to remove TCE contamination in the water from wells TW-2, TW-4, and TW-5.

With installation of this treatment system, the City of Tumwater regained full use of its groundwater wells at the Palermo Wellfield. The operation of the system is semi-automated, and the system can be monitored through a remote control unit. The system design included the means to provide treatment of higher VOC concentrations than have been detected at the wellfield so far.

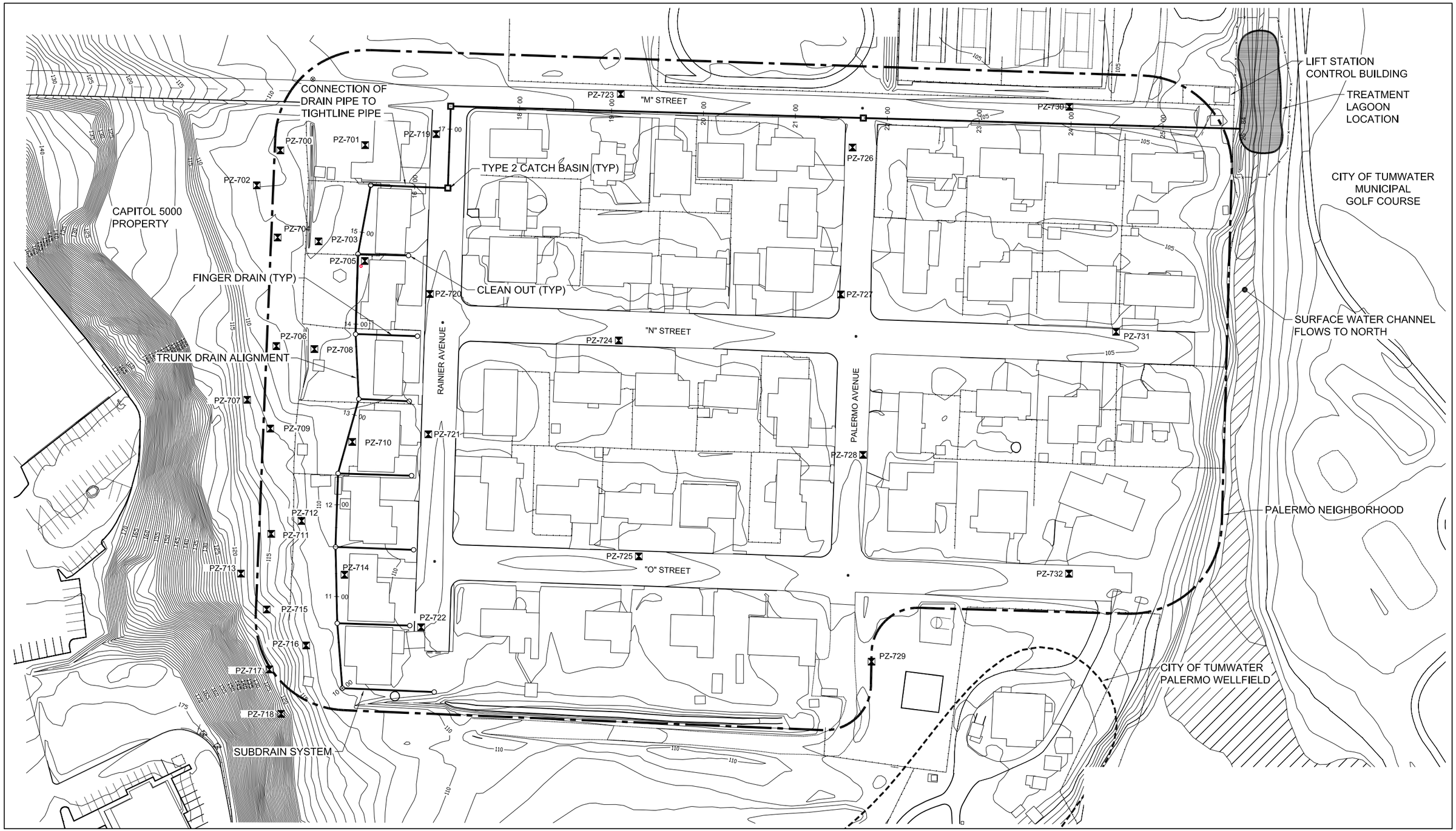
The wellhead treatment system was constructed as part of a removal action in advance of the ROD and was incorporated as part of the selected remedy. The wellhead treatment system was constructed between February 1998 and February 1999, when the system was substantially complete. Testing and optimization of the treatment system's effectiveness occurred between January and June 1999. O&M of this system was transferred to the City in April 1999. The formal transfer of personal property for this system has not yet been completed. As reported by the City, operation of this system has been without significant incident. The system effectively treats influent water to below the MCLs for PCE and TCE.

4.2.2 Component 2 – Subdrain and Treatment Lagoon

The subdrain system and treatment lagoon portion of the remedy (Figure 4-1) was constructed between August 8, 2000 and January 9, 2001. The costs of designing and installing this system were higher than estimated in the ROD because of the need to construct a pipeline beneath M Street (rather than tying into the existing storm drain pipe) and difficult construction conditions behind the Rainier Avenue homes. Design data also revealed that a deeper, longer drain located closer to the homes would be required to meet the project objectives, which increased the design and construction costs over the ROD estimate.

Once the subdrain and treatment lagoon system was constructed, EPA performed a one-year performance validation from February 2001 through January 2002. The ROD goal for the subdrain performance was to lower the groundwater elevation to 18 inches below the crawlspace floors for the homes west of Rainier Avenue. The floors of these crawlspaces were conservatively estimated to be 18 inches below ground surface. The performance goal is therefore often described as "three feet below ground surface."

Following construction and performance validation of the subdrain system and treatment lagoon components of the remedy, Ecology assumed responsibility for performing operation and maintenance of these facilities. Ecology then transferred some O&M responsibilities to the City of Tumwater. The City assumed physical maintenance responsibility for the property easements, equipment, and structures that make up the system. Ecology assumed responsibility for water quality sampling and measurement of parameters, such as groundwater depths and water flow rate, that demonstrate the performance of the system and its protectiveness of human health and the environment. As of this second five-year review, the acquisition of easements from land owners and the formal transfer of personal property from EPA to the City has not been completed.



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SCALE IN FEET

SOURCE:
QUALITY ASSURANCE PROJECT PLAN
SAMPLING AND ANALYSIS FOR O&M OF
SUBDRAIN SYSTEM (URS, 2000)

LEGEND

PIEZOMETER LOCATION

Figure 4-1
Palermo Wellfield Superfund Site
Second Five-Year Review
Subdrain System and Treatment Lagoon

4.2.3 Component 3 – Standing-Water Evaluation

The presence or absence of standing water in residential crawlspaces within the Palermo neighborhood was evaluated as part of the subdrain design investigations. Where standing water was found, it was sampled and the conclusions drawn from this assessment were used during design of the subdrain. The design concluded that only the homes along the west side of Rainier Avenue currently required drainage, but that the conveyance piping beneath Rainier Avenue and M Street should be oversized to allow future expansion of the drain system, if necessary. The subdrain design was expected to have some influence beneath homes along the east side of Rainier Avenue, with a decreasing influence farther east.

4.2.4 Component 4 – Soil Vapor Extraction System at Southgate Dry Cleaners

The SVE system was constructed and tested between November 1997 and March 1998. The treatment components of the system were located adjacent to the Southgate Mall building that contains Southgate Dry Cleaners, with piping to four extraction wells in the parking lot and one well within Southgate Dry Cleaners. The piping to the wells was underground except for the pipe to the well inside the building, which entered through the roof.

The piping from the wells was plumbed to a manifold that provided valving and sample ports to allow control and sampling of the vapor flow from each well. After the manifold, the combined vapor flow entered the extraction blower, which created the vacuum to pull vapors from the soil. After passing through the blower, the vapor entered a moisture knock-out canister to remove water. The vapor was then treated using a series of granular activated carbon filters. The treated vapor was discharged to the atmosphere through a 20-foot-tall emission stack. Water removed by the knock-out canister was periodically pumped to a temporary storage tank. Most of the treatment components of the system were housed within a shipping container placed next to the building. The carbon canisters and the temporary water storage tank were located outside the container within a fenced compound.

The SVE system was operated from March 1998 though June 2000. In the preliminary closeout report (EPA 2001a) the following was reported regarding the implementation of the SVE system:

> "The SVE system began operation on March 24, 1998, and removed approximately 425 pounds of PCE before it was decommissioned in June 2000, based on comparing the results of vapor samples collected from the system at startup to those collected just prior to decommissioning. The highest concentration of PCE in soil beneath Southgate Dry Cleaners prior to remediation was 63.2 mg/kg. By applying the ratio of the PCE concentration in vapor samples at startup and just prior to decommissioning to the concentration in soils prior to remediation, an average PCE concentration remaining in soil within the area of SVE system influence is estimated at 0.013 mg/kg. This is below the soil remediation goal (RG) of 0.0858 mg/kg. However, the one confirmation soil sample collected in the same area following decommissioning of the SVE system indicated a concentration of 0.232 mg/kg PCE. This indicates the presence of isolated areas of soil beneath Southgate Dry Cleaners containing PCE concentrations still in excess of the RG and therefore requires a deed restriction on the property in accordance with the ROD."

At the time of preparation of this second five-year review report, the deed restriction required by the ROD is not yet in place. Further discussion of the deed restriction is presented in Section 4.3.3.

4.2.5 Component 5 – Long-Term Groundwater Monitoring

A long-term groundwater monitoring program was initiated in 2001, with the first sampling event conducted in August 2001. Semi-annual groundwater monitoring events continue to be conducted on a relatively regular schedule, with the most recent event occurring in May 2008. Annual long-term monitoring reports are generated detailing the results of the sampling.

Groundwater sampling results are included in Appendix A.

4.2.6 Components 6 and 7 – Monitoring of Subdrain and Lagoon Performance

At the completion of the performance validation period in January 2002, O&M of the subdrain system and treatment lagoon were initiated by Ecology and the City. O&M procedures and schedules were documented in an O&M manual prepared by EPA and dated August 30, 2003 (URS 2003). Ecology followed up with an addendum to the O&M Plan in February 2003 (Ecology 2003). The City maintains O&M of the physical components of the treatment lagoon and subdrain. Ecology conducts the semi-annual monitoring.

Ecology Subdrain Status Reports are provided in Appendix B

4.2.7 Component 8 – Public Notice of Contaminated Groundwater

EPA published a fact sheet in February 2001, which was sent to local well drillers and property owners. The fact sheet included an alert concerning installation of new wells in the area of contaminated groundwater. A figure was included to show the area of contamination. In addition to this public notice, the City requires that all properties within the city limits be connected to the City water supply. This requirement is a disincentive to the drilling of new private wells.

4.3 SYSTEM OPERATION AND MAINTENANCE

This section describes the O&M requirements for the remedy components, summarizes the O&M activities that have been conducted to date, and describes any problems that have been identified through O&M. Components 1, 2, and 4 through 7 of the remedy involve either ongoing O&M or periodic monitoring. The Southgate Dry Cleaners deed restriction (part of component 4) and the public notice of groundwater contamination (component 8) do not specifically require ongoing O&M or monitoring, but are reviewed for effectiveness during each five-year review. The standing-water evaluation (remedy component 3) was a one-time event conducted during pre-design data collection for the subdrain and treatment lagoon and does not require any O&M or monitoring. However, observations of standing water in crawlspaces are conducted and recorded during indoor air monitoring events.

4.3.1 Component 1 – Wellhead Treatment

O&M and monitoring of the wellhead treatment air strippers is conducted by the City. O&M includes weekly, monthly, semi-annual, and annual maintenance including periodic change-outs of the air filters, equipment lubrication and cleaning, and equipment repair or replacement, as needed.

The wellhead treatment system captures and treats hundreds of millions of gallons of water per year. The City pumped more than 400-million gallons of water in 2007. The City data also indicates that pumping from the wellfield occurred during every month of 2007 and every month to date in 2008.

There is a CERCLA exemption for air-stripper operation on Superfund sites, so an air-discharge permit from Olympic Regional Clean Air Agency (ORCAA) is not required. Air-discharge monitoring is not required by the ROD.

Some operational difficulties have arisen since system installation and have been addressed by the City. These issues included the need to add an air dryer system to the air supply for the pneumatically-actuated failsafe valves, and troubleshooting and reprogramming of the control system.

Since March 2006, EPA has sampled three wells (TW-2, 4, and 5) located within the wellfield as part of the long-term monitoring program. These wells are specifically sampled prior to the treatment process to evaluate plume extent. A total of four sampling events at TW-2, 4, and 5 recorded PCE results below laboratory detection limits of 1 µg/L. TCE concentrations in TW-2 and 5 maintain concentrations above 5 µg/L MCL. TW-4 has had detectable concentrations of TCE, but at concentrations below 5 µg/L.

EPA began monitoring the effluent from the two air-stripper towers in June 2007. The sampling events in 2007 (June and November) and May 2008, recorded concentrations of TCE and PCE below laboratory detection limits of 1 µg/L.

4.3.2 Components 2, 6, and 7 – Subdrain and Treatment Lagoon Operation

4.3.2.1 Physical Component O&M

O&M of the physical components of the subdrain system and treatment lagoon is performed by the City. O&M conducted since completion of the performance validation period in January 2002 has consisted of periodic inspections of the lagoon aerators and repair or replacement of the aerators as needed.

The only difficulty that has arisen during O&M and monitoring is keeping all three lagoon aerators running continuously. The aerators experience periodic failures, apparently as the result of suspended solids in the lagoon water, which damage the motors. In the most recent report, Ecology documented that the central aerator had sunk to the bottom of the lagoon; however, the aerator has since been retrieved and placed back into operation by the City.

Based on the results of compliance monitoring (Ecology 2004, 2005, 2006, 2007a), the treated water meets the RGs prior to discharge to the Deschutes River, even with only two aerators operating.

4.3.2.2 Monitoring Component O&M

Monitoring of the subdrain system and treatment lagoon is conducted by Ecology. A total of ten sampling events have been conducted since completion of the performance validation period in January 2002. The reports covering these events indicate that the data is relatively consistent from one sampling event to the next with concentrations decreasing over time. The concentrations of COCs in some effluent samples early on in the O&M of the treatment lagoon exceeded the RG. These samples were collected at a point immediately downgradient of the treatment lagoon. In October 2003 Ecology moved the compliance sampling point to a location just prior to where the stream discharges to the Deschutes River. The compliance sampling point and surface water channel from the treatment lagoon are shown on Figure 4-2. The latest round of Ecology sampling, in June 2007, indicates RGs are being met.

Ecology records total depth of the cleanouts on the subdrain system during O&M activities. Sediment buildup was recorded in the cleanouts over successive monitoring events from

September 2004 through June 2006. In the fall of 2006, the City removed the sediment buildup in the subdrain system located between Cleanout CO-3 and CO-8. After the following monitoring event, Ecology reported the presence of some sediment in the same course and recommended close monitoring for continued operation within established parameters. Total depths measured in the catch basins and lagoon were not significantly different from the original depths measured in February 2001.

The most recent status report from June 2007 suggests reestablishment of the trail access to the monitoring locations between the base of the bluff and the residences along the western side of Rainier Avenue. Thick vegetation is overwhelming the area and will eventually consume the monitoring locations. Additionally, the western survey marker for transect A-3 remains missing and needs to be replaced to collect accurate depth measurements. Thinning of vegetation surrounding the survey markers is also recommended for ease in access and data collection. The project sign on the eastern side of the treatment lagoon also needs to be replaced.

4.3.3 Component 4 – SVE System O&M

The SVE system was installed in March 1998 under the supervision of EPA's Superfund Technical Assistance and Response Team (START) contractor, Ecology and Environment, Inc. (E&E). E&E operated, maintained, and monitored the SVE system from the time of its installation until July 1999, when O&M of the system was transferred to EPA's Response Action Contract (RAC) program. Under RAC, URS operated, maintained, and monitored the SVE system from July 1999 through June 2000, when the SVE system was decommissioned. Following decommissioning, a confirmation soil sample was collected to evaluate the remaining PCE concentrations in soil.

STATION 364
(COMPLIANCE
SAMPLING POINT)

DESCHUTES RIVER

SURFACE WATER
CHANNEL

CITY OF TUMWATER
MUNICIPAL GOLF COURSE

TREATMENT
LAGOON

PALERMO
NEIGHBORHOOD

"M" ST

"N" ST

"O" ST

RAINIER AVE

PALERMO AVE

CAPITAL
5000 BLDG

FORMER BINGER'S
GULL STATION

BARNES LAKE

WDOT TESTING LAB

BREWERY
CITY PIZZA

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N

400'

LEGEND

PALERMO NEIGHBORHOOD BOUNDARY

SOURCE:
QUALITY ASSURANCE PROJECT PLAN
SAMPLING AND ANALYSIS FOR O&M OF SUBDRAIN SYSTEM
(URS, 2000)

Figure 4-2
Palermo Wellfield Superfund Site
Second Five-Year Review
Treatment Lagoon, Discharge

Based on the results of the May 16, 2000 vapor sample collected from the SVE system, calculations were performed to estimate the following:

- Total mass of PCE removed by the SVE system from startup through the date of decommissioning
- Average concentrations of PCE remaining in soil below Southgate Dry Cleaners

The calculations showed that approximately 425 pounds of PCE were removed by the SVE system from March 24, 1998 through June 20, 2000. The average PCE concentration in soil within the area of SVE system influence was estimated at 0.013 mg/kg. The RG for soil in this area is 0.0858 mg/kg (EPA 2000).

As envisioned by the ROD, the SVE system was decommissioned based on the estimated residual PCE concentration in soil calculated using the vapor concentrations. Following decommissioning, a confirmation soil sample was collected. This soil sample showed that PCE remained in soil above the RG, with a measured residual concentration of 0.232 mg/kg. This concentration is substantially lower than the PCE concentration in soil prior to SVE system operation (63.2 mg/kg), indicating that the system did remove a substantial PCE mass. However, the confirmation soil sample showed that PCE remains in soil at concentrations exceeding the RG, in some locations. This condition triggers the ROD requirement for a deed restriction at Southgate Dry Cleaners.

On June 9, 2008, a title search was conducted by Pacific Northwest Title Insurance Company, Inc. As of this date, no deed restrictions have been implemented for the property. Results of the title search are presented in Appendix C.

4.3.4 Component 5 – Long-Term Groundwater Monitoring

The long-term groundwater monitoring program initially included semi-annual sampling of 12 monitoring wells located roughly along the centerline of the PCE and TCE groundwater plume. In March 2006, EPA canvassed the plume area and included a total of 20 monitoring wells, 4 City production wells in the Palermo Wellfield, and 3 piezometers east of the subdrain system. The following field effort in October 2006 included 16 monitoring wells, 3 City production wells, and 3 piezometers. Since June 2007, EPA has incorporated a total of 15 monitoring wells, 3 City production wells, and 3 piezometers into the long-term monitoring program. Sampling locations are shown in Figure 4-3.

BARNES LAKE

CAPITAL 5000 BLDG

FORMER BINGER'S GULL STATION

WDOT TESTING LAB

BREWERY CITY PIZZA

SOUTHGATE MALL

SOUTHGATE DRY CLEANERS

CHEVRON STATION

BP STATION

FORMER WDOT FACILITY

TEXACO STATION

POAGE'S TOWING AND AUTO REPAIR

PALERMO VALLEY BLUFF

PALERMO NEIGHBORHOOD

PALERMO WELLFIELD

CITY OF TUMWATER MUNICIPAL GOLF COURS

"M" ST

"N" ST

"O" ST

RAINIER AVE

PALERMO AVE

SOUTH 2ND AVE

TROSPER ROAD

TYEE DR

LITTLEROCK RD

INTERSTATE 5

LINDA ST

CAPITOL BLVD

RUBY ST

WEST LEE ST

EAST LEE ST

PZ-721

PZ-724

PZ-728

TW-58

TW-24

110

95.58

0.5 U

103

111

102

109

101 (A+B)

104 (A+B)

107

MW-ES-01

MW-ES-02

MW-ES-03

MW-ES-04

MW-ES-05

MW-ES-06

MW-ES-07

MW-ES-09

MW-ES-10

MW-ES-11

MW-4A, MW-4B

MW-6

MW-7

MW-1

MW-3

MW-4

MW-5

MW-2

MW-UI

TW-5

TW-2

TW-4

TW-3

TW-8

TW-6

LEGEND

- ROADS/HIGHWAY
- BUILDINGS
- TW-2 DRINKING WATER WELL SAMPLED
- TW-8 DRINKING WATER WELL NOT SAMPLED
- MW-ES-05 MONITORING WELL SAMPLED
- 100 MONITORING WELL NOT SAMPLED
- PZ-74 PIEZOMETERS SAMPLED
- PIEZOMETERS NOT SAMPLED

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SCALE IN FEET

LEGEND

PALERMO NEIGHBORHOOD BOUNDARY

SOURCE:
QUALITY ASSURANCE PROJECT PLAN
SAMPLING AND ANALYSIS FOR O&M OF SUBDRAIN SYSTEM
(URS, 2000)

Figure 4-3
Palermo Wellfield Superfund Site
Second Five-Year-Review
Long-Term-Monitoring Sampling Locations

Monitoring points located upgradient and downgradient of the plume are included to allow assessment of changes in the aerial extent of the plume. These points are sampled semi-annually, with one sampling event in the dry season and one in the wet season.

A total of ten sampling events have occurred since the date of the first five-year review. All groundwater samples collected since May 2004 have routinely been analyzed for VOCs to assess both changes in PCE and TCE concentrations. Additional one-time analyses were added during the following events:

- May 2004: 1,4-dioxane
- March 2006: PCE and TCE compound specific isotope analysis

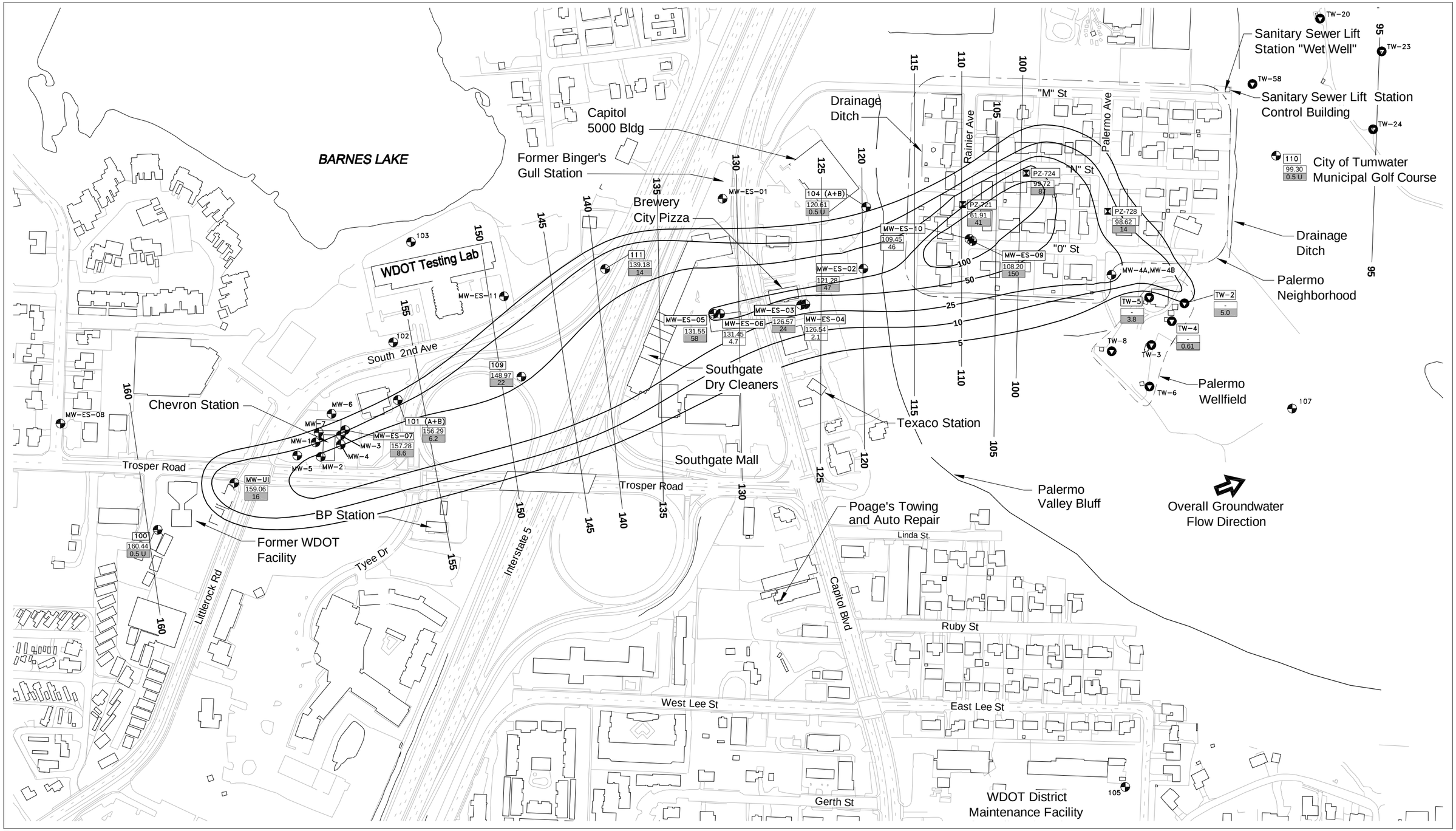
Based on the last ten events, the following conclusions were drawn:

- The groundwater-flow pattern and contaminant distribution are similar to those identified during the RI. PCE concentrations remain above RGs in MW-ES-04 and MW-ES-06, whereas TCE concentrations are more widely distributed and are significantly higher.
- Concentrations of both contaminants appear to be decreasing in groundwater at most sampling locations. TCE at MW-UI has shown an "up and down" trend since monitoring began in 2001. However, this location has shown a steady upward trend since 2005. TCE at MW-ES-06 has also shown varied concentration over time with a general upward trend. PCE at this location has been steadily decreasing.
- PCE and TCE were not detected at the downgradient sentinel well (MW-110) during any of the sampling events.
- Long-term monitoring events in 2004, 2006, 2007, and 2008 detected TCE in piezometers PZ-721, PZ-724 and PZ-728. Concentrations vary but are consistently above the RG.
- TCE was detected in three production wells (TW-2, 4, and 5) in the four sampling events since March 2006. Only TW-2 and TW-5 consistently show concentrations above the RG.
- PCE concentrations are lower than those measured during the RI and exhibit a weak seasonality. Comparison of the long-term monitoring data to the RI data implies that the removal of residual PCE in soil by the SVE system operated from March 1998 to June 2000 has resulted in decreased PCE concentrations in groundwater downgradient of Southgate Dry Cleaners.
- Long-term monitoring events consistently show TCE in piezometer PZ-728, located approximately 150 feet northwest and roughly cross-gradient of the wellfield, at concentrations exceeding the ROD-established RG of 5µg/L. No additional sampling locations downgradient between PZ-728 and MW-110 have been sampled to assess the horizontal or vertical extent of the TCE plume downgradient of the wellfield.
- There is little evidence for the occurrence of substantial biodegradation of PCE and TCE during either the wet or dry season. Conditions remain generally unfavorable for biodegradation, as found during the RI.

- Concentrations of TCE in piezometers located east of the subdrain exhibit substantially higher concentrations on the order of two to three times those of the subdrain, indicating subdrain capture of TCE may not be occurring.

Figures 4-4 and 4-5 show the current TCE and PCE plume configurations, respectively, based on available groundwater sampling data. Groundwater sampling results are provided in Appendix A.

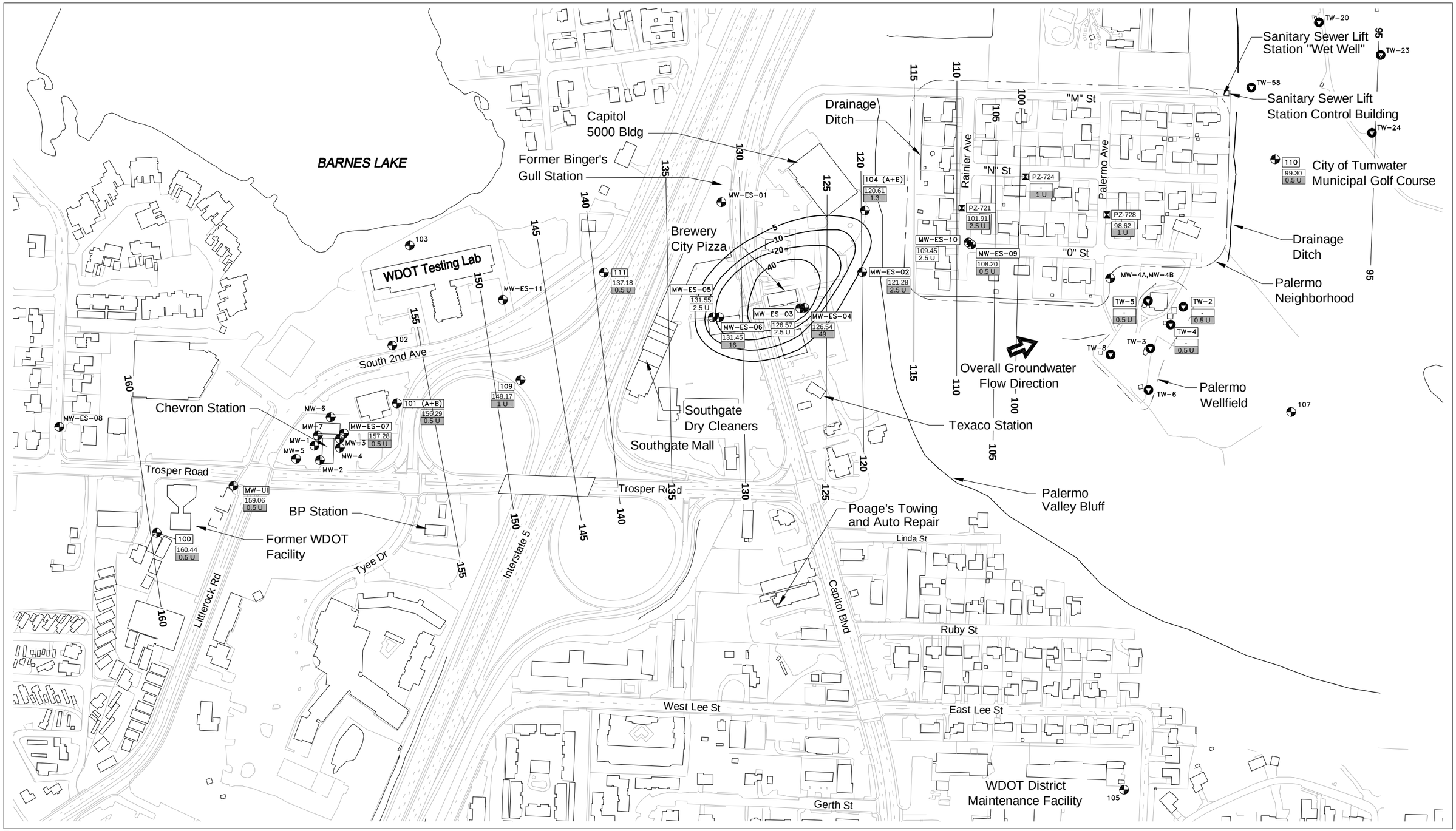
Further evaluation of the long-term monitoring program is needed to determine the effectiveness of the selected remedy.



NOTES

1. Overall Groundwater Gradient =0.016 Vertical Feet Per Linear Foot.
2. Highlighted TCE Values Used To Generate Contours.

Figure 4-4
Palermo Wellfield Superfund Site
Second Five-Year Review
Piezometric Contour Map with TCE Concentrations in Groundwater
May 2008



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LEGEND

- Roads/highway
- Buildings
- TW-8 Drinking Water Well
- Piezometer
- MW-ES-05 Monitoring Well Sampled
- 100 Monitoring Well Not Sampled
- 144.28 / 0.5 U Groundwater Elevation (ft) / PCE Value (ug/l)

NOTES

1. Overall Groundwater Gradient =0.015 Vertical Feet Per Linear Foot.
2. Highlighted PCE Values Used To Generate Contours.

Figure 4-5
Palermo Wellfield Superfund Site
Second Five-Year Review
Piezometric Contour Map with PCE Concentrations in Groundwater
May 2008

5. PROGRESS SINCE THE LAST FIVE YEAR REVIEW

The first five-year review deferred the indoor air protectiveness remedy until additional assessment could be performed by EPA. The first five-year review identified six issues. Issues and needs identified during the first five-year review included:

- Incomplete transfer of personal property and easements for the subdrain system, lagoon, and wellhead treatments system.
- Re-evaluation of human health risk associated with indoor air.
- Implementation of a deed restriction at Southgate Dry Cleaners.
- Performance of low level vinyl chloride analysis in groundwater.
- Securing the treatment lagoon from public access. Placement of a warning sign on the golf course side of the treatment lagoon.
- Assessing the adequacy of fish passage through the lagoon weir.

The following sections describe the status of each of the identified issues.

5.1 PROPERTY TRANSFER

No formal property transfers have been completed since the last five-year review.

5.2 RE-EVALUATION OF HUMAN HEALTH RISK

The first five-year review deferred comments on the indoor air protectiveness until further evaluation could be conducted to assess the indoor air exposure pathway. Since the last five-year review, a total of five air sampling events have been conducted. When possible, indoor air sampling was performed simultaneously with groundwater sampling to provide a comparison of indoor air TCE and PCE concentrations with those in groundwater.

Further discussion of indoor air monitoring conducted at the site and associated risk is presented in Section 7.2.2.

5.3 DEED RESTRICTION

As discussed in Section 4.3.3, a title search for the Southgate Dry Cleaner property was conducted in June 2008. A deed restriction has not been implemented for the Southgate Dry Cleaners property.

5.4 VINYL CHLORIDE ANALYSIS

Low level analysis of vinyl chloride has not been performed to confirm the plume configuration. However, analysis for vinyl chloride is included during long-term groundwater monitoring. To date, vinyl chloride has not been detected at concentrations exceeding the 1 µg/L laboratory reporting limit.

5.5 TREATMENT LAGOON SECURITY

The treatment lagoon is currently secured with a chain link fence on the western side and wrought-iron fencing on the eastern side facing the general public on the golf course. The

western fence contains a gate that remains locked when personnel are not onsite. A warning sign has not been placed on the western side of the lagoon.

5.6 TREATMENT LAGOON FISH PASSAGE

A consultation with Washington State Department of Fish and Wildlife was completed and EPA was provided with criteria on fish passage construction. However, the fish passage through the treatment lagoon weir could not be inspected during the site visit because of vegetation overgrowth. Future inspection of the fish passage and further consultation with Washington State Department of Fish and Wildlife is required.

6. FIVE-YEAR REVIEW PROCESS

This section provides a description of the second five-year review process and findings.

6.1 ADMINISTRATIVE COMPONENTS

The following parties were identified as being potentially interested in the five-year review process:

- The residents and business owners located within or near the geographic boundaries of the Palermo Wellfield Superfund Site
- The City of Tumwater
- Ecology
- WDOH

The Palermo Wellfield Superfund Site Five-Year Review was led by Christopher Cora of EPA, Remedial Project Manager (RPM) for the Site, and included support from the City, Ecology, WDOH, and Parametrix (contractor to EPA). The review was initiated by a kickoff meeting held on June 9, 2008, which included hydrogeology and risk assessment specialists from EPA and Parametrix. Key topics of that meeting included the effectiveness of the groundwater extraction system at the Palermo Wellfield in capturing PCE and TCE-contaminated groundwater and the need to reassess the protectiveness statement presented in the first Five-Year Review Report.

Email interviews were distributed to personnel at the City, Ecology, and WDOH during the week of April 29, 2008. A site inspection with Ecology and City personnel was conducted on May 22, 2008 and included additional in-person interviews.

The findings of the five-year review process are discussed in Sections 6.2 through 6.7.

6.2 SUMMARY OF COMMUNITY INVOLVEMENT

On May 16, 2008, a notice that a five-year review was to be conducted was run in the Daily Olympian newspaper. The newspaper article directed public comments or concerns about unusual odors, standing water in crawlspaces, and impacts to animal and plant life to EPA RPM Christopher Cora.

6.3 DOCUMENT REVIEW

A list of the documents reviewed during the second five-year review is shown in Table 6-1.

Table 6-1. Documents Reviewed

Document	Author and Date	Relevance
EPA Superfund Record of Decision: Palermo Well Field Ground Water Contamination, EPA ID: WA0000026534, OU1, Tumwater, WA	EPA 1999	Remedy selection, description, background; applicable or relevant and appropriate requirements and remedial action objectives and goals.
Document	**Author and Date**	**Relevance**
First Five-Year Review Report Palermo Wellfield Superfund Site, Tumwater, Washington	EPA 2003	Review of selected remedy operation and performance, identifies outstanding issues and provides recommendations for next five-year review.
Draft Technical Memorandum, Palermo Indoor Air Sampling, Result of Phase I Palermo Indoor Air Monitoring	Parametrix 2004	Presents results of indoor air monitoring in May 2004.
Draft Technical Memorandum, Palermo Indoor Air Sampling, Result of the Second Round of Palermo Indoor Air Monitoring	Parametrix 2005b	Presents results of indoor air monitoring and piezometer sampling in December 2004.
Revised Draft Technical Memorandum Palermo Indoor Air Sampling, Result of the Third Round of Palermo Indoor Air Monitoring	Parametrix 2006b	Presents results of indoor air monitoring in January 2006
Technical Memorandum Round 4 Indoor Air Monitoring Results	Parametrix 2007b	Presents results of indoor air monitoring in June 2007.
Draft Groundwater Long-Term Monitoring 2004 Annual Report, Palermo Wellfield Superfund Site, Tumwater, Washington	Parametrix 2005a	Presents results of semi-annual groundwater sampling conducted in 2004.
Draft Groundwater Long-Term Monitoring 2005 Annual Report, Palermo Wellfield Superfund Site, Tumwater, Washington	Parametrix 2006a	Presents results of semi-annual groundwater sampling conducted in 2005.
Draft Groundwater Long-Term Monitoring 2006 Annual Report, Palermo Wellfield Superfund Site, Tumwater, Washington	Parametrix 2007a	Presents results of semi-annual groundwater sampling conducted in 2006. Includes more extensive sampling program including wellfield wells, air stripper towers, and piezometers.

(Table Continues)

Table 6-1. Documents Reviewed (Continued)

Draft Groundwater Long-Term Monitoring 2007 Annual Report, Palermo Wellfield Superfund Site, Tumwater, Washington	Parametrix 2008	Presents results of semi-annual groundwater sampling conducted in 2007. Includes wellfield wells, air stripper towers, and historic groundwater data provided by the City of Tumwater
Quality Assurance Project Plan Addendum to the Operation and Maintenance Manual of the Treatment Lagoon, Palermo Wellfield Superfund Site	Ecology 2003a	Describes specific frequency of monitoring and sampling of the subdrain and treatment lagoon
Document	**Author and Date**	**Relevance**
Palermo Superfund Site Subdrain System and Treatment Lagoon Status Report, December 2002 and May 2003	Ecology 2003b	Presents results, conclusions, and recommendations of semi-annual sampling and monitoring of the subdrain and treatment lagoon
Palermo Superfund Site Subdrain System and Treatment Lagoon Status Report, October 2003 and May 2004	Ecology 2004	Presents results, conclusions, and recommendations of semi-annual sampling and monitoring of the subdrain and treatment lagoon
Palermo Superfund Site Subdrain System and Treatment Lagoon Status Report, September 2004 and June 2005	Ecology 2005	Presents results, conclusions, and recommendations of semi-annual sampling and monitoring of the subdrain and treatment lagoon
Palermo Superfund Site Subdrain System and Treatment Lagoon Status Report, September 2005 and June 2006	Ecology 2006	Presents results, conclusions, and recommendations of semi-annual sampling and monitoring of the subdrain and treatment lagoon
Palermo Superfund Site Subdrain System and Treatment Lagoon Status Report, November 2006 and June 2007	Ecology 2007a	Presents results, conclusions, and recommendations of semi-annual sampling and monitoring of the subdrain and treatment lagoon
Final Remedial Investigation for Palermo Wellfield Superfund Site, Tumwater, Washington	URS 1999a	Summarizes previous investigations, presents results of the remedial investigation, contamination extent, models transport of site contaminants, and describes natural attenuation of the site. Also provides human and ecological risk assessment results.
Draft Final Operations and Maintenance Plan Subdrain System and Treatment Lagoon Palermo Wellfield Superfund Site Tumwater, Washington	URS 2000	Describes operations and maintenance schedule for the subdrain and treatment lagoon

(Table Continues)

Table 6-1. Documents Reviewed (Continued)

Annual Monitoring Report, August 2002 - August 2003, Palermo Wellfield Superfund Site, Tumwater, Washington.	URS 2003	Presents results of semi-annual groundwater sampling conducted in 2002/2003.
Expert Report of Dimitri Vlassopoulos, Ph.D. U.S. v. Washington State Department of Transportation, et al.	Popadopulos 2006	Presents results of compound-specific stable isotope analyses used to assess the source and migration of VOCs in groundwater at the Site.

6.4 DATA REVIEW

This section presents generalized trends from all accessible data sources for the last five years.

6.4.1 Key Data Trends

The key data trends for the Palermo Wellfield remedy include the following:

- PCE and TCE concentrations in municipal drinking water supplied from the Palermo Wellfield: These concentrations have been below laboratory reporting limits since installation of the wellhead treatment system.
- Concentrations of both contaminants appear to be decreasing in groundwater at most sampling locations. TCE at MW-UI has shown an “up and down” trend since monitoring began in 2001. However, this location has shown a steady upward trend since 2005. TCE at MW-ES-06 has also shown varied concentration over time with a general upward trend. PCE at this location has been steadily decreasing. Groundwater TCE and PCE concentration trend plots are also included in Appendix A.
- PCE and TCE concentrations in water discharged from the treatment lagoon have been above the RGs in some samples. To allow for proper comparison at the point of compliance, Ecology established a sampling station at the discharge to the Deschutes River. Since establishment of this station in October 2003, concentrations at the compliance monitoring point have all been below the RG.
- Based on indoor air sampling results since 2004, concentrations of PCE and TCE appear to be generally decreasing over time at most sampling locations. Trend plots for TCE and PCE in indoor air are presented in Appendix D.

6.5 SUMMARY OF SITE INSPECTION

The site inspection was conducted on May 22, 2008. Attendees included the following:

- Christopher Cora, EPA
- Steve Craig, City of Tumwater
- Dan Smith, City of Tumwater
- Laura Klasner, Ecology

- Pam Marti, Ecology
- Lara Linde, Parametrix
- Scott Elkind, Parametrix

The site inspection included visits to the wellhead treatment system, the subdrain system, the treatment lagoon at the golf course, and the Southgate Dry Cleaners. Key observations made during the site inspection and discussions related to remedy operations are discussed in the following sections. The site inspection checklist is included in Appendix E.

6.5.1 Wellhead Treatment System

A brief facility tour, historical review, and operations and maintenance discussion was led by Steve Craig, Operations Manager for the City. The treatment system, well construction, air stripper towers, and wet well were included in the discussions to better understand the entire operation of the treatment system.

The treatment system appears to be in good working order and well maintained. The City indicated that as the treatment system grows in age, it requires more maintenance. The City routinely replaces valves in the stripper towers that become frozen in the winter because the valves are exposed to ambient air conditions. Ongoing upgrades to the system include installation of an air dryer to reduce the failure of these valves.

Recently the wellfield had undergone the annual maintenance program consisting of stripping granular media with ascorbic acid to remove build up, cleaning the strippers, and testing for coliform bacteria. The City would like to receive results from EPA's semi-annual sampling events.

6.5.2 Subdrain System and Treatment Lagoon

The City ensures maintenance is conducted on the treatment lagoon on an as-needed basis as specified by the O&M Plan and has replaced one of the aerators and retrieved another aerator off the lagoon bottom. A total of three aerators are present. However, only two run at a time on an oscillating cycle. The central aerator was replaced.

A sewer line replacement occurred in 2006, which did not disrupt the subdrain system. The work did add a catch basin at the intersection of Rainier Avenue and M Street.

The City relies on Ecology for visual inspections and recommendations on maintenance for the subdrain system. In the last five years, only one sediment removal event has occurred at the recommendation of Ecology and was performed by the City in 2006. The City also arranges for annual maintenance on the trails behind the wellfield.

Ecology's involvement and role in the O&M of the subdrain and treatment system is limited to sampling and recording observations. Ecology prepares annual reports of the sampling and observation but does not currently distribute the reports.

Pam Marti of Ecology pointed out that a re-evaluation of the frequency of treatment lagoon transect monitoring may be needed since the depth to the bottom of the lagoon does not appear to change. A reduction to annual monitoring was suggested.

Other issues included replacement of the project sign on the eastern side of the treatment lagoon, replacement of the survey marker for transect A-3 at the treatment lagoon, and maintenance of the vegetation between the residences on Rainier Avenue and the bluff.

6.5.3 Southgate Dry Cleaners

The land use at Southgate Dry Cleaners appears not to have changed since the treatment system was decommissioned in 2000. Infiltration of precipitation to the area of residual soil contamination is still minimized by the presence of buildings (Southgate Mall) and the paved parking lot.

6.6 SUMMARY OF INTERVIEWS

Interviews were conducted via email beginning the week of April 29 and included members of Ecology, WDOH, and City of Tumwater. Persons interviewed included:

- Steve Craig, City of Tumwater
- Dan Smith, City of Tumwater
- Scott Rose, Ecology
- Martha Maggi, Ecology
- Pam Marti, Ecology
- Laura Klasner, Ecology
- Barbara Trejo, WDOH

All but one person provided with the interview questionnaire completed and returned the form. The questions posed to the City of Tumwater, Ecology, and WDOH staff are shown in Appendix E. In addition to the email responses, additional conversations regarding site operations and issues were completed during the May 22, 2008 site inspection and are presented in Section 6.5.

6.6.1 City of Tumwater Personnel

6.6.1.1 Functionality of the Wellfield Treatment System

City staff believes the groundwater treatment system at the Palermo Wellfield is working well based on the virtual elimination of VOCs in the treated water distributed to the end users.

The City conducts weekly, monthly, semi-annual, annual, and bi-annual maintenance on the treatment system according to the O&M manual. The City also conducts preventative maintenance based on historical experience.

Overall design of the facility has led to hydraulically and pneumatically operated control valves failing seasonally, due to freezing temperatures in the winter. Replacement of the air compressor and a facility upgrade to an air dryer system has been added to protect pneumatic valves located outside.

Failures of the lagoon aerator pumps have been noted periodically and replaced in a timely manner. In the last year, two pumps have failed and one sunk to the bottom of the lagoon. The sunken aerator pump was retrieved by a dive team and placed back into operation.

6.6.1.2 Groundwater Use

Both the City's Wellhead Protection Ordinance and the Aquifer Protection Overlay are enforced. These protect groundwater and municipal water supply through prohibiting certain land uses within wellhead protection areas and within city limits. Installation of new water

wells is regulated by WDOH. When the City is informed a new well is being considered for installation, they provide comments relative to well location. Well installation is coordinated through the City of Tumwater Public Works – Water Resources Department. The City is also considering a prohibition of new well drilling city-wide. Staff believes the prohibition could benefit the Site.

6.6.1.3 Complaints or Comments from the Public

The City was contacted on two separate occasions. The first issue was regarding air quality in the area and was triggered by an EPA announcement concerning additional air quality studies in the area.

The second issue was regarding a pet bathing in the conveyance swale behind some of the homes prior to the treatment lagoon. Concerns by the resident were handled appropriately by the City with assistance from EPA.

The City has received no other comments, requests, or complaints regarding the remedy.

6.6.1.4 Other Comments and Concerns

City personnel feel it was valuable to share information and maintain current coordination with EPA on upcoming sampling events.

The City also requests notification of funding opportunities to cover ongoing operations and maintenance costs of the treatment system, subdrain, and treatment lagoon.

6.6.2 Ecology Personnel

6.6.2.1 Functionality of the Subdrain System and Treatment Lagoon

Currently Ecology provides semi-annual monitoring of the subdrain and treatment lagoon. Monitoring includes the following:

- Measurement of depth-to-water at twelve piezometers and eight clean-outs.
- Measurement of total depth at eight clean-outs and three catch basins.
- Measurement of flow rates and collection of groundwater samples from three clean-outs, three outfalls to the treatment lagoon, and three surface water stations.

Interviews conducted with Ecology personnel confirm that reduction of groundwater elevations to three feet below ground surface was not met for the two most southern homes along the west side of Rainier Avenue. Access to piezometers PZ-715 and PZ-716 are impaired due to excessive vegetation.

In 2006, the City removed sediment from the subdrain. Sediment removal returned the clean-outs to prior elevations which have since been monitored closely for sediment buildup.

6.6.2.2 Complaints or Comments from the Public

Ecology has received no comments, requests, or complaints regarding the remedy.

6.6.2.3 Deed Restrictions and Long-Term Monitoring

Ecology agrees that a deed restriction is necessary for the Southgate Dry Cleaners property to reduce the potential of PCE transfer from soils to groundwater. Ecology has submitted

comments supporting reevaluation of the monitoring network to assess plume migration and groundwater remediation. Specific comments are contained in Appendix F.

6.6.2.4 Washington State Department of Fish and Wildlife Consultation

Treatment lagoon construction criteria were provided to EPA by the Department of Fish and Wildlife. The Department of Fish and Wildlife was concerned about the height of the outfall as it affects fish passage.

6.6.2.5 Other Comments and Concerns

Ecology has had difficulty maintaining up-to-date contact information for property owners and tenants along Rainier Avenue. Contact is necessary for access for monitoring the subdrain system. In addition, during the course of monitoring the treatment lagoon, Ecology has observed thick vegetation around the survey markers. Vegetation must be removed occasionally to ensure access to markers.

Ecology would like to receive EPA groundwater sampling reports. The only EPA report on file is from 2006. During the site inspection, a discussion with Ecology regarding better transfer of information was completed. This will include groundwater reports and other data collected at the Site.

Ecology staff have concerns regarding vapor intrusion in indoor air in the Palermo neighborhood. This concern is because TCE and PCE have been detected in indoor air and the slope factor used by Ecology results in a risk greater than 1E-6. Additional concerns raised by Ecology during this five-year review are included in Appendix F.

6.6.3 WDOH Personnel

The WDOH has had a limited role in the project. By EPA's request, WDOH has been involved in the vapor intrusion evaluation and has published this evaluation in health consultation reports. The WDOH has also summarized results of the evaluations in fact sheets and letters distributed to residences which participated in air monitoring events.

Inhalation risks for some of the residences overlying the plume have a very low to low increased risk hazard, per WDOH interview questionnaire. WDOH suggests EPA consider whether the current remedies employed will reduce shallow groundwater contaminants related to the inhalation risk. WDOH reviewed a draft version of this review, their comments are included in Appendix F.

6.6.3.1 Complaints or Comments from the Public

WDOH has received no comments, requests, or complaints regarding the remedy.

6.6.3.2 Other Comments and Concerns

WDOH would like to receive periodic updates on the project and suggests clarification should be made on how the vapor intrusion pathway will be addressed. WDOH is concerned whether the monitoring network is adequate for assessing the migration of the plume and remediation of the groundwater. Additional concerns raised by Ecology and WDOH during this five-year review are included in Appendix F.

7. TECHNICAL ASSESSMENT

This section presents an assessment of the protectiveness of the remedy for the Site. There are three questions used to determine whether a remedy is protective:

- Question A – Is the remedy functioning as intended by the decision documents?
- Question B – Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?
- Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

The protectiveness of the different components of the remedy based on these three questions is discussed in the following sections.

7.1 IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS

The remedy is not fully functioning as intended by the ROD. The functionality of each component of the remedy is discussed in the following sections. In cases where a single overall action was taken to address multiple remedy components, those components have been grouped.

7.1.1 Wellhead Treatment System

The wellhead treatment system is functioning as intended by the ROD. No COCs have been detected in the treated water.

7.1.2 Subdrain System and Treatment Lagoon

The subdrain system is only partly functioning as intended by the ROD because groundwater elevations at the southern end of the drain have not been lowered by the required three feet. The treatment lagoon has functioned as intended. The following conclusions were drawn based on the results of the five-year review process:

- Since the initial round of sampling in December 2002, reduction of groundwater elevations to three feet below the ground surface has been met for the central and northern homes along the west side of Rainier Avenue. However, groundwater elevations below the two southern homes have not been reduced by the required three feet.
- Since the October 2003 sampling event, PCE and TCE concentrations have been below the remediation goals set for both PCE (0.8 μg/L) and TCE (2.7 μg/L) for surface water that discharges to the Deschutes River.

A total of five indoor air sampling events have been conducted in the Palermo Neighborhood during this five-year-review period. One TCE exceedance occurred in May 2004 and one PCE exceedance occurred in December 2004. The PCE exceedance may not have been related to a release from groundwater because samples from the same residence resulted in very low concentrations of PCE in the crawl space and living room during the same sampling event, suggesting there was a unique source of PCE in the room with the sampling equipment.

Indoor air sampling locations are shown on Figure 7-1. Indoor air sampling results are provided in Table 7-1.

Additional discussion of indoor air sampling and evaluation of results is presented in Section 7.2.2.

Table 7-1. Indoor Air Sampling Results 2001 to 2008

Home	Location	TCE (µg/m^3)							PCE (µg/m^3)						
		Mar 01[1]	Aug 01[1]	May 04	Dec 04	Jan 06	Jun 07	May 08	Mar 01[1]	Aug 01[1]	May 04	Dec 04	Jan 06	Jun 07	May 08
1	Living	-	-	0.11	0.058	-	-	-	-	-	0.57	0.13	-	-	-
	Crawl	-	-	0.028 ND	0.041	-	-	-	-	-	0.12 ND	0.12 ND	-	-	-
2	Living	-	-	0.085	0.16	-	-	-	-	-	0.2	0.17	-	-	-
	Crawl	-	-	0.1	0.14	-	-	-	-	-	0.23	0.24	-	-	-
3	Living	-	-	0.73	0.53	-	-	-	-	-	0.7	0.51	-	-	-
	Crawl	-	-	0.14	0.094	-	-	-	-	-	0.4	0.35	-	-	-
4	Living	1.0 ND	1.0 ND	0.092	0.15	-	-	-	2.1	1.8	0.96	1.0	-	-	-
	Crawl	1.0 ND	1.0 ND	0.11	0.16	-	-	-	1.0 ND	1.0 ND	0.52	0.28	-	-	-
5	Living	-	1.0 ND	0.34	0.18	-	-	-	-	1.8	1.1	0.98	-	-	-
	Crawl	-	1.0 ND	0.086	0.041	-	-	-	**-**	2.1	**6.1**	0.49	-	-	-
6	Living	1.0 ND	1.0 ND	0.032	0.39	-	-	-	1.0 ND	1.0 ND	0.5	0.42	-	-	-
	Crawl	1.0 ND	1.0 ND	-	-	-	-	-	1.0 ND	1.0 ND	1.0 ND	-	-	-	-
7	Living	1.0 ND	1.0 ND	**1.8**	0.34	**-**	**-**	**-**	1.0 ND	1.0 ND	3.5	0.12 ND	-	-	-
	Crawl	1.0 ND	1.0 ND	0.043	0.083	-	-	-	1.0 ND	1.0 ND	0.10 ND	0.11 ND	-	-	-
8	Living	**-**	**-**	**1.5**	**3.1**	0.81	0.46	-	-	-	1.2	0.34	0.66	1.5	-
	Crawl	-	-	1.1	**3.6**	0.99	0.57	-	-	-	0.13	0.83	0.12	0.086 ND	-
9	Living	**3.1**	**2.2**	0.06	1.1	0.21	-	-	1.0 ND	1.0 ND	0.12	0.71	0.10J	-	-
	Crawl	**5.6**	**4.6**	0.16	**2.7**	0.28	-	-	1.0 ND	1.0 ND	0.42	0.13	0.11 ND	-	-
10	Living	-	-	**-**	**-**	0.10	0.03	-	**-**	-	-	-	0.32	0.099 ND	-
	Crawl	-	-	**-**	**-**	0.05	0.038	-	**-**	-	-	-	0.10 ND	0.099 ND	-
11	Living	-	-	0.027	0.12	-	-	-	-	-	0.1	0.16	-	-	-
	Crawl	-	-	0.074	0.16	-	-	-	-	-	1.6	0.12 ND	-	-	-
12	Living	-	-	0.072	-	0.61	0.042	0.038	-	-	0.17	-	1.6	0.092	0.84

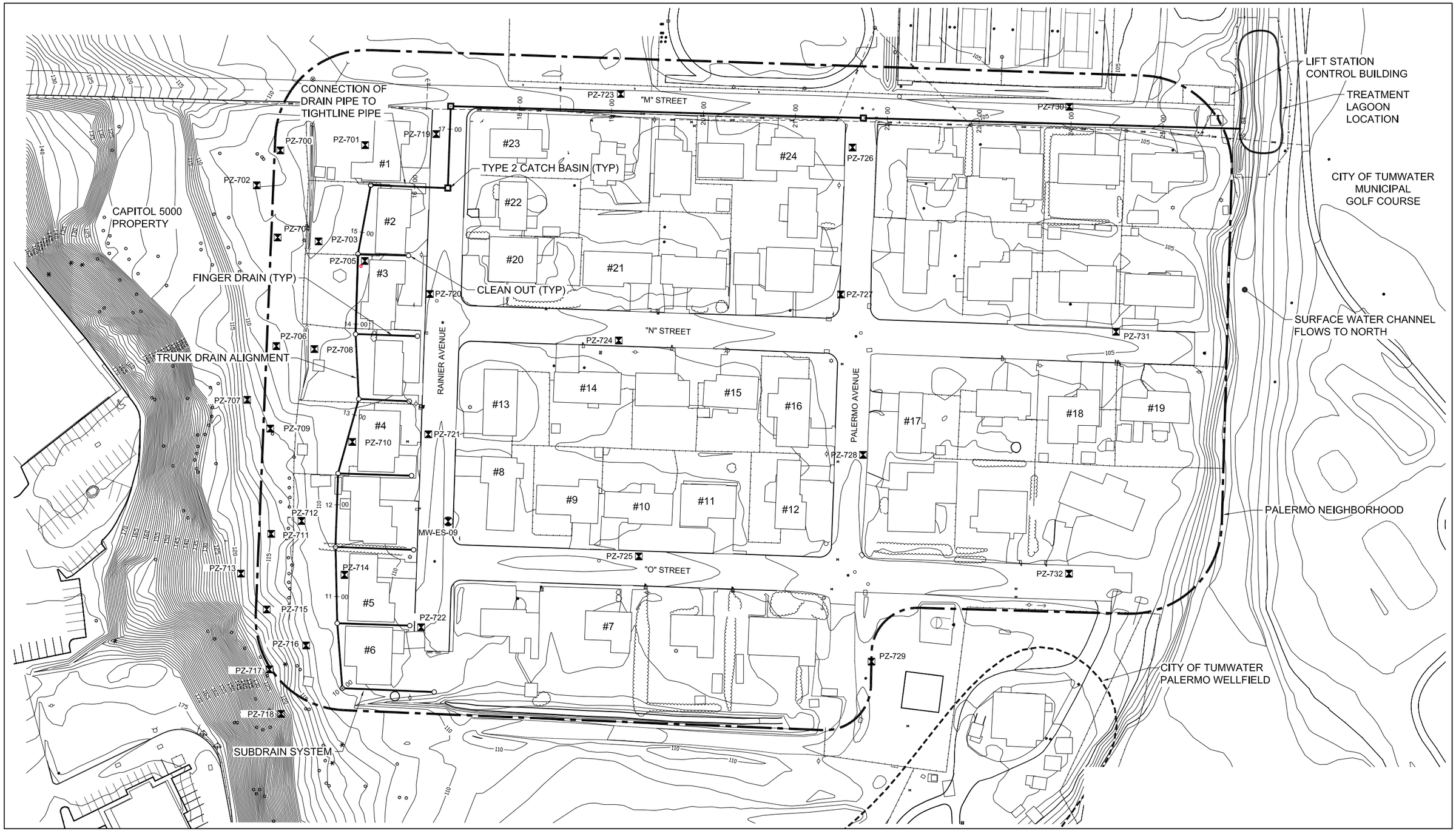
Table 7-1. Indoor Air Sampling Results 2001 to 2008

Home	Location	TCE (µg/m^3)							PCE (µg/m^3)						
		Mar 01[1]	Aug 01[1]	May 04	Dec 04	Jan 06	Jun 07	May 08	Mar 01[1]	Aug 01[1]	May 04	Dec 04	Jan 06	Jun 07	May 08
13	Living	-	-	0.16	**2.6**	0.19	0.39	0.18	-	-	0.15	0.56	0.24	0.12	0.23
	Crawl	-	-	1.4	0.98	0.86	0.56	0.54	-	-	0.38	0.87	0.35	0.14	0.13
14	Living	-	-	0.54	1	-	0.05	0.021	-	-	0.31	0.15	-	0.14	0.14
	Crawl	-	-	0.27	1.2	-	0.30	0.11	-	-	0.11 ND	0.11	-	0.091 ND	0.36
15	Living	-	-	-	-	0.2	0.097	0.080	-	-	-	-	0.39	0.11 ND	0.086
	Crawl	-	-	-	-	0.14	0.22	0.021 ND	-	-	-	-	0.17	0.10 ND	0.086
16	Living	-	-	0.5	1.4	0.81	0.47	0.13	-	-	0.11	0.14	0.28	0.099 ND	0.86
	Crawl	-	-	0.48	0.66	0.80	0.28	0.67	-	-	0.16 ND	0.12	0.16	0.088 ND	0.11
17	Living	-	-	0.043	0.087	-	-	-	-	-	0.23	0.14 ND	-	-	-
	Crawl	-	-	0.028 ND	0.094	-	-	-	-	-	0.12 ND	0.12 ND	-	-	-
18	Living	1.0 ND	1.0 ND	-	-	-	-	-	1.0 ND	1.0 ND	-	-	-	-	-
	Crawl	1.0 ND	1.0 ND	-	-	-	-	-	1.0 ND	1.0 ND	-	-	-	-	-
19	Living	-	-	0.37	0.57	-	-	-	-	-	2.4	2.3	-	-	-
	Crawl	-	-	0.035	0.034	-	-	-	-	-	0.17	0.21	-	-	-
20	Living	-	-	-	0.13	-	-	-	-	-	-	**18[2]**	**-**	**-**	**-**
	Living	-	-	0.14	0.19	-	-	-	-	-	0.11	0.49[3]	-	-	-
	Crawl	-	-	0.78	0.22	-	-	-	-	-	0.87	0.17	-	-	
21	Living	-	-	0.065	-	-	-	-	-	-	1.3	-	-	-	-
	Crawl	-	-	0.081	-	-	-	-	-	-	0.14	-	-	-	-
22	Living	-	-	0.17	0.15	-	-	-	-	-	0.16	0.14	-	-	-
	Crawl	-	-	0.033	0.11	-	-	-	-	-	0.12	0.12 ND	-	-	-
23	Living	1.0 ND	1.0 ND	0.044	0.035	-	-	-	1.0 ND	1.0 ND	0.37	0.11 ND	-	-	-
	Crawl	1.0 ND	1.0 ND	0.027	0.03	-	-	-	1.0 ND	1.0 ND	ND	0.11	-	-	-

Table 7-1. Indoor Air Sampling Results 2001 to 2008

Home	Location	TCE ($\mu g/m^3$)							PCE ($\mu g/m^3$)						
		Mar 01[1]	Aug 01[1]	May 04	Dec 04	Jan 06	Jun 07	May 08	Mar 01[1]	Aug 01[1]	May 04	Dec 04	Jan 06	Jun 07	May 08
24	Living	-	-	0.032	-	-	-	-	-	-	0.11 ND	-	-	-	-
	Crawl	-	-	0.23 ND	-	-	-	-	-	-	0.096 ND	-	-	-	-

1 Source (URS 2003). The detection limit for TCE and PCE for these samples was 1.0 $\mu g/m^3$ versus approximately 0.02 $\mu g/m^3$ and 0.4 $\mu g/m^3$ for TCE and PCE, respectively for future sampling events.
2 Sample collected from the back unit of the home.
3 Sample collected from the front unit of the home.
Bold = Exceeds ROD cleanup levels.
Crawl = crawlspace.
Living = living space.
ND = not detected above given laboratory reporting limit.
PCE = tetrachloroethylene
TCE = trichloroethylene
$\mu g/m^3$ – micrograms per cubic meter



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SCALE IN FEET

SOURCE:
QUALITY ASSURANCE PROJECT PLAN
SAMPLING AND ANALYSIS FOR O&M OF
SUBDRAIN SYSTEM (URS, 2000)

LEGEND

PIEZOMETER LOCATION

#1 INDOOR AIR SAMPLING LOCATION

Figure 7-1
Palermo Wellfield Superfund Site
Second Five-Year Review
Indoor Air Sampling Locations

7.1.3 Soil Vapor Extraction System at Southgate Dry Cleaners

The soil vapor extraction system at Southgate Dry Cleaners functioned in accordance with the ROD, but did not achieve the ROD-specified RG for PCE in soil. Confirmational soil sampling indicated PCE exceeded the ROD RG of 0.0858 mg/Kg. In accordance with the ROD, a deed restriction is required to reduce the possibility of residual PCE migrating from soil to groundwater, if soils exceed the RG. This deed restriction would likely require maintenance of the asphalt parking lot. On June 9, 2008, a title search was conducted by Pacific Northwest Title Insurance Company, Inc. The results of the title search indicated that a deed restriction is not yet in place. However, soils with contamination exceeding the RG are currently covered by asphalt, which significantly reduces the potential for PCE to migrate from soil to groundwater, and thereby complies with the intent of the deed restriction.

7.1.4 Long-Term Groundwater Monitoring

The existing monitoring network indicates that the plume is captured by the Palermo Wellfield. However, there is uncertainty as to whether the monitoring well network is adequate for monitoring variations in the aquifer. Although the results of long-term monitoring indicate that contaminants have not migrated to the downgradient monitoring well (MW-110), the current groundwater monitoring system appears inadequate for assessing the effectiveness of the wellfield in fully capturing the contaminant plume and controlling plume migration. Concentrations of COC's in groundwater remain elevated and have not significantly changed since the last five-year review.

There are limited monitoring points downgradient of the hot spot identified by monitoring wells MW-ES-09 and MW-ES-10. The current downgradient monitoring points are very shallow piezometers (approximately 10 feet below ground surface). The downgradient "sentinel" well MW-110 located at the City of Tumwater Golf Course is also shallow (approximately 38 feet below ground surface). No deeper monitoring points are currently available to determine if there is TCE in the deeper portion of the aquifer. Because of the lack of downgradient wells and deeper wells in the downgradient portion of the Site, the current vertical and horizontal extent of the downgradient plume is unknown.

The current groundwater monitoring system needs to be re-evaluated to determine the best locations of existing wells and possible new wells to better assess contaminant plume migration and remediation. A capture-zone analysis is needed to assess whether or not the contaminant plume is being fully captured and controlled by the operation of the Palermo Wellfield.

Natural attenuation is not a significant process at the Site. A review of groundwater analytical results indicate that there is little biodegradation of TCE and PCE in the plume, nor are groundwater conditions conducive for degradation of PCE or TCE. In addition, an isotope analysis of TCE and PCE in groundwater was conducted during the March 2006 long-term groundwater monitoring event. Results of the isotope analysis confirmed natural attenuation is not a significant mechanism for reducing TCE and PCE concentrations in this groundwater plume.

7.1.5 Public Notification of Contaminated Groundwater

The public notification of contaminated groundwater was completed in accordance with the ROD. A fact sheet, specifically discussing the contaminated groundwater, was mailed directly to well drillers and property owners in the area. Property owners have also received

fact sheets during the course of the investigation and remediation that provide information about all aspects of the work, including the presence of contaminated groundwater. WDOH, the City, Ecology, and WDOH have been involved in many aspects of the RI/FS and remediation work at the site and are well informed of the presence of contaminated groundwater.

7.2 ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID

Several of the assumptions used at the time of remedy selection are no longer valid or are undergoing reassessment, as discussed below. However, ultimately this Review concluded that there have been no changes that call into question the protectiveness of the remedy such that changes to the selected remedy are necessary at this time.

7.2.1 Changes to Applicable or Relevant and Appropriate Requirements (ARARs)

All the ARARs identified in the ROD were reviewed for changes that could affect the assessment of whether the remedy is protective. The following five regulations listed as ARARs had had changes that required detailed evaluation, however ultimately this Review concluded there have been no changes since the ROD that call into question the protectiveness of the remedy such that changes to the selected remedy are necessary.

- Washington State primary MCLs for groundwater
- MTCA cleanup standards in WAC 173-340-720 for groundwater
- MTCA cleanup standards in WAC 173-340-740 for soil
- MTCA cleanup standards in WAC 173-340-750 for air
- National Toxics Rule water quality standards for surface water

The indoor air cleanup values in the 1999 ROD were derived consistent with MTCA regulations. As stated in the first five-year-review report, in 2001 changes were made to the MTCA regulations (Chapter 173-340-708 WAC) related to procedures used in the 1999 ROD for calculating air cleanup values standards. The current default Ecology MTCA Method B indoor air cleanup levels for TCE and PCE are 0.022 $\mu g/m^3$ and 0.42 $\mu g/m^3$, respectively, which, relative to the ROD, represent a reduction of approximately two orders of magnitude from the 1.46 $\mu g/m^3$ RG for TCE and an order of magnitude reduction from the 4.38 $\mu g/m^3$ RG for PCE. The MTCA default cleanup level results in one-in-a-million increased chance of developing cancer. EPA's acceptable risk range is one-in-ten thousand to one-in-a million. The RG falls within EPA's acceptable range. An evaluation of the effect of this change on the protectiveness of the remedy is presented in Section 7.2.2.1.

7.2.2 Risk Assessment and Toxicology Analysis

A risk assessment and toxicology analysis was conducted based on *Comprehensive Five-Year Review Guidance, Appendix G* (EPA 2001).

The five-year review guidance indicates that the question of interest in developing the five-year review is not whether a standard identified as an ARAR in the ROD has changed in the intervening period, but whether this change to a regulation calls into question the protectiveness of the remedy. If the change in the standard would be more stringent, the next stage is to evaluate and compare the old standard and the new standard and their associated risks.

7.2.2.1 Potential Inhalation Risks

As stated in Section 7.2.1, the current Ecology MTCA Method B cleanup level for TCE is 0.022 µg/m^3. This MTCA Method B air cleanup levels represent a concentration that would be protective at a 10^{-6} excess cancer risk goal, which is the risk goal in the ROD and the State target goal under WAC 173-340-750. Current indoor air concentrations are shown in Table 7-1. Although concentrations are above the calculated MTCA Method B cleanup level in some samples, they are below remediation goals in the ROD, which are within the acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$. The slope factor utilized to calculate the cleanup level under MTCA, 0.4 per mg/kg-day, is the high end (most protective) of the slope factor range provided in *Trichloroethylene Health Risk Assessment: Synthesis and Characterization (External Review Draft*) [EPA 2001] and has until recently also been recommended for use by EPA Region 10. The inhalation slope factor used in the Final ROD in 1999 was 0.006 per mg/kg-day. Based on new scientific information, EPA Region 10 now recommends the midpoint, 0.089 per mg/kg-day, of the slope factor range in EPA 2001 be used as an interim value until EPA provides toxicity values on the Integrated Risk Information System (IRIS) database or other information becomes available to suggest a different value would be more appropriate. Ecology is considering adopting the midpoint of the slope factor range, and if this occurs, the MTCA Method B air cleanup level for TCE would be 0.098 µg/m^3.

The standard equation for calculating the MTCA Method B air cleanup level for TCE is:

Air Cleanup Level (µg/m^3) = (CR x ABW x AT x UCF) / (CPF x BR x ABS x ED x EF)

Where: CR = cancer risk level – $1x10^{-6}$ (unitless)

ABW = average body weight - 70 kilograms

AT = averaging time - 75 years

UCF = unit conversion factor - 1,000 µg/mg

CPF = cancer potency (slope) factor - 0.4 (mg/kg-d)$^{-1}$

BR = breathing rate - 20 m^3/day

ABS = inhalation absorption fraction - 1 (unitless)

ED = exposure duration - 30 years

EF = exposure frequency - 1 (unitless)

A total of five air-sampling events have been conducted in the Palermo neighborhood during this five-year review. During this period, four locations have had one or more samples exceeding the ROD RG of 1.46 µg/m^3 in indoor air for TCE and the associated 10^{-6} ROD risk goal. During the same period, all sampling locations exceeded the current MTCA Method B air cleanup level for TCE of 0.022 µg/m^3. Using the EPA interim slope factor of 0.089 per mg/kg-day, a total of 20 sampling locations have exceeded the associated MTCA Method B air cleanup level of 0.098 µg/m^3 since 2003.

Ecology currently uses a PCE cancer slope factor of 0.021 (mg/kg-d)$^{-1}$. EPA recommends using the same slope factor. EPA used a PCE cancer slope factor of 0.002 (mg/kg-d)$^{-1}$ when calculating risk in the ROD.

Since 2003, PCE exceeding 4.38 µg/m^3 has only been detected during a single sampling event in December 2004 at one location (see Figure 7-1).

7.2.2.2 Groundwater Concentration Protective of Indoor Air

At the time the ROD was approved, no indoor air sampling had been completed at the Site. The ROD-specified RGs for TCE and PCE in surface water and shallow groundwater for protection of indoor air were calculated in the FS (URS 1999b) using the Johnson and Ettinger (J&E) model assuming an acceptable indoor air inhalation risk level (10^{-6}). The calculated groundwater RGs for protection of indoor air using the J&E model are 0.027 µg/L and 0.05 µg/L for TCE and PCE, respectively.

As stated in the ROD (EPA 1999), "Because of the conservative nature of the modeling conducted to estimate indoor air concentrations of TCE and PCE, and because the resulting RGs for crawlspace water are two orders of magnitude below drinking water standards, EPA will review the appropriateness of these RGs and the methodology to assess compliance with the indoor air cleanup levels during the Five-Year Review." The RGs were reviewed during the first five-year review. At the time of the first five-year review, only two limited air sampling events had been conducted. The EPA concluded that additional evaluation was required to further assess the ROD-specified RGs for the groundwater-to-indoor-air pathway.

Since completion of the first five-year review, a total of five additional indoor air sampling events have been completed at the site for a total of seven events since the completion of the ROD. Results of the indoor air sampling are shown in Table 7-1. Based on actual air sampling analytical results, the groundwater RGs for protection of indoor air appear to be overly conservative and the J&E modeling results do not represent actual conditions.

J&E modeling was completed during the RI (URS 1999a) using in-crawlspace surface water concentrations to predict indoor air concentrations. Indoor air concentrations were predicted using both the mean and maximum TCE and PCE concentrations in crawlspace surface water.

The ROD predicted indoor air concentrations were 408 µg/m^3 and 687 µg/m^3 for TCE and PCE, respectively, using the average surface water concentrations in the crawlspaces of 19.55 µg/L for TCE and 20.25 µg/L for PCE. Assuming the maximum concentrations of 115 µg/L for TCE and 105 µg/L for PCE, the calculated indoor air concentrations were 2,400 µg/m^3 and 3,460 µg/m^3 for TCE and PCE, respectively.

Groundwater and indoor air samples were collected concurrently in June 2007 and May 2008. For the June 2007 sampling events, shallow monitoring well MW-ES-09, located near the corner of Rainier Avenue and O Street, contained TCE in groundwater at a concentration of 169 µg/L. PCE was not detected in the groundwater sample. Indoor and crawlspace air samples were collected from Home #8 (see Figure 7-1), located roughly 25 feet west of MW-ES-09. The TCE concentrations in indoor air and crawlspace air samples collected at Home #8 were 0.46 µg/m^3 and 0.57 µg/m^3, respectively. In the same general area, piezometer PZ-721 contained TCE in groundwater at 35 ug/L, while Home #13, located about 30 feet west of the piezometer, showed TCE concentrations of 0.39 µg/m^3 and 0.56 µg/m^3 in indoor air and crawlspace air, respectively.

For the May 2008 sampling event, piezometer PZ-721 contained TCE in groundwater at 87 ug/L, while Home #13 showed TCE concentrations of 0.18 µg/m^3 and 0.54 µg/m^3 in indoor air and crawlspace air, respectively.

Table 7-2 provides a comparison of modeling, groundwater, and indoor air concentrations for several sampling events.

Table 7-2. Comparison of Groundwater, Air, and Modeling Data

Well/Home	Date	Groundwater TCE Concentration (µg/L)	Air Concentration (µg/m^3)	
			Indoor	Crawlspace
J&E Model	-	20	408	-
J&E Model	-	115	2,400	-
MW-ES-09 / #8	06/07	169	0.46	0.57
PZ-720 / #3	12/04	17	0.53	0.094
PZ-721 / #13	12/04	98	2.6	0.98
	06/07	35	0.39	0.56
	05/08	87	0.18	0.54
PZ-721 / #4	12/04	98	0.15	0.16
PZ-724 / #14	12/04	39	1	1.2
PZ-728 / #16	12/04	31	1.4	0.66
	06/07	18	0.47	0.28
	05/08	14	0.13	0.67

J&E = Johnson and Ettinger
µg/L = micrograms per liter
µg/m^3 = micrograms per cubic meter

A comparison of actual air sampling results to modeled values indicates that the actual concentration of TCE from groundwater to indoor air is much less than those predicted by modeling. Therefore, the RGs from groundwater concentrations protective of air presented in the ROD appear to be overly conservative and should be reevaluated using actual indoor air sampling data.

Although the groundwater-to-indoor-air exposure pathway appears to be complete in at least some homes in the block bounded by N and O Streets and Palermo and Rainier Avenues, the concentrations entering indoor air are below cleanup levels. Continued sampling of indoor air is still warranted, particularly if groundwater concentrations in the vicinity increase.

7.2.2.3 Drinking Water Cleanup Goals for Palermo Wellfield

For TCE, the groundwater cleanup level selected in the 1999 ROD for the Palermo Wellfield drinking water is based on the Federal Drinking Water Standards MCL of 5.0 µg/L. In addition to MCLs, MTCA Method B groundwater cleanup standards in section 173-340-720 were identified as ARARs. Based on MTCA Method B and the oral cancer slope factor of 0.011 per mg/kg-day in use at the time, the risk at the MCL for TCE equated to an excess cancer risk of 1.26 x 10^{-6}, and so in accordance with section 173-340-720 (7)(b), the MCL was deemed to be sufficiently protective and was selected as the groundwater cleanup standard for the Wellfield.

However, since that time EPA and others have been re-evaluating cancer risks associated with inhalation and ingestion of TCE. The value for TCE that was originally used in remedy selection for this site has been withdrawn by EPA and a new value has yet to be included in

the IRIS database. In October 2004 the Ecology updated its guidance for calculating risk levels for TCE under MTCA to include a more protective cancer slope factor for ingestion and inhalation of TCE. The slope factor recommended in the Ecology guidance, 0.4 per mg/kg-day, is the high end (most protective) of the slope factor range provided in *Trichloroethylene Health Risk Assessment: Synthesis and Characterization (External Review Draft*) [EPA 2001] and has until recently also been recommended for use by EPA Region 10. Based on new scientific information, EPA Region 10 now recommends the midpoint, 0.089 per mg/kg-day, of the slope factor range in EPA, 2001 be used as an interim value until EPA provides toxicity values on the IRIS database or other information becomes available to suggest a different value would be more appropriate. Ecology is considering adopting the midpoint for use under MTCA .

Using the cancer potency factor of 0.4 per mg/kg-day recommended by Ecology since 2004, the MTCA Method B groundwater cleanup level that equates to an estimated excess cancer risk of $1x10^{-6}$ is 0.11 µg/L (so 1.1 µg/L would equate to $1x10^{-5}$ and 11.0 would equate to $1x10^{-4}$). Applying the slope factor of 0.4 per mg/kg-day, the risk at the MCL would be approximately $5x10^{-5}$ (and using the newly recommended slope factor of 0.089 the risk at the MCL would equate to $1x10^{-5}$), which falls within the acceptable risk range of 10^{-4} to 10^{-6} so based on NCP requirements, cleanup to that standard remains protective. However, if a slope factor is used or adopted that is more protective than the one available at the time of the ROD there is some question whether cleanup to the MCL would meet ARARs (specifically the MTCA Method B requirements for cleanup levels based on applicable laws such as MCLs to be adjusted downward if they pose excess cancer risk greater than 1×10^{-5} or an HI greater than 1, and for site cleanup goals not to exceed a cumulative excess cancer risk for all contaminants of $1x10^{-5}$), the time to achieve cleanup goals could be longer than currently anticipated, and the air pathway may also warrant reconsideration.

EPA expects to complete its own review of the carcinogenicity of TCE by late 2010. Given these uncertainties, EPA has determined no changes in cleanup levels or RAOs are warranted at this time, however the remedy should continue to operate and the TCE cleanup goals should be re-evaluated for protectiveness and compliance with ARARs when TCE toxicity values are published in IRIS or before the next five-year review, whichever is sooner.

7.2.3 Institutional Control Assessment

An assessment of institutional controls (IC) was conducted in accordance with draft *Supplement to the Comprehensive Five-Year Review Guidance: Evaluation of Institutional Controls* (EPA 2005).

The results of the June 2008 title search show no current deed restrictions on the Southgate Dry Cleaners property. The PCE slope factor has been lowered one order of magnitude from when the remedy was selected; this does not affect the RAO for the IC.

7.2.4 Progress of Remedy

The remedy is not progressing as expected. The ROD states drinking water standards will be met within five to thirty years. Since wellhead treatment system start-up in 1999, there has been no substantial decrease in concentrations at the “hot spot” in the area of MW-ES-09/MW-ES-10. These wells are located in the Palermo neighborhood within 600 feet of the wellhead treatment system. Since the treatment system start-up in 1999, the monitoring well nearest to the treatment system with the highest TCE concentration (MW-ES-09) has shown a decrease in concentration, from approximately 210 µg/L in 1999 to 160 µg/L in 2007.

The subdrain has not lowered groundwater in the southern section of the drain system the required three feet.

As stated in Section 7.1.4, natural attenuation is not a mechanism for significantly reducing TCE and PCE concentration in groundwater, as assumed in the ROD. Therefore, the restoration of groundwater shall not occur within five to thirty years as predicted by the ROD.

7.2.5 Validity of Assumptions for Remedy Components

This section discusses the validity of the ROD assumptions related to exposure, toxicity data, cleanup levels, and RAOs for each of the remedy components.

7.2.5.1 Wellhead Treatment System

The ROD exposure assumptions, toxicity data, cleanup levels, and RAOs related to this remedy component are still valid. However, operation of the Palermo Wellfield may not be completely capturing shallow contaminated groundwater as assumed by the ROD.

7.2.5.2 Subdrain System and Treatment Lagoon

The ROD exposure assumptions, toxicity data, cleanup levels, and RAOs related to this remedy component are still valid. See Section 7.2.2 for a more detailed discussion of the TCE cancer slope factor and the RG for groundwater-to-indoor-air pathway.

In 2006 the EPA National Recommended Water Quality Criteria for Priority Toxic Pollutants were changed to 0.69 µg/L for PCE and 2.5 µg/L for TCE. The 1999 ROD remediation goals for surface water were 0.8 µg/L for PCE and 2.7 µg/L for TCE. Since 2006, PCE and TCE concentrations at Deschutes River (Station 364) have been below the revise water quality criteria.

7.2.5.3 Soil Vapor Extraction System at Southgate Dry Cleaners

ROD assumptions related to this remedy component are still valid.

7.2.5.4 Long-Term Groundwater Monitoring

The ROD exposure assumptions, toxicity data, cleanup levels, and RAOs applicable to this remedy component are still valid.

7.3 HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY

Yes, new information has come to light since the last five-year review.

There remains uncertainty about the toxicity of TCE that raises questions about whether the Remedial Action Objective of reducing risks below the $1x10^{-6}$ carcinogenic risk level has been fully achieved in indoor air. The highest detected TCE values in the most recent indoor air sampling (0.1) are more than an order of magnitude below the TCE cleanup goal of 1.46 $\mu g/m^3$ selected in the ROD, which was based on the California EPA slope factors that EPA was relying upon at that time (there has been no cancer potency value in IRIS since 1989). The State of Washington recommends use of a cancer slope factor approximately two orders of magnitude higher than the value used in the ROD. This results in a more conservative indoor air cleanup value. The risk posed by the current exposure to TCE in indoor air still

falls within EPA's acceptable risk range of 10^{-4} to 10^{-6}. Based on this, not only is this element of the remedy functioning as intended, but cleanup goals for indoor air have been met.

Since the adoption of the ROD, however, EPA has been re-evaluating the TCE cancer risk in light of concerns that TCE may pose greater risks than previously estimated. The State of Washington has chosen to adopt a more conservative cancer slope factor, which suggests the excess risk from exposure to the highest measured values could pose a risk of approximately 10-5, which is greater than the RAO of 10^{-6}, though still within the of 10^{-4} to 10^{-6} range EPA typically uses to manage risks.. There is also some question whether non-carcinogenic risk at a level of 1.46 could exceed EPA's general risk management goal of a hazard quotient of less than 1. After evaluating the various scientific studies and issues, EPA Region 10's Office of Environmental Assessment has recently issued an opinion to the Office of Environmental Cleanup that at least until these uncertainties are resolved, a conservative approach should be taken to evaluating and managing TCE risk, suggesting that the Cal EPA slope factor be adjusted downward by at least a factor of 10 to ensure protectiveness. Given these uncertainties, indoor air monitoring should be continued and the TCE cleanup goals should be re-evaluated once a final cancer slope factor is selected, or at the next five-year review to ensure the remedy remains protective.

In addition to uncertainty regarding the appropriate TCE cancer slope factor, several remedy components may not be fully protective. Potential issues related to the protectiveness of the remedy are discussed in the following sections.

7.3.1.1 Wellhead Treatment System

No new information has come to light that could impact the protectiveness of this remedy component.

7.3.1.2 Subdrain System and Treatment Lagoon

No new information has come to light that could impact the protectiveness of this remedy component.

7.3.1.3 Soil Vapor Extraction System at Southgate Dry Cleaners

No new information has come to light that could impact the protectiveness of this remedy component.

7.3.1.4 Long-Term Groundwater Monitoring

The results of long-term groundwater monitoring results show that contaminated groundwater may not be completely captured by the Palermo Wellfield extraction wells. TCE may be bypassing the wellfield and potentially impacting the Deschutes River.

In 2006, EPA conducted isotope analysis of TCE and PCE in groundwater at the site, as well as evaluation of groundwater chemical analysis. The analysis indicated natural attenuation is not a significant process at the Site as assumed in the ROD. Because only limited natural attenuation is occurring at the Site, the TCE throughout the plume will not be degraded as fast as assumed. Therefore, the restoration of groundwater will not occur within five to thirty years, as predicted by the ROD.

As discussed in Section 7.1.4, natural attenuation is not a significant mechanism for reducing TCE and PCE concentration in groundwater as assumed in the ROD. Therefore, the concentration of TCE in groundwater is not being reduced at the rate assumed in the ROD.

The spatial distribution of the TCE plume is currently not fully understood. As discussed in Section 7.1.4, because of the lack of downgradient wells and deeper wells in the downgradient portion of the site, the current vertical and horizontal extent of the TCE plume is not known.

7.4 TECHNICAL ASSESSMENT SUMMARY

According to the data reviewed, the site inspection, and the interviews, the remedy is not completely functioning as intended.

7.4.1 Wellhead Treatment System

The wellhead treatment system is functioning as intended by the ROD.

7.4.2 Subdrain System and Treatment Lagoon

The subdrain system and treatment lagoon are only partly functioning as envisioned by the ROD. However, it appears this remedy component is protective. Reduction of groundwater elevations to three feet below ground surface has not been met for the two most southern residences along the west side of Rainier Avenue. Air sampling results have shown TCE and/or PCE concentrations exceeding ROD levels at various locations in the area of the Rainier Avenue and O Street (see Section 7.1.2). However, since 2004, no air samples have exceeded the ROD values for TCE or PCE.

Although the groundwater–to-indoor-air exposure pathway appears to be complete in at least some homes in the block bounded by N and O Streets and Palermo and Rainier Avenues, the concentrations entering indoor air appear to be generally decreasing over time. Because the national toxicological assessment of TCE is in flux, estimated risks to residents will be reevaluated when this is resolved. Periodic sampling of indoor air is warranted, particularly if groundwater concentrations in the vicinity increase.

The ROD-required RG for groundwater-to-indoor-air pathway is not supported by on-site data. A comparison of actual air sampling results to modeled values indicates that the actual concentration of TCE from groundwater to indoor air is much less than those predicted by modeling. Therefore, the RGs from groundwater concentrations protective of air presented in the ROD appear to be overly conservative and not representative of actual site conditions. As such, the ROD-required reduction of groundwater elevations to three feet below ground surface (18-inches below the crawlspace) may not be necessary.

7.4.3 Soil Vapor Extraction System at Southgate Dry Cleaners

The soil vapor extraction system at Southgate Dry Cleaners functioned in accordance with the ROD. Confirmation soil samples indicated that some PCE remains in soil at concentrations exceeding the RG. In accordance with the ROD, a deed restriction is required to reduce the probability of residual PCE from leaching from soil to groundwater. The deed restriction is not yet in place, so currently the remedy is not completely protective in the long-term. However, the soil contamination is currently covered by asphalt, which reduces the potential for PCE migrating from soil to groundwater and provides short-term protectiveness. The current asphalt cover achieves the same intent as the deed restriction.

7.4.4 Long-Term Groundwater Monitoring

Long-term groundwater monitoring is functioning as intended by the ROD, and in the short term, is protective. However, the existing groundwater monitoring system may not be adequate for assessing the overall effectiveness of the remedy because the monitoring network may not be optimized for the hydrologic conditions. There is the potential that gaps in the monitoring well network may result in contaminated groundwater not being captured by the Palermo Wellfield nor being detected in downgradient wells. Isotope analysis of TCE and PCE in groundwater at the Site, as well as evaluation of groundwater chemical analysis, indicate natural attenuation is not a significant process at the Site as assumed in the ROD. Therefore, the restoration of groundwater will not occur within five to thirty years as predicted by the ROD.

7.4.5 Public Notification of Contaminated Groundwater

The public notification of contaminated groundwater was completed in accordance with the ROD.

8. ISSUES

Table 8-1 lists the issues that were identified during the second five-year review that appear to have the potential to impact the protectiveness of the remedy.

Table 8-1. Issues Identified During Five-Year Review Process

Issue	Affects Protectiveness?	
	Current	Future
Natural attenuation is not a significant process at the Site, so it appears the restoration timeframe in the ROD will not be met with the selected remedy.	No	Yes
The deed restriction for Southgate Dry Cleaners and the transfer of personal property and easements for monitoring has not been completed.	No	Yes
Warning signs are missing at the treatment lagoon.	Yes	Yes
The effectiveness of Palermo Wellfield operation at capturing and controlling contaminant migration requires further evaluation.	No	Yes
The adequacy of the groundwater monitoring system requires further evaluation.	No	Yes
The remediation goal for groundwater to protect against inhalation risk is unsupportable based on indoor air monitoring results.	No	No

9. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 9-1 lists the recommendations and follow-up actions for each of the issues listed in Table 8-1, together with other recommendations that do not necessarily affect the protectiveness of the remedy.

Table 9-1. Recommendations and Follow-up Actions

Recommendation/Follow-up Action	Responsible Party	Milestone Date	Affects Protectiveness?	
			Current	Future
Prepare and record a deed restriction at Southgate Dry Cleaners or sample SVE treated soil to determine whether actual soil concentrations require an Institutional Control.	EPA	10/2010	No	Yes
Install a warning sign on the fencing along the western side of the lagoon.	Ecology	12/2008	Yes	Yes
Re-establish access to piezometers PZ-704, PZ-709, and PZ-715, which are located on the wooded Palermo bluff.	Ecology	10/2008	No	No
Conduct a capture zone analysis to assess whether or not the TCE plume is being fully captured by the operation of the Palermo Wellfield. Analysis shall assess the vertical distribution of contaminants within the aquifer. Complete an ESD or ROD amendment as appropriate.	EPA	10/2010	No	Yes
Evaluate the groundwater monitoring system to assess if existing wells are adequate for monitoring plume migration and remediation and to determine if additional monitoring points are required in the downgradient portion of the Site.	EPA	10/2010	No	Yes
Re-evaluate the conceptual site model and Remedial Action Objectives (RAOs) since natural attenuation is not a significant process for reducing TCE and PCE concentrations in groundwater. Complete an ESD or ROD amendment as appropriate.	EPA	10/2010	No	Yes
Continue indoor air monitoring to insure concentrations remain below 1.46 $\mu g/m^3$.	EPA	ongoing	No	Yes
Re-evaluate the RG for the groundwater-to-indoor-air pathway.	EPA	10/2010	No	No

The following items do not affect protectiveness, but are documented to provide follow-up on:

- Enhance Data sharing between EPA, Department of Ecology, and City of Tumwater
- Clear vegetation around piezometers along the bluff above the neighborhood
- Complete personal property and easement transfers for the subdrain system, lagoon, piezometers, and wellhead treatment system
- Re-evaluate the frequency of treatment lagoon transect monitoring

- Replace the west survey marker for cross-section A3 at the north end of the lagoon

10. PROTECTIVENESS STATEMENT

A protectiveness determination cannot be made at this time for the Palermo Wellfield site until further information is obtained. Further information will be obtained by re-evaluating the groundwater monitoring system, adding monitoring locations if necessary, conducting a capture zone analysis, and re-evaluating the conceptual site model and ability of the selected remedy to achieve remedial action objectives, including aquifer restoration. It is expected that these actions will take approximately 24 months to complete, at which time a protectiveness determination will be made.

Human Exposure Environmental Indicator Status for the Palermo Site remains "Insufficient Data" because of the need to collect and analyze more indoor air and groundwater data, which is scheduled to happen over the next *24* months.

Groundwater Migration Environmental Indicator Status for the Palermo site remains "Insufficient Data to Make a Determination" because the groundwater monitoring network may be inadequate to monitor plume migration. Additional monitoring and a capture zone analysis is scheduled to be done over the next *24* months.

11. NEXT REVIEW

The next five-year review for the Palermo Wellfield Superfund Site is scheduled to be completed five years from the date of this review, September 30, 2013.

A Five-Year Review Addendum shall be done within 24 months to address the deferral of the protectiveness statement.

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APPENDIX A

Groundwater Sampling Results

APPENDIX A IS CONTAINED IN A SEPARATE FOLDER

APPENDIX B

Ecology Subdrain Status Reports

APPENDIX B IS CONTAINED IN A SEPARATE FOLDER

APPENDIX C

Title Search Results

Order No. 144952

MISCELLANEOUS GUARANTEE

PACIFIC NORTHWEST TITLE INSURANCE COMPANY, INC.

GUARANTEE

SUBJECT TO THE EXCLUSIONS FROM COVERAGE, THE LIMITS OF LIABILITY AND OTHER PROVISIONS OF THE CONDITIONS AND STIPULATIONS, HERETO ANNEXED AND MADE A PART OF THIS GUARANTEE, AND SUBJECT TO THE FURTHER EXCLUSION AND LIMITATION THAT NO GUARANTEE IS GIVEN NOR LIABILITY ASSUMED WITH RESPECT TO THE IDENTITY OF ANY PARTY NAMED OR REFERRED TO IN SCHEDULE A OR WITH RESPECT TO THE VALIDITY, LEGAL EFFECT OR PRIORITY OF ANY MATTER SHOWN THEREIN.

Pacific Northwest Title Insurance Company, Inc.
a Washington corporation, herein called the Company,

GUARANTEES

the Assured named in Schedule A against actual monetary loss or damage not exceeding the liability amount stated in Schedule A which the Assured shall sustain by reason of any incorrectness in the assurances set forth in Schedule A.

Dated: June 9, 2008

Please note carefully the liability exclusions and limitations and the specific assurances afforded by this guarantee. If you wish additional liability, or assurances other than as contained herein, please contact the company for further information as to the availability and cost.

PACIFIC NORTHWEST TITLE
Insurance Company, Inc.

PACIFIC NORTHWEST TITLE INSURANCE COMPANY, INC. CORPORATE SEAL 1925 WASHINGTON

President

Countersigned by:

Authorized Signatory Jody Coots SK

Company Thurston County Title Company
105 East 8th
Olympia WA 98501

City, State (360) 943-7300 FAX (360) 786-9315

G-1103-7639

SUBDIVISION GUARANTEE

SCHEDULE A

Office File Number	Policy Number	Date of Policy	Amount of Insurance
144952	**G-1103-7639**	**June 9, 2008 at 8:00 a.m.**	**$1,000.00**

Name of Assured:

PARAMETRIX

The assurances referred to on the face page are:

That, according to those public records which, constructive notice of matters relative to the description of which is fully set forth in under the recording laws, impart following described real property:

See Exhibit A attached hereto and made a part hereof.

Title to said real property is vested in:

SOUTHGATE DEVELOPMENT COMPANY, INC., a Washington corporation

Subject to the matters shown below under Exceptions, which Exceptions are not necessarily shown in the order of their priority.

EXCEPTIONS:

1. General Taxes and assessments, if any, no search having been made thereof; also, taxes or assessments which are not shown as existing liens by the records of any taxing authority that levies taxes or assessments on real property or by the public records.

2. Unpatented mining claims, reservations or exceptions in the United States Patents or in Acts authorizing the issuance thereof; water rights, claims or title to water.

3. Title to any property beyond the lines of the real property expressly described herein, or title to streets, roads, avenues, lanes, ways or waterways on which such real property abuts, or the right to maintain therein vaults, tunnels, ramps, or any other structure or improvement; or any rights or easements therein unless such property, rights or easements are expressly and specifically set forth in said description.

SCHEDULE A (Continued)

File Number: 144952 Policy Number: G-1103-7639

Additional Exceptions:

4. Lease affecting the premises hereinafter stated upon and subject to all the provisions therein contained.

Lessor:	Washington Natural Gas
Lessee:	Jin Soo Na
Dated:	September 26, 1989
Recorded:	October 31, 1989
Recording No.:	8910310123
For a term of:	60 Months
Affects:	Said premises

5. Deed of Trust dated October 31, 1997, recorded October 31, 1997 under File No. 3117870, to secure an indebtedness of $1,400,000.00; and any interest, advances or other obligations secured thereby;

Grantor:	David Gubbe and Marjorie Mae Gubbe, husband and wife, as to Parcel 1 and Parcel 2; Southgate Development Company, Inc., a Washington corporation, as to Parcel 3 and Parcel 4
Trustee:	First American Title Insurance Company
Beneficiary:	First Community Bank of Washington

(Affects this and other property)

6. Unrecorded lease dated December 11, 1997, constructive notice of which is given by recital in Subordination and Non-Disturbance Agreement,

Recorded:	January 22, 1998
Recording Nos.:	3131205 and 3131206
Lessor:	Foodmaker, Inc., a Delaware corporation
Lessee:	David Gubbe and Marjorie Mae Gubbe, husband and wife, Landlord

Said lease was made second and subordinate to Deed of Trust shown in Paragraph 5 by Subordination and Non-Disturbance Agreement recorded January 22, 1998 under Auditor's File Nos. 3131205 and 3131206.

7. Financing statement filed April 7, 2004 under File No. 3630868, records of Thurston County, Washington;

Debtor:	Southgate Dry Cleaners, Inc.
Secured Party:	Summit Leasing, Inc.
Covers:	Said premises

8. Unrecorded leaseholds, if any.

SCHEDULE A (Continued)

File Number: **144952** Policy Number: **G-1103-7639**

9. Restrictions affecting Parcel A in deed recorded under File No. 929281:

   a) Building set back of 35 feet from Capitol Boulevard.

   b) Type of business to be conducted upon premises is subject to approval of Southgate Development Company.

   c) Right of first refusal is reserved by Southgate Development Company when premises are sold.

10. Reservation of right of ingress and egress for repair and maintenance of pipe line over this and other property, with covenant to bear equal share of cost therefor with other owners, made by D.E. Turner and wife, in deed dated April 23, 1945 and recorded under Auditor's File No. 393341. (Affects Parcel A)

11. Easement for electric transmission and distribution line, etc., together with necessary appurtenances, granted by instrument recorded on January 10, 1961 under File No. 636971, to Puget Sound Power and Light Company. (Affects a portion of Parcel B and is in lieu of easement recorded October 14, 1960 under File No. 633858. (Affects Parcel C)

12. Terms and conditions of a non-exclusive easement to the Common Parking and Easement Agreement between Lawrence C. Vatne and Ruth E. Vatne, husband and wife, and Arthur Vatne and Carrie Vatne, husband and wife, and Clarence W. Vatne and Lottie L. Vatne, husband and wife, and C.E. Loveless and Joan E. Loveless, husband and wife, recorded February 2, 1962 under File No. 654145 and as modified by instrument recorded February 2, 1962 under File No. 654146, providing for parking facilities, water, storm and sanitary sewer lines located in accordance with good engineering practices. (Affects Parcel B)

13. Rights in easement to lay, maintain and operate, etc., a pipeline granted to D.E. Turner and E. Ralston, Co-partners under the firm name and style of "Bush Prairie Water Users Association", dated May 5, 1928 and recorded in Volume 132 of Deeds, page 20.

14. Easement for 6 inch sewer line as granted in instrument recorded April 5, 1963 under File No. 676081. (Affects Parcel B)

15. Easement for sewer, six feet in width of unspecified location, as granted in instrument recorded December 11, 1967 under File No. 772981. (Affects Parcel B)

16. Easement for electric transmission and distribution line, etc., together with necessary appurtenances, granted by instrument recorded on November 29, 1971 under File No. 855562, to Puget Sound Power and Light Company, a Washington corporation. (Affects Parcel C)

17. Relinquishment of all existing, future and potential easements for access, light, view and air, and all rights of ingress, egress and regress to, from and between said premises and the highway or highways to be constructed on lands conveyed by Deed dated March 1, 1955 under File No. 543428 to the State of Washington and by condemnation proceeding, Thurston County Superior Court Cause No. 84-2-00939-7. (Affects Parcel C)

18. No Structure permitted within 50 feet of Primary State Highway No. 1 right of way. (Affects Parcel C)

SCHEDULE A (Continued)

File Number: 144952 Policy Number: G-1103-7639

19. Easement affecting a portion of said premises and for the purposes hereinafter stated, as granted by instrument record on September 13, 1985 under File No. 8509130016, in favor of Puget Sound Power and Light Company, a Washington corporation, for lines of telephone or telegraph or other signal or communication circuits, consisting of such underground conduits, cables, etc., and appurtenances thereto, as the grantee may from time to time require. (Affects Parcel B)

20. Terms and conditions of Settlement Agreement, Release of all Claims, and Covenant as recorded April 13, 1995 under Auditor's File No. 9504130127.

    Addendum to Settlement Agreement, Release of all Claims, and Covenant as recorded April 13, 1995 under Auditor's File No. 9504130128.

21. Sanitary Sewer Extension Agreement, by and between Bobby R. Frye and City of Tumwater, recorded on May 17, 1999 under File No. 3231107, which contains provisions for the collection of latecomers fees due upon hookup to said system.

End of Schedule A Exceptions.

NOTES:

a) At the request of the assured the following information is provided:

Last half of general taxes for 2008 in the sum of $2,304.55. Tax Account No. 0908-00-49000. (Area Code 440/Excise Tax Rate 1.78%) (Affects Parcel A)

Last half of general taxes for 2008 in the sum of $3,302.66. Tax Account No. 0908-00-36000. (Area Code 440/Excise Tax Rate 1.78%) (Affects Parcel B)

Last half of general taxes for 2008 in the sum of $5,934.77. Tax Account No. 0908-00-37000. (Area Code 440/Excise Tax Rate 1.78%) (Affects Parcel C)

Last half of general taxes for 2008 in the sum of $82.08. Tax Account No. 9900-02-17800. (Area Code 440/Excise Tax Rate 1.78%) (Affects personal property)

Last half of general taxes for 2008 in the sum of $457.56. Tax Account No. 9900-08-50000. (Area Code 440/Excise Tax Rate 1.78%) (Affects personal property)

Last half of general taxes for 2008 in the sum of $133.72. Tax Account No. 9900-19-68600. (Area Code 440/Excise Tax Rate 1.78%) (Affects personal property)

General taxes for 2008 in the sum of $215.55, are paid in full. Tax Account No. 9900-13-17500. (Area Code 440/Excise Tax Rate 1.78%) (Affects personal property)

General taxes for 2008 in the sum of $92.68, are paid in full. Tax Account No. 9900-19-27500. (Area Code 440/Excise Tax Rate 1.78%)
(Affects personal property)

General taxes for 2008 in the sum of $70.93, are paid in full. Tax Account No. 9900-13-93100. (Area Code 440/Excise Tax Rate 1.78%)
(Affects personal property)

According to the Thurston County Treasurer tax rolls there are no taxes due and owing for 2008. Tax Account Nos. 9900-20-85155, 9900-14-51000 and 9900-20-79369.
(Affects personal property)

b) The address of the subject property is:

5115 CAPITOL BLVD S
TUMWATER, WA 98501
(Affects Parcel A)

5211 CAPITOL BLVD S
TUMWATER, WA 98501
(Affects Parcel B)

5203 CAPITOL BLVD S
TUMWATER, WA 98501
(Affects Parcel C)

5141 CAPITOL BLVD S
TUMWATER, WA 98501
(Affects personal property)

c) According to the records of Thurston County Assessor, the current value of said premises is as follows:

Tax Account No.:		0908-00-49000
Land:	$	197,900.00
Improvements:	$	259,500.00
Total:	$	457,400.00
(Affects Parcel A)		

Tax Account No.:		0908-00-36000
Land:	$	352,300.00
Improvements:	$	303,500.00
Total:	$	655,800.00
(Affects Parcel B)		

SCHEDULE A (Continued)

Tax Account No.:		0908-00-37000
Land:	$	360,850.00
Improvements:	$	818,200.00
Total:	$	1,179,050.00
(Affects Parcel C)		

Tax Account No.:		9900-02-17800
Land:	$	0.00
Improvements:	$	13,052.00
Total:	$	13,052.00
(Affects personal property)		

Tax Account No.:		9900-08-50000
Land:	$	0.00
Improvements:	$	105,961.00
Total:	$	105,961.00
(Affects personal property)		

Tax Account No.:		9900-19-68600
Land:	$	0.00
Improvements:	$	26,582.00
Total:	$	26,582.00
(Affects personal property)		

Tax Account No.:		9900-13-17500
Land:	$	0.00
Improvements:	$	21,424.00
Total:	$	21,424.00
(Affects personal property)		

Tax Account No.:		9900-19-27500
Land:	$	0.00
Improvements:	$	7,369.00
Total:	$	7,369.00
(Affects personal property)		

Tax Account No.:		9900-13-93100
Land:	$	0.00
Improvements:	$	7,050.00
Total:	$	7,050.00
(Affects personal property)		

Tax Account No.:		9900-20-85155
Land:	$	0.00
Improvements:	$	0.00
Total:	$	0.00
(Affects personal property)		

Tax Account No.:		9900-14-51000
Land:	$	0.00
Improvements:	$	4,115.00
Total:	$	4,115.00
(Affects personal property)		

Tax Account No.:		9900-20-79369
Land:	$	0.00
Improvements:	$	0.00
Total:	$	0.00
(Affects personal property)		

d) The following abbreviated legal description is provided as a courtesy to enable the document preparer to conform with the requirements of RCW 65.04.045, pertaining to standardization of recorded documents.

Abbreviated Legal Description: Ptn Barnes DLC No. 65 34-18-2W

Restrs/attd
JC/smw & asm

Exhibit A

PARCEL A

That part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described as follows:

Beginning at the intersection of the Westerly line of Capitol Boulevard, as it existed on March 30, 1962, with the North line of the South 487.87 feet of said Barnes Claim; running thence North 17° 30' West along said Westerly line of Capitol Boulevard 80 feet; thence South 80° West 200 feet, South 17° 30' East 80 feet and North 80° East 200 feet to the point of beginning. EXCEPTING THEREFROM Capitol Boulevard as widened.

PARCEL B

That part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described as follows:

Beginning at a point 182.4 feet North of a point on the South line of said Barnes Claim North 89° 57' West 743.63 feet as measured along said South line from the East line of Section 34, said Township and Range; running thence West 71 feet, North 125 feet, west 28.47 feet, North 21° 40' East 122.95 feet, North 80° East 97.69 feet, 17° 30' West 15 feet and North 80° East 200 feet, more or less, to the Westerly line of Capitol Boulevard; thence Southeasterly along said Westerly line of Capitol Boulevard; 80 feet, more or less; thence South 80° West 262.18 feet, more or less, and South 183.44 feet to the point of beginning. TOGETHERWITH an non-exclusive easement to that part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described as follows:

Beginning at a point on the South line of said Barnes Claim, North 89° 57' West 807.95 feet as measured along said South line from the East line of Section 34, said township and range; running thence North 89° 57' West along said South line 30 feet; thence North 0° 45' East 182.33 feet, East 60 feet, South 0° 45' West 30 feet, West 30 feet and South 0° 45' West 152.35 feet to the point of beginning; EXCEPTING THEREFROM Trosper Road along the South boundary.
ALSO EXCEPTING Capitol Boulevard as widened.

PARCEL C

That part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described on April 1, 1955 as follows:

Beginning at a point on the South line of said Barnes Claim, East 1,076.65 feet from the intersection of the Easterly line of the right of way conveyed to The Portland and Puget Sound Railroad Company by deed dated September 5, 1890 and recorded in Volume 23 of Deeds, page 411, with said South line of Claim; running thence North 175 feet, more or less, to the initial point of this description; thence East 495.7 feet, more or less, to the Northeast corner of tract conveyed to Irene M. Simons by deed dated in May, 1945 and recorded in Volume 193 of Deeds, page 555; thence Southerly along the Easterly line of said Simons tract 57 feet, more or less, to the Northwest corner of tract sold under contract to Lawrence C. Vatne and wife, dated January 1, 1955, and recorded under File No. 544168; thence along the boundary of said Vatne Tract East 145 feet, more or less, Southeasterly 20 feet and East 55 feet, more or less, to the Northeast corner thereof; thence Northwesterly along the Westerly line of Old Pacific Highway 318 feet, more or less, to the Southeast corner of tract conveyed to John Golmer Brower and wife by deed dated December 11, 1945 and recorded in Volume 205 of Deeds, page 361; thence Southwesterly along the Southerly line of said Brower Tract 200 feet to the Southwest corner thereof; thence Northwesterly parallel with said highway 160 feet; thence Southwesterly parallel

with said Southerly line of Brower Tract 363 feet, more or less; thence South 274.1 feet, more or less to the point of beginning.

ALSO, that part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described as follows:

Beginning at a point on the Westerly line of Capitol Boulevard, described as being South 69° 02' 50" West 743.26 feet, more or less, and Southeasterly 590.61 feet from the East quarter corner of Section 34, said township and range, and being the Northeasterly corner of tract conveyed to John Golmer and wife, by deed dated December 11, 1945 and recorded under File No. 406259; thence South 17° 30' East along said Westerly line of Capitol Boulevard 80 feet to the Southeasterly corner of said Brower Tract; thence along the boundary of said Brower Tract, South 80° West 200 feet, North 17° 30' West 80 feet and North 80° East 200 feet to the point of beginning.

ALSO, that part of the Barnes Donation Claim No. 65 in Township 18 North, Range 2 West, W.M., described as follows:

Beginning at a point on the South line of said Barnes Donation Claim which is South 89° 57' East 1,322.9 feet from the intersection of said South line with the Easterly right of way line conveyed to The Portland and Puget Sound Railway Company by deed dated September 5, 1890, recorded in Volume 23 of deeds, page 411, which point also bears North 89° 57' West 837.95 feet along the South line of said claim from its Southeast corner; thence North 0° 45' East 182.33 feet; thence East 60 feet, more or less, to the Northwest corner of tract conveyed to Samuel R. Hall and wife, by deed dated November 20, 1945 recorded under File No. 399955; thence South 0° 45' West along West line said Hall Tract and said line extended 182.38 feet to the South line of said claim; thence North 89° 57' West 60 feet, more or less, to the point of beginning.

ALSO, that part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., as described as follows:

Beginning at a point North 1° 36' 40" West 152.59 feet from a point on the South line of said Barnes Claim, North 89° 57' West 590.44 feet from its Southeast corner on the East line of Section 34, said township and range; running thence North 1° 36' 40" West 30.01 feet, West 180 feet, South 0° 45' West 30 feet and East 181.24 feet to the point of beginning.

ALSO, that part of Barnes Donation Claim 65, Township 18 North, Range 2 West, W.M., described as follows:

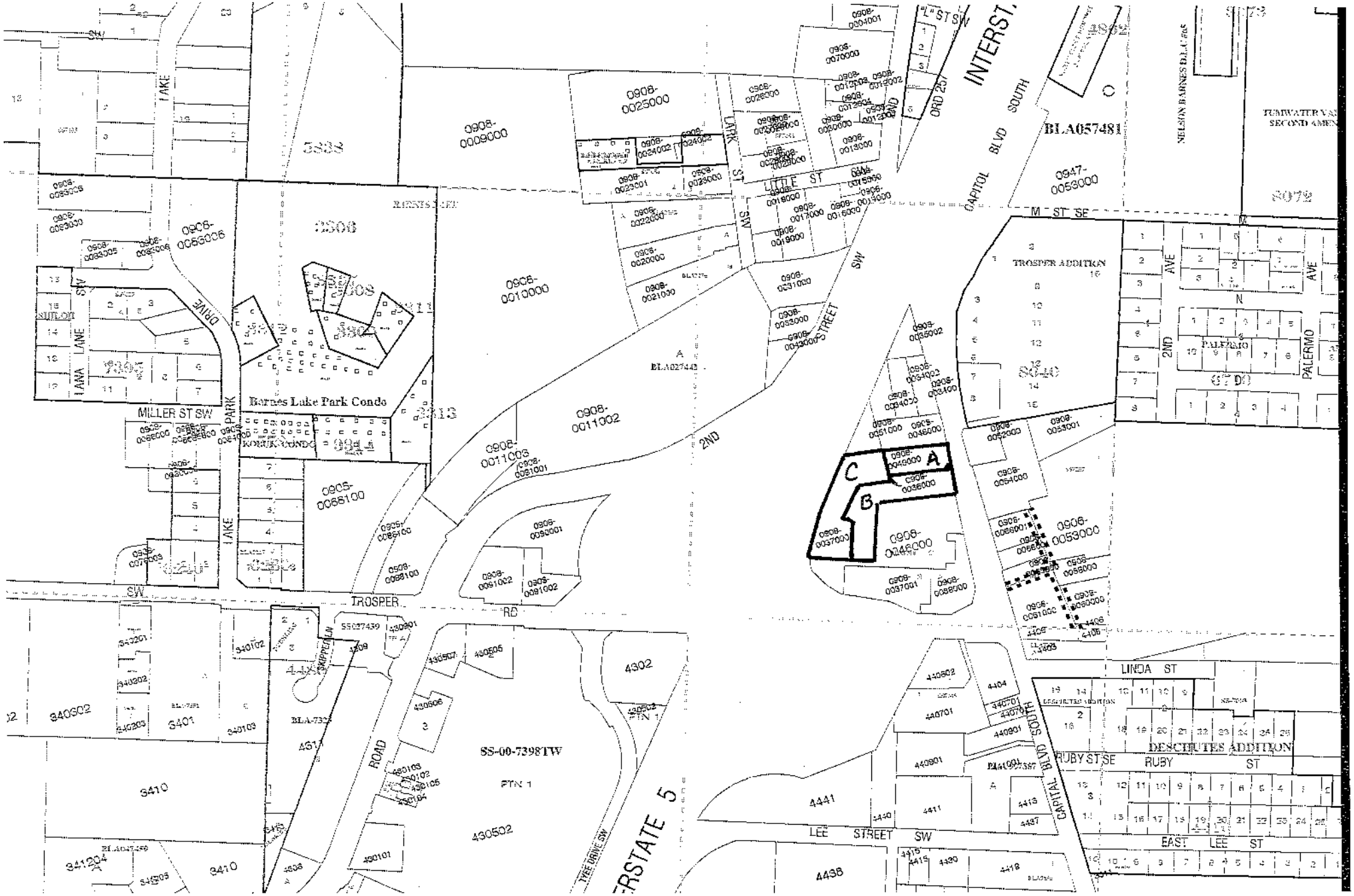
Beginning at the intersection of the Easterly line of Primary State Highway One (as located in 1975), with the centerline of a 60-foot wide strip known as Deschutes Way (as located prior to 1956), being South 68° 55' 25" West 710.41 feet from the East quarter corner of Section 34, said township and range; thence South 23° 22' 25" West along said Easterly line of Highway 572.93 feet to the initial point of this description, being the most Westerly Southwest corner of tract conveyed to Charles G. VanMeter, et, al by deed recorded under File No. 861909; thence North 81° 44' 11" East 87.82 feet; North 67° 03' 05" West 74.77 feet; South 23° 22' 25" West 45.51 feet to the initial point.

EXCEPTING THEREFROM Primary State Highway No. 1 (I-5), Trosper Road, and Capitol Boulevard, as they now exist.
ALSO EXCEPT the following described tract:

That part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described as follows:

Beginning at a point on the Westerly line of Capitol Boulevard, 185.15 feet distant Northerly from the South line of said Barnes Claim; running thence North 14° 15' West along said Westerly line of Capitol Boulevard 231.71 feet; thence South 80° West 252.1 feet, South 183.44 feet, East 148.06 feet, South 20 Feet, East 41.62 feet, South 2° 51' 30" East 35.57 feet, East 48.07 feet, North 14° 15' West 60 feet and East 80 feet to the point of beginning.

In Thurston County, Washington.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LANA LANE
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NELSON BARNES D.L.C. #65
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DESCHUTES ADDITION
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THURSTON COUNTY RE. 64249

FA No. I-5-2(122)101
Project No. 300510A

THURSTON COUNTY
OLYMPIA, WA
10/10/90 3:16 PM
REQUEST OF: /TTC
Sam S. Reed, AUDITOR
BY: JEFFREY, DEPUTY
$11.00 WD

WARRANTY DEED

IN THE MATTER OF STATE ROUTE 5,

Trosper Road to Martin Way

KNOW ALL MEN BY THESE PRESENTS, That the Grantors

SOUTHGATE DEVELOPMENT CO., INC.

for and in consideration of the sum of TEN and NO/100---($10.00)---Dollars, and other valuable considerations, hereby conveys and warrants to the STATE OF WASHINGTON, the following described real estate situated in Thurston County, in the State of Washington, to the same extent and purpose as if the rights herein granted had been acquired under Eminent Domain statute of the State of Washington:

(See Attached Exhibit "A")

Also the Grantor herein conveys and warrants to the State of Washington all rights of ingress and egress, (including all existing, future or potential easements of access, light, view and air) to, from and between SR 5, Trosper Road to Martin Way and the remainder of said Parcel "A".

The undersigned hereby agrees to surrender occupancy of the lands herein conveyed upon acceptance by the Chief Right of Way Agent.

Also the undersigned hereby requests the Assessor and Treasurer of said county to set-over to the remainder of the above described Parcel "A" the lien of all unpaid taxes, if any, affecting the right of way hereby conveyed, as provided by RCW 84.60.070.

The lands herein conveyed contain an area of 52 square feet, more or less, and the specific details concerning all of which are to be found within that certain map of definite location now of record and on file in the office of the Secretary of Transportation at Olympia, and bearing date of approval May 23, 1980, and revised July 27, 1990.

It is understood and agreed that the delivery of this deed is hereby tendered and that the terms and obligations hereof shall not become binding upon the State of Washington unless and until accepted and approved hereon in writing for the State of Washington, Department of Transportation, by its Secretary or his duly authorized representative.

DATED this 12 day of Sept, 1990

Southgate Development Co. Inc.

David Hubbe Pres.

Accepted and Approved:

Date: 10/5/90

STATE OF WASHINGTON
Department of Transportation

By: Joachim Pestinger
Chief Right of Way Agent

182468 none 10.10.90

Vol: 1771 Page: 778
File No: 9010100178

Parcel No. 3-07121

STATE OF WASHINGTON)
:
County of)

On this 12 day of September, 1992, before me personally appeared David Schell

to me known to be President

of the corporation that executed the foregoing instrument and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned and on oath stated that he was authorized to execute said instrument.

GIVEN under my hand and official seal the day and year last above written.

Kenneth A. Cagney
Notary Public in and for the State of Washington,
Residing at Olympia
My Appointment Expires 12-7-94

Vol: 1771 Page: 774
File No: 9010100178

 Parcel No. 3-07121

"Parcel C"

EXHIBIT "A"

All that part of the hereinafter described Parcel "A" lying Southwesterly and Westerly of a line described as beginning at a point opposite Highway Engineer's Station (hereinafter referred to as HES) J5 37+00 on the J5 Line Survey of SR 5, Trosper Road to Martin Way and 40 feet Northerly therefrom; thence Northwesterly to a point opposite HES J5 37+00 and 73 feet Northerly therefrom; thence Northwesterly to a point opposite HES E-N5 2+42.15 on the E-N5 Line Survey of said SR 5 and 37 feet Northerly therefrom; thence Northwesterly to a point opposite HES E-N5 3+25 and 45 feet Northeasterly therefrom; thence Northwesterly to a point opposite HES E-N5 4+00 and 35 feet Easterly therefrom; thence Northerly parallel with said E-N5 Line Survey to a point opposite HES E-N5 5+08.67; thence Northerly to a point opposite HES 895+00 on the SR 5 line survey of said SR 5 and 103 feet Southeasterly therefrom; thence Northeasterly to a point opposite HES 895+35 and 100 feet Southeasterly therefrom and the end of this line description.

PARCEL "A":

That part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described on April 1, 1955 as follows:

Beginning at a point on the South line of said Barnes claim, East 1076.65 feet from the intersection of the Easterly line of right of way conveyed to The Portland and Puget Sound Railroad Company by deed dated September 5, 1890 and recorded in Volume 23 of Deeds, page 411, with said South line of claim; running thence North 175 feet, more or less, to the initial point of this description; thence East 495.7 feet, more or less, to the Northeast corner of tract conveyed to Irene N. Simons by deed dated in May, 1945 and recorded in Volume 193 of Deeds, page 555; thence Southerly along the Easterly line of said Simons tract 57 feet, more or less, to the Northwest corner of tract sold under contract to Lawrence C. Vatne and wife, dated January 1, 1955, and recorded under File No. 544168; thence along the boundary of said Vatne Tract East 145 feet, more or less, Southeasterly 20 feet and East 55 feet, more or less, to the Northeast corner thereof; thence Northwesterly along the Westerly line of Old Pacific Highway 318 feet, more or less, to the Southeast corner of tract conveyed to John Golmer Brower and wife by deed dated December 11, 1945 and recorded in Volume 205 of Deeds, page 361; thence Southwesterly along the Southerly line of said Brower Tract 200 feet to the Southwest corner thereof; thence Northwesterly parallel with said highway 160 feet; thence Southwesterly parallel with said Southerly line of Brower Tract 363 feet, more or less; thence South 274.1 feet, more or less, to the point of beginning; EXCEPTING THEREFROM Capital Boulevard, Trosper Road, and EXCEPTING also tracts acquired by State of Washington for highway purposes;

ALSO EXCEPT the following described tract, to-wit:

That part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described as follows:

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File No: 9010100178

Beginning at a point on the Westerly line of Capitol Boulevard, 185.15 feet distant Northerly from the South line of said Barnes claim; running thence North 14°15' West along said Westerly line of Capitol Boulevard 231.71 feet; thence South 80° West 252.1 feet, South 183.44 feet, East 148.06 feet, South 20 feet, East 41.62 feet, South 2°51'30" East 35.57 feet, East 48.07 feet, North 14°15' West 60 feet and East 80 feet to the point of beginning;

ALSO, that part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described as follows:

Beginning at a point on the Westerly line of Capitol Boulevard, described as being South 69°02'50" West 743.26 feet, more or less, and Southeasterly 590.61 feet from the East quarter corner of Section 34, said township and range, and being the Northeasterly corner of tract conveyed to John Golmer Brower and wife, by deed dated December 11, 1945 and recorded under File No. 406259; running thence South 17°30' East along said Westerly line of Capitol Boulevard 80 feet to the Southeasterly corner of said Brower Tract; thence along the boundary of said Brower Tract, South 80° West 200 feet, North 17°30' West 80 feet and North 80° East 200 feet to the point of beginning; EXCEPT Capitol Boulevard as widened;

ALSO, that part of the Barnes Donation Claim No. 65 in Township 18 North, Range 2 West, W.M., described as follows:

Beginning at a point on the South line of said Barnes Donation Claim which is South 89°57' East 1322.9 feet from the intersection of said South line with the Easterly right of way line conveyed to The Portland and Puget Sound Railway company by deed dated September 5, 1890, recorded in Volume 23 of Deeds, page 411, which point also bears North 89°57' West 837.95 feet along the South line of said claim from its Southeast corner; thence North 0°45' East 182.33 feet; thence East 60 feet, more or less, to the Northwest corner of tract conveyed to Samuel R. Hall and wife, by deed dated November 20, 1945, recorded under File No. 399955; thence South 0°45' West along West line of said Hall Tract and said line extended 182.38 feet to the South line of said claim; thence North 89°57' West 60 feet, more or less, to the point of beginning; EXCEPT that part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described as follows:

Beginning at a point on the North line of Trosper Road, North 0°45' East 31.06 feet from a point on the South line of said Barnes claim, North 89°57' West 777.95 feet from its Southeast corner on the East line of Section 34, said township and range; running thence North 84°17'20" West along said North line of road 30.11 feet; thence North 0°45' East 118.72 feet, East 30 feet and South 0°45' West 121.32 feet to the point of beginning; TOGETHER WITH easement for ingress, egress and utility purposes over that part of said Barnes claim described as beginning at a point on said North line of Trosper Road, North 0°45' East 33.63 feet from a point on said South line of Barnes claim, North 89°57' West 807.95 feet from its Southeast corner on said East line of Section 34, and running thence North 84°17'20" West along said North line of road 30.11

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File No: 9010100178

feet and thence North 0°45' East 146.12 feet, East 30 feet and South 0°45' West 148.72 feet to the point of beginning. ALSO EXCEPT Prosper Road;

ALSO, that part of Barnes Donation Claim No. 65, Township 18 North, Range 2 West, W.M., described as follows:

Beginning at a point North 1°36'40" West 152.59 feet from a point on the South line of said Barnes claim, North 89°57' West 590.44 feet from its Southeast corner on the East line of Section 34, said township and range; running thence North 1°36'40" West 30.01 feet, West 180 feet, South 0°45' West 30 feet and East 181.24 feet to the point of beginning;

ALSO, that part of Barnes Donation Claim 65, Township 18 North, Range 2 West, W.M., described as follows:

Beginning at the intersection of the Easterly line of Primary State Highway One (as located in 1975), with the centerline of a 60-foot wide strip known as Deschutes Way (as located prior to 1956), being South 68°55'25" West 710.41 feet from the East quarter corner of Section 34, said township and range; thence South 23°22'25" West along said Easterly line of Highway 572.93 feet to the initial point of this description, being the most Westerly Southwest corner of tract conveyed to Charles G. VanMeter, et al, by deed recorded under File No. 861909; thence North 81°44'11" East 87.82 feet; North 67°03'05" West 74.77 feet; South 23°22'25" West 45.51 feet to the initial point.

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File No: 9010100178

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ENDORSEMENT

Guarantee Number **G-1103-7639**
Issued By
THURSTON COUNTY TITLE COMPANY
acting as agent for
PACIFIC NORTHWEST TITLE INSURANCE COMPANY

File Number **144952**

The Company hereby assures the Assured that as of the Effective Date hereof there are no matters shown by the public records affecting the real property described in said Subdivision Guarantee other than those shown under Exceptions in said Guarantee, except:

Add Paragraph 22 to Schedule A, as follows:

22. Relinquishment of all existing future or potential easements for access, light, view and air, and all rights of ingress, egress and regress to, from and between said premises and the highway or highways to be constructed on lands conveyed by Deed dated September 12, 1990, recorded October 10, 1990 under File No. 9010100178, to the State of Washington.

The total liability of the Company under said Guarantee and under this endorsement thereto shall not exceed, in the aggregate, the amount stated in said Guarantee. This endorsement is made a part of said Guarantee and is subject to the terms and provisions thereof.

Dated: June 16, 2008, at 8:00 a.m.

THURSTON COUNTY TITLE COMPANY as agent for
PACIFIC NORTHWEST TITLE INSURANCE COMPANY

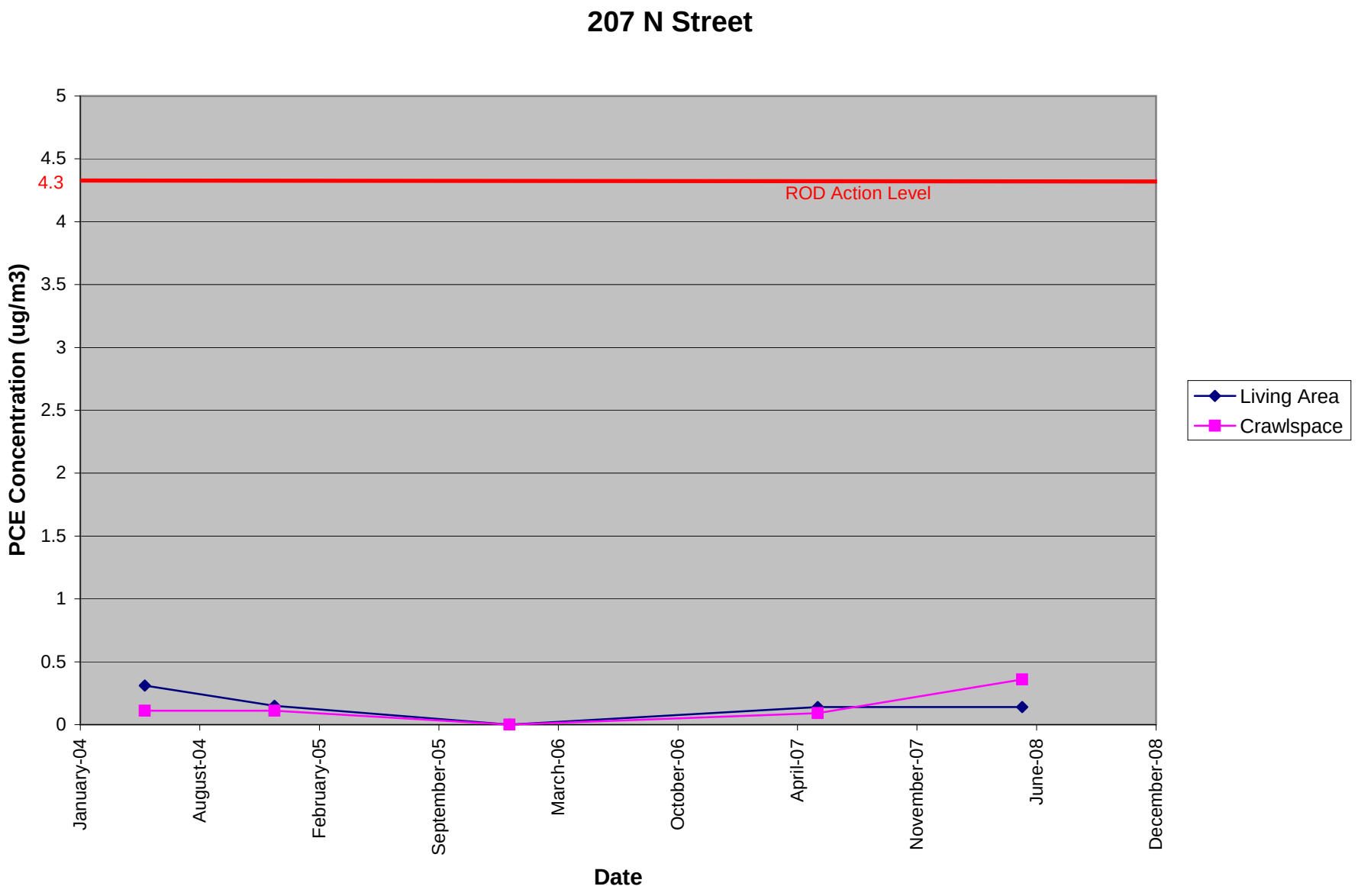
Countersigned

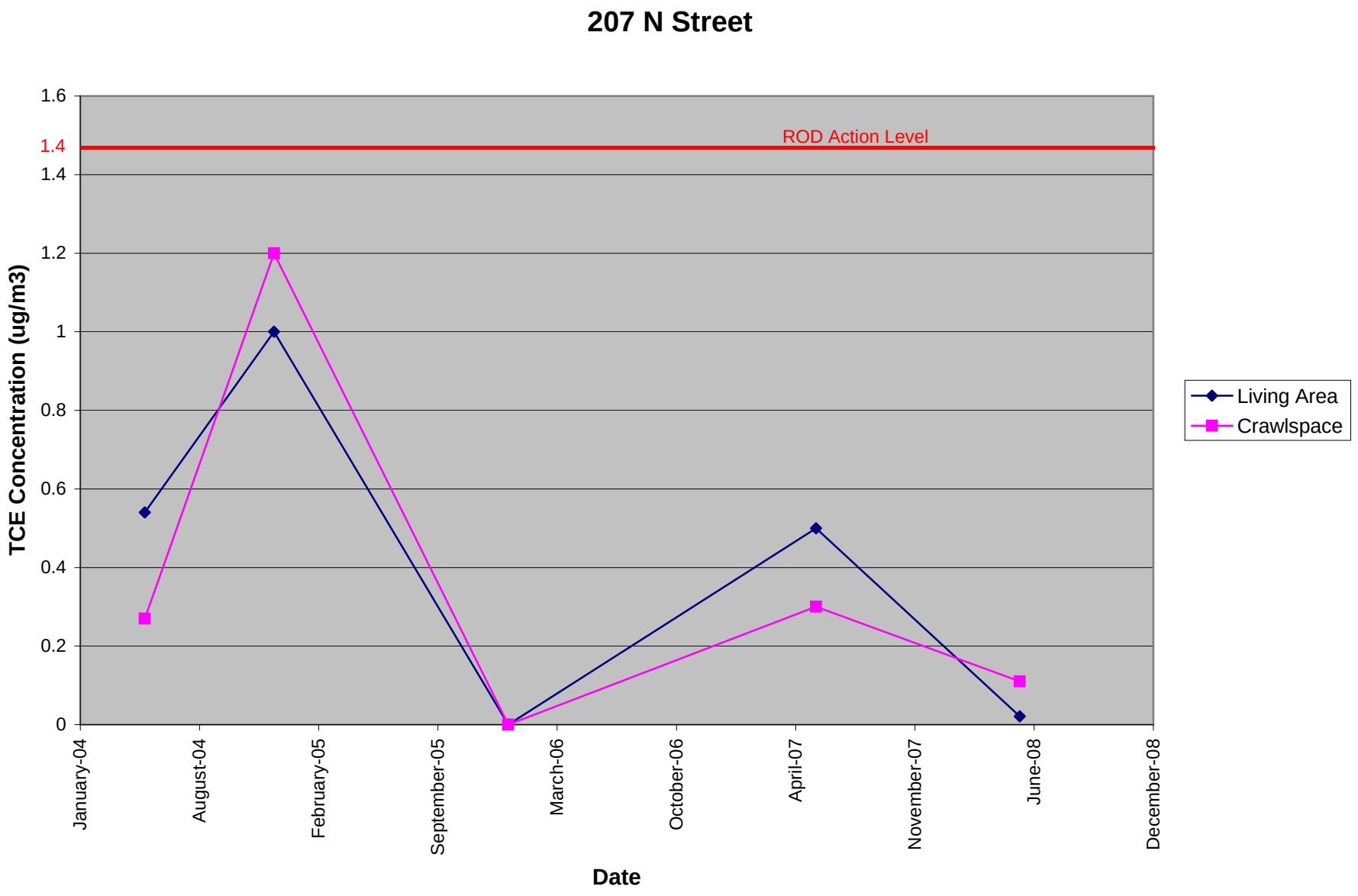
Authorized Signatory
Note: This endorsement shall not be valid or binding until countersigned by an authorized signatory.

ENDORSEMENT TO SUBDIVISION GUARANTEE

APPENDIX D

Indoor Air Trend Plots


207 N Street
PCE Concentration (ug/m3)
5
4.5
4.3
4
3.5
3
2.5
2
1.5
1
0.5
0
ROD Action Level
January-04
August-04
February-05
September-05
March-06
October-06
April-07
November-07
June-08
December-08
Date
Living Area
Crawlspace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TCE Concentration (ug/m3)
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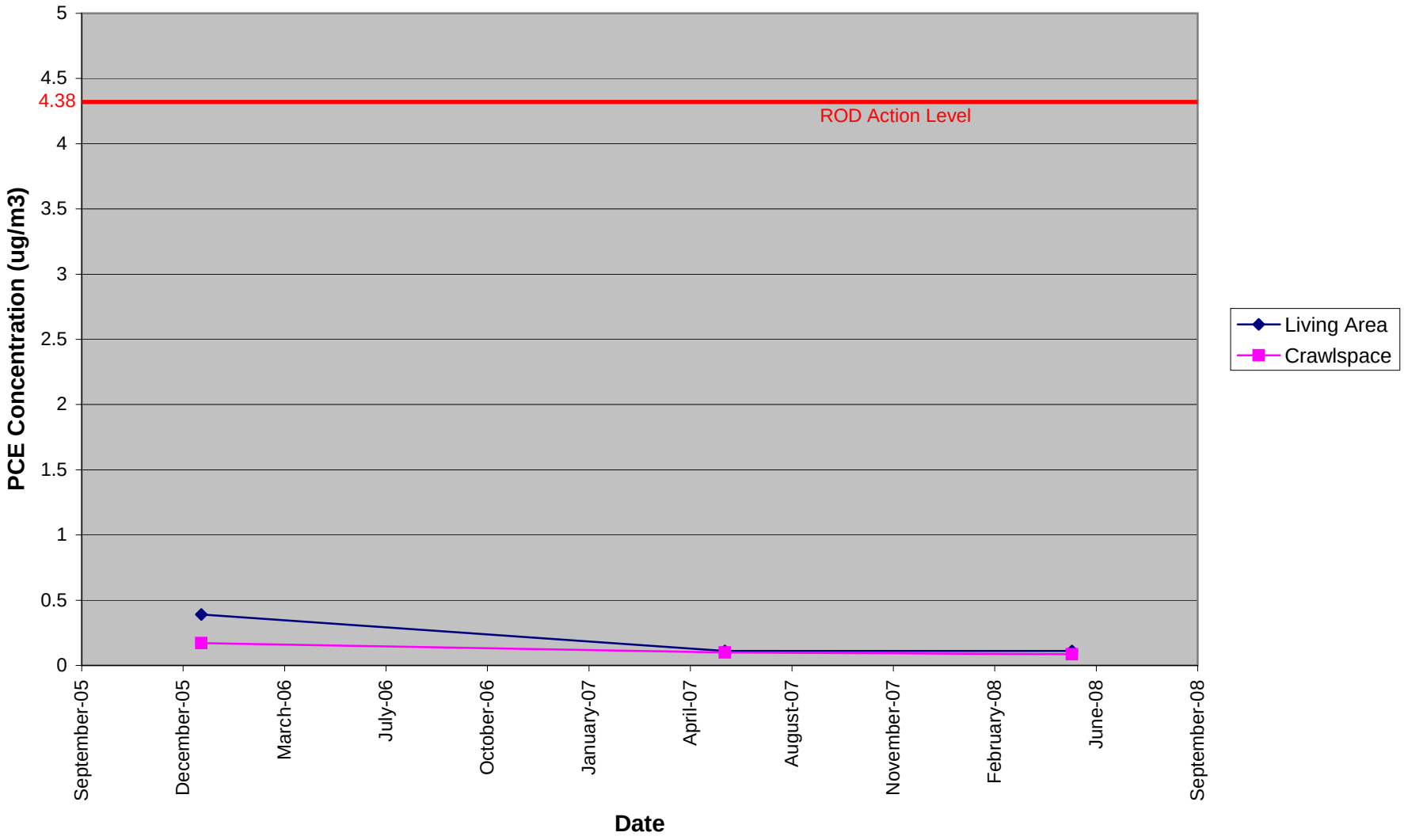
1.4
1.4
1.2
1
0.8
0.6
0.4
0.2
0
ROD Action Level
January-04
August-04
February-05
September-05
March-06
October-06
April-07
November-07
June-08
December-08
Date
Living Area
Crawlspace

211 N Street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4.38
4
3.5
3
2.5
2
1.5
1
0.5
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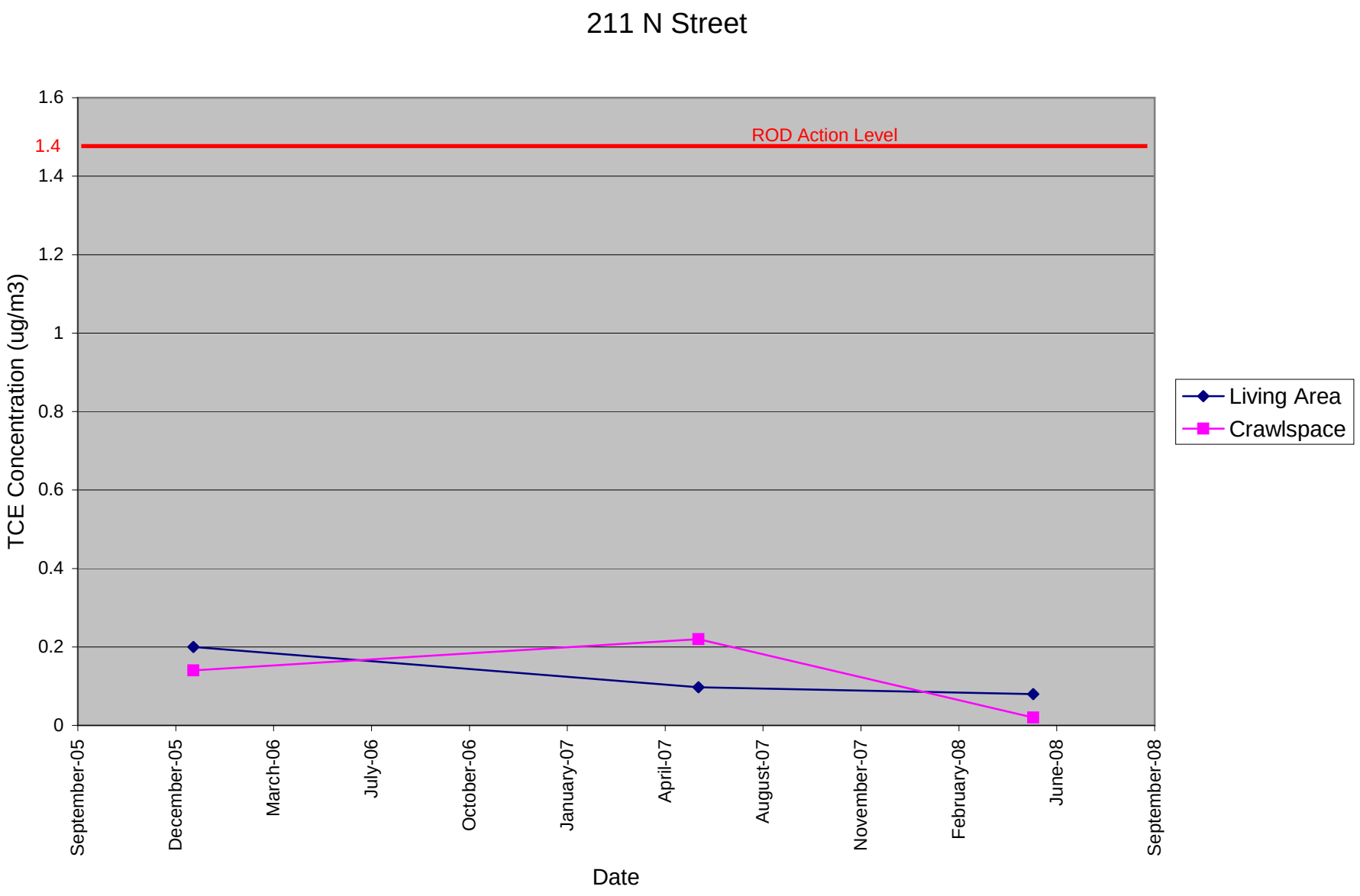
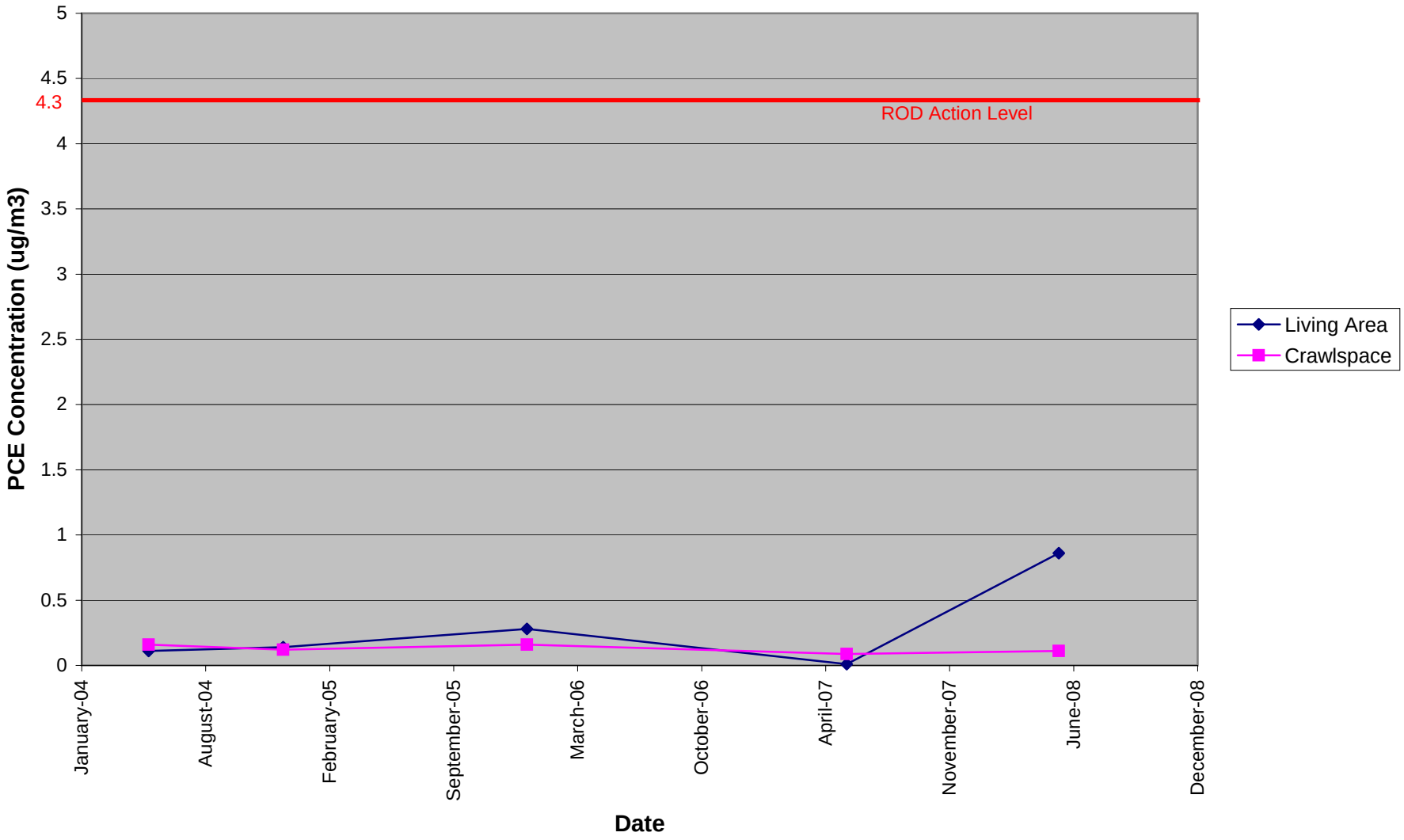
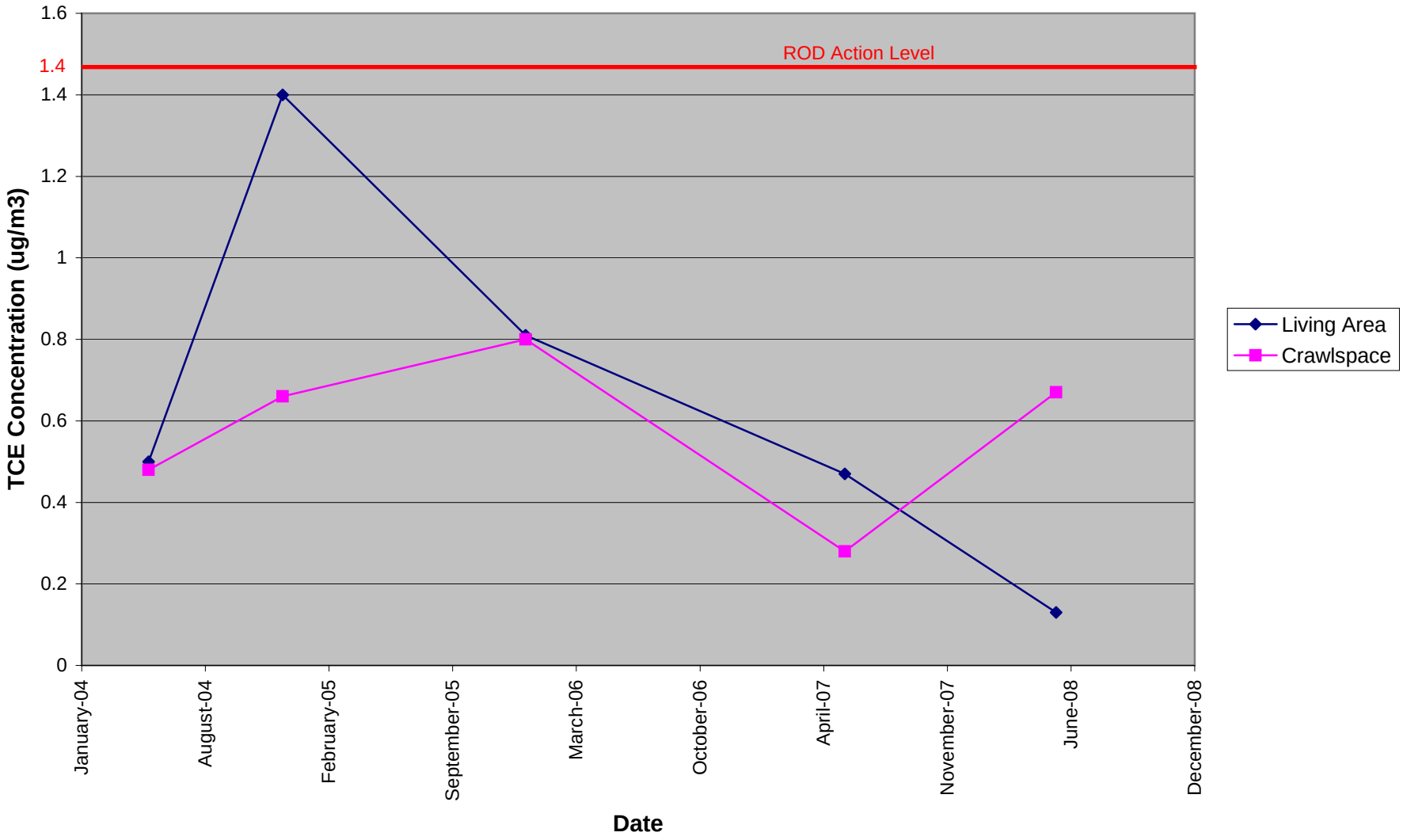
ROD Action Level
September-05
December-05
March-06
July-06
October-06
January-07
April-07
August-07
November-07
February-08
June-08
September-08
Date
Living Area
Crawlspace


211 N Street
1.6
1.4
1.4
1.2
1
0.8
0.6
0.4
0.2
0
ROD Action Level
TCE Concentration (ug/m3)
September-05
December-05
March-06
July-06
October-06
January-07
April-07
August-07
November-07
February-08
June-08
September-08
Date
Living Area
Crawlspace

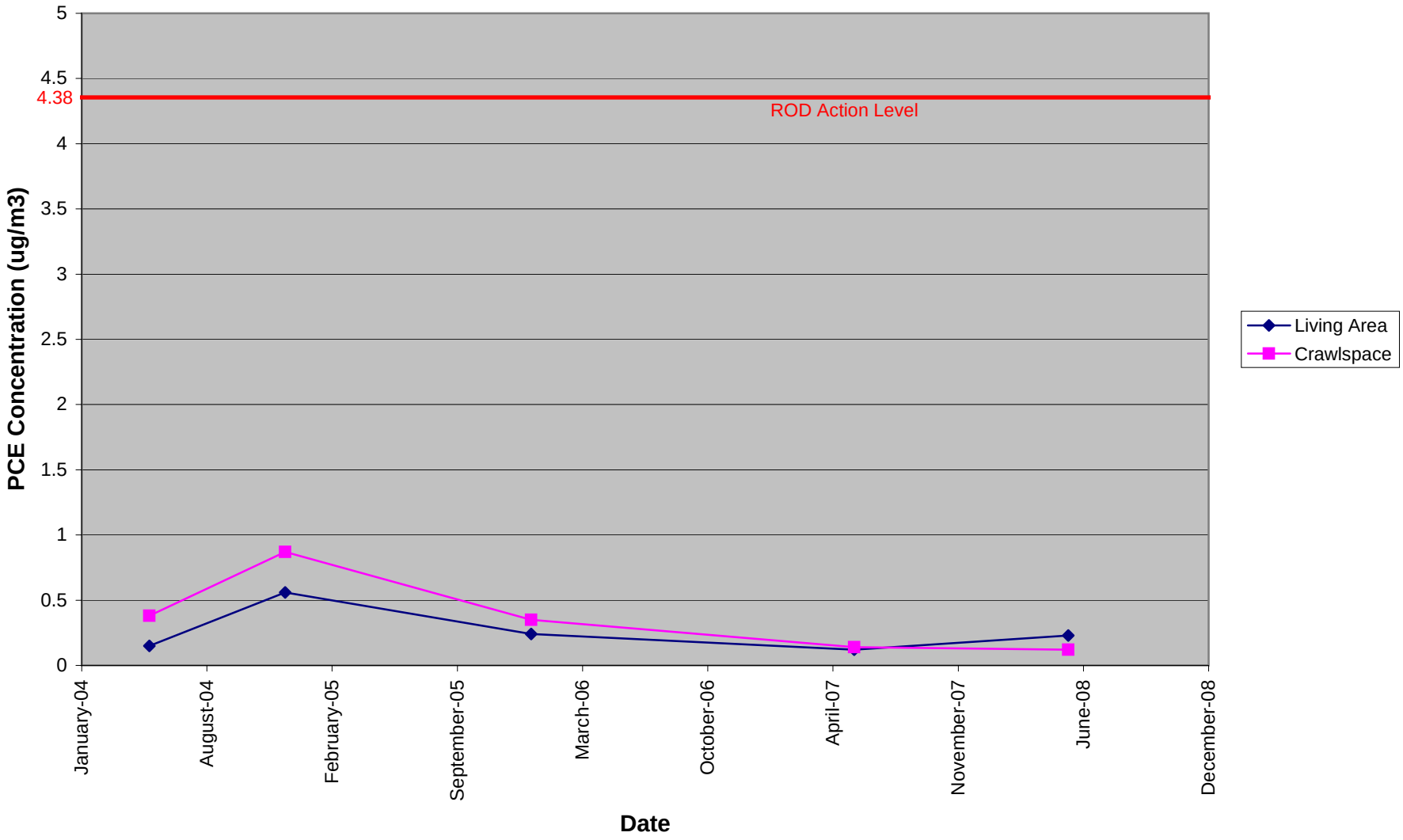
5001 Palermo Avenue



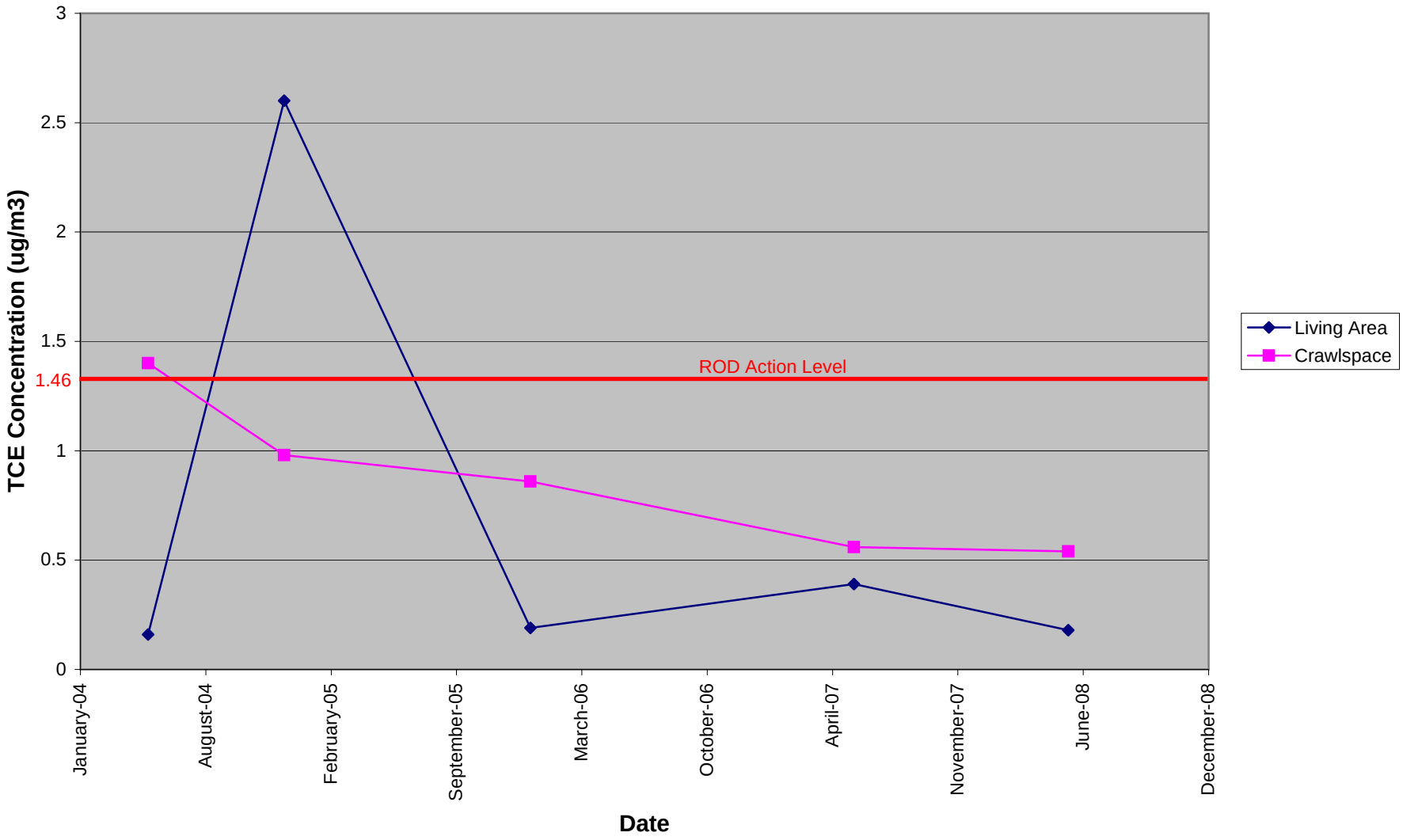
5001 Palermo Avenue



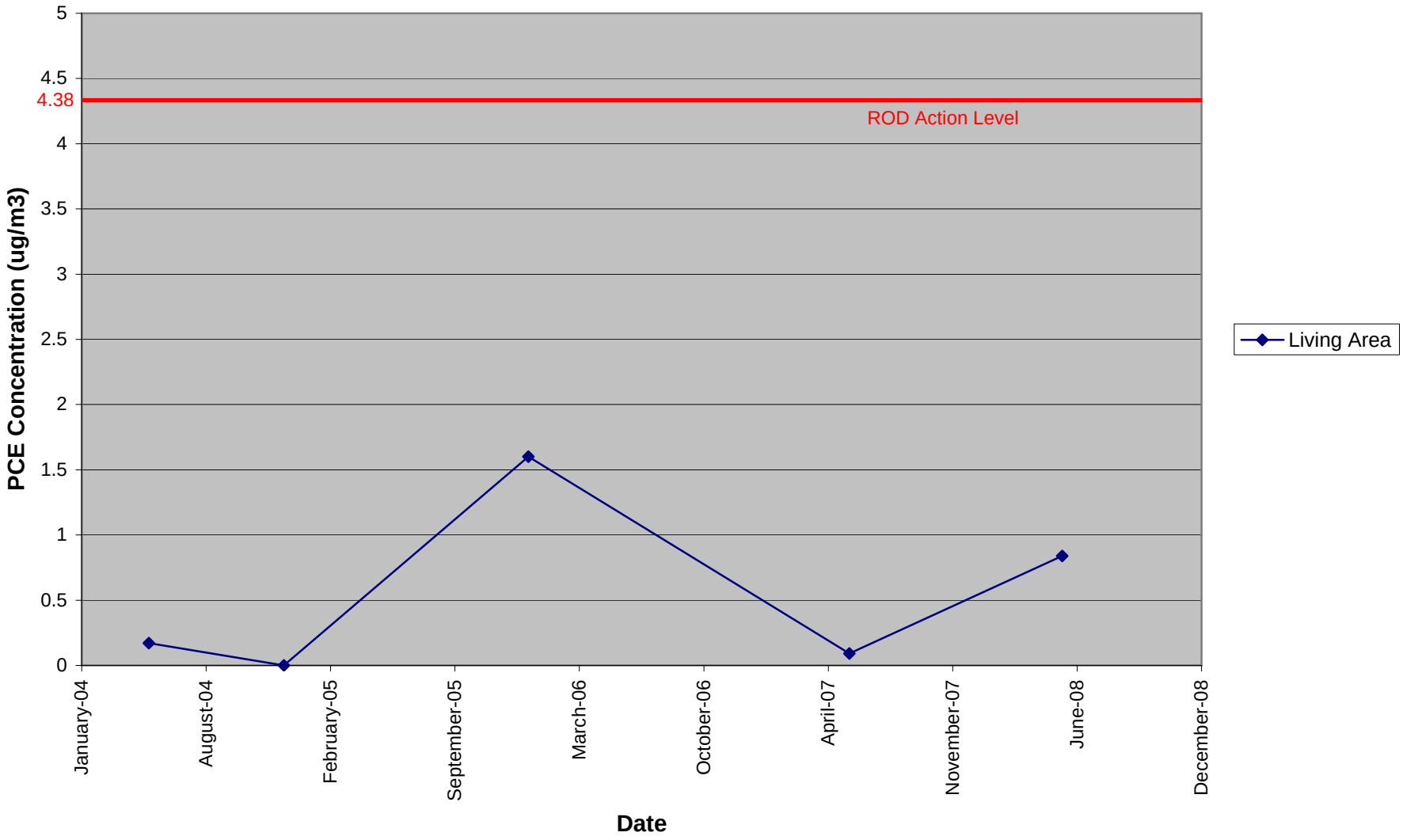
5002 Rainier Avenue



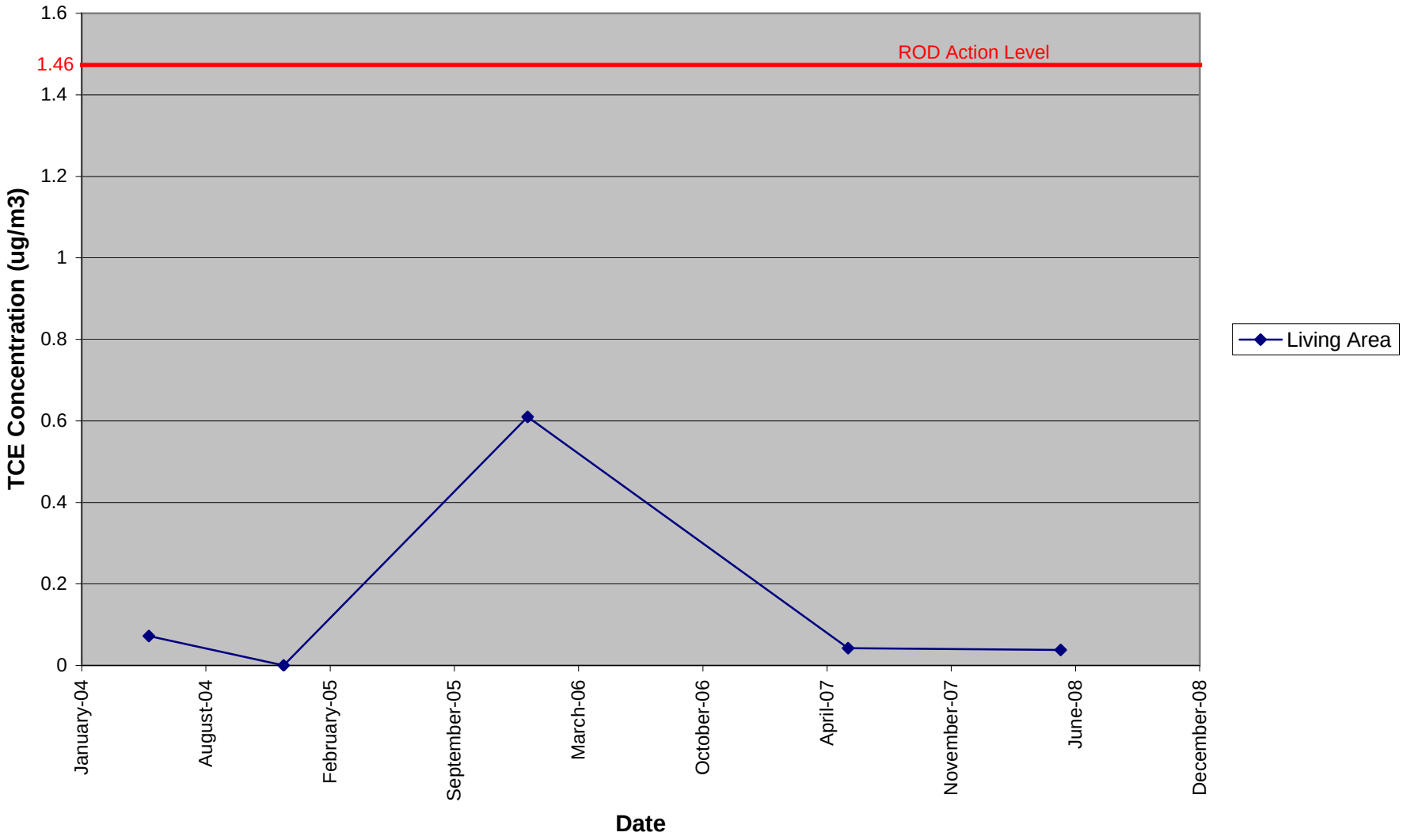
5002 Rainier Avenue

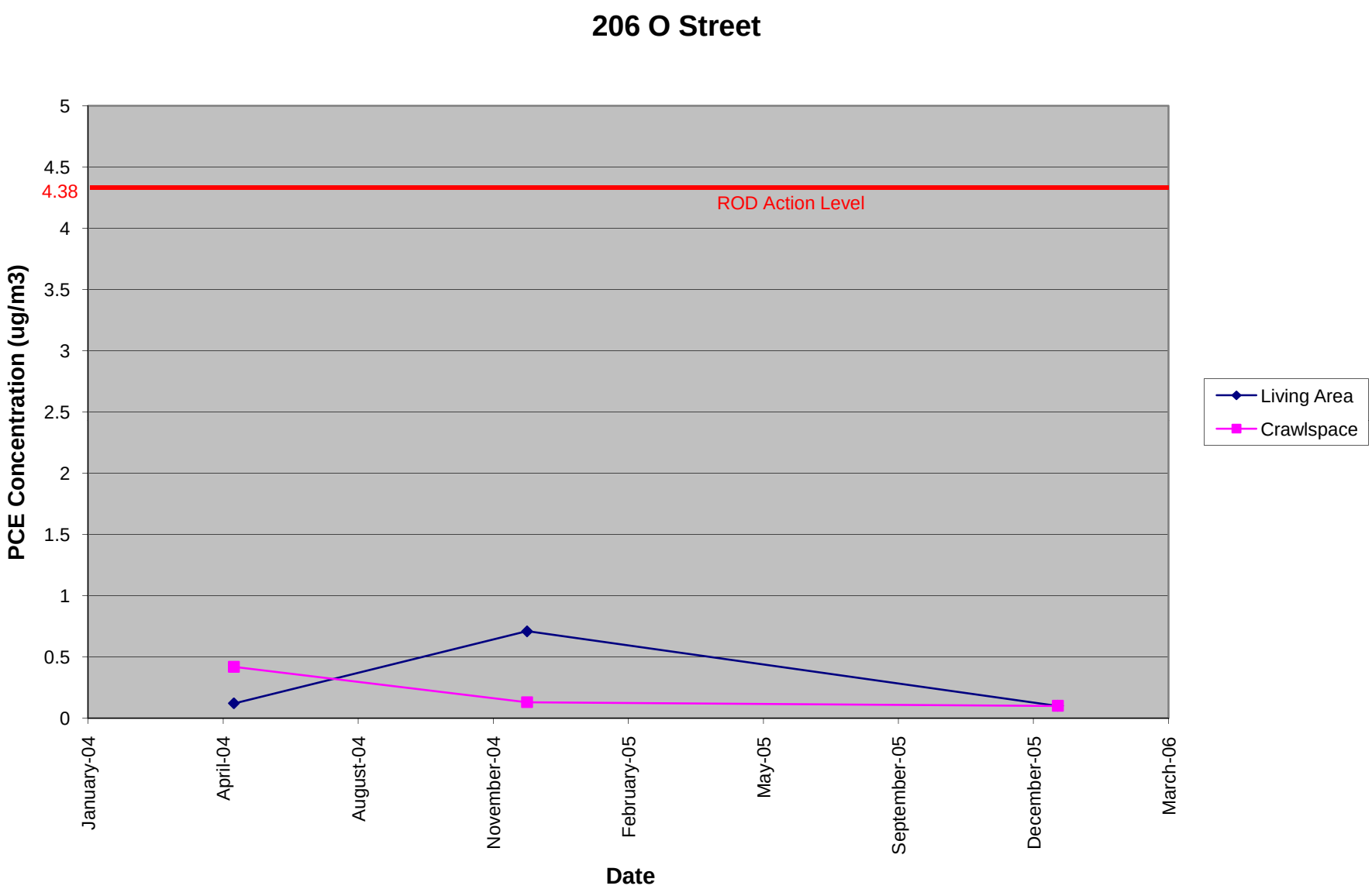


5023 Palermo Avenue



5023 Palermo Avenue




206 O Street
PCE Concentration (ug/m3)
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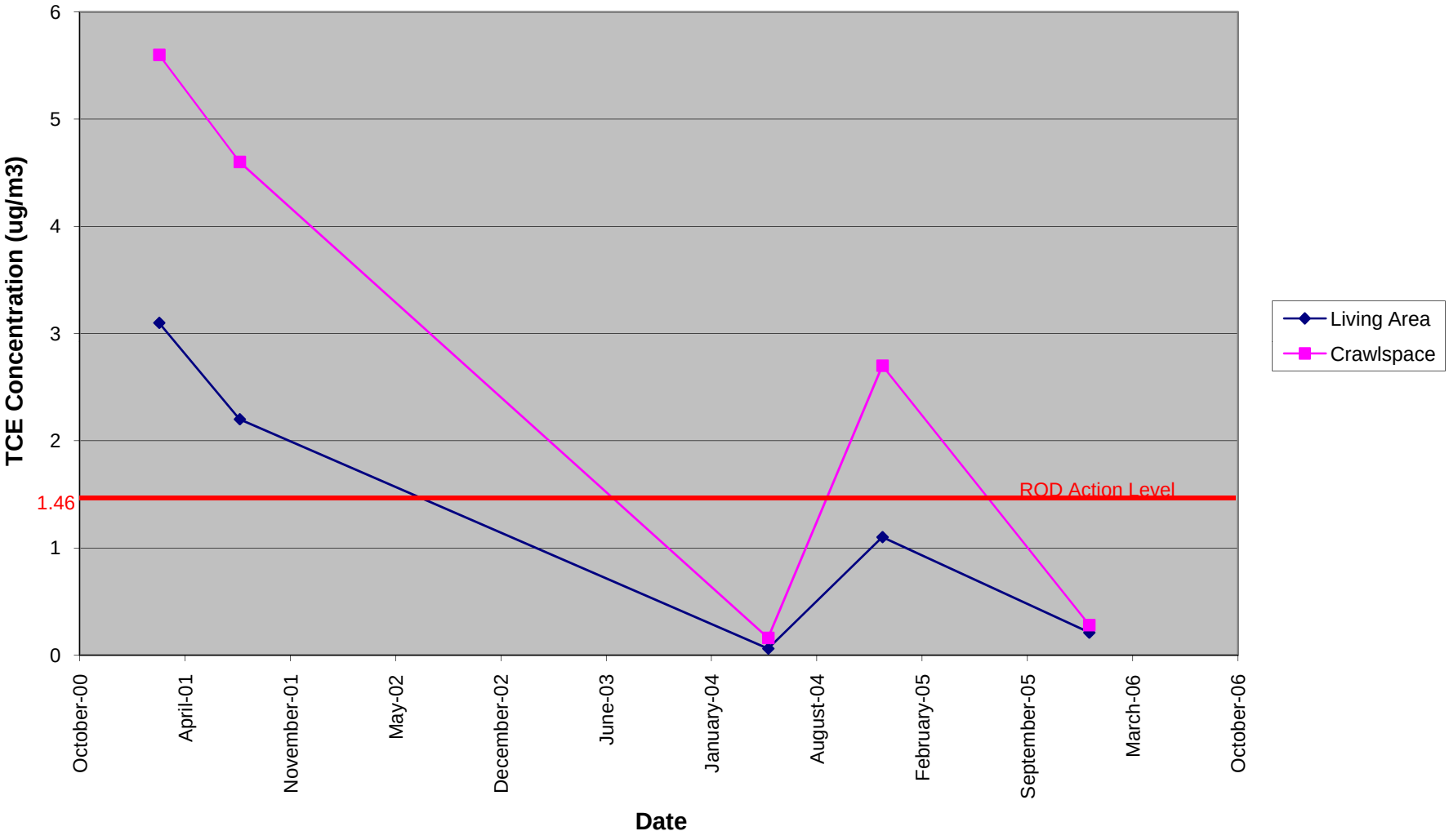
4.5
4.38
4
3.5
3
2.5
2
1.5
1
0.5
0
ROD Action Level
January-04
April-04
August-04
November-04
February-05
May-05
September-05
December-05
March-06
Date
Living Area
Crawlspace

206 O Street


TCE Concentration (ug/m3)
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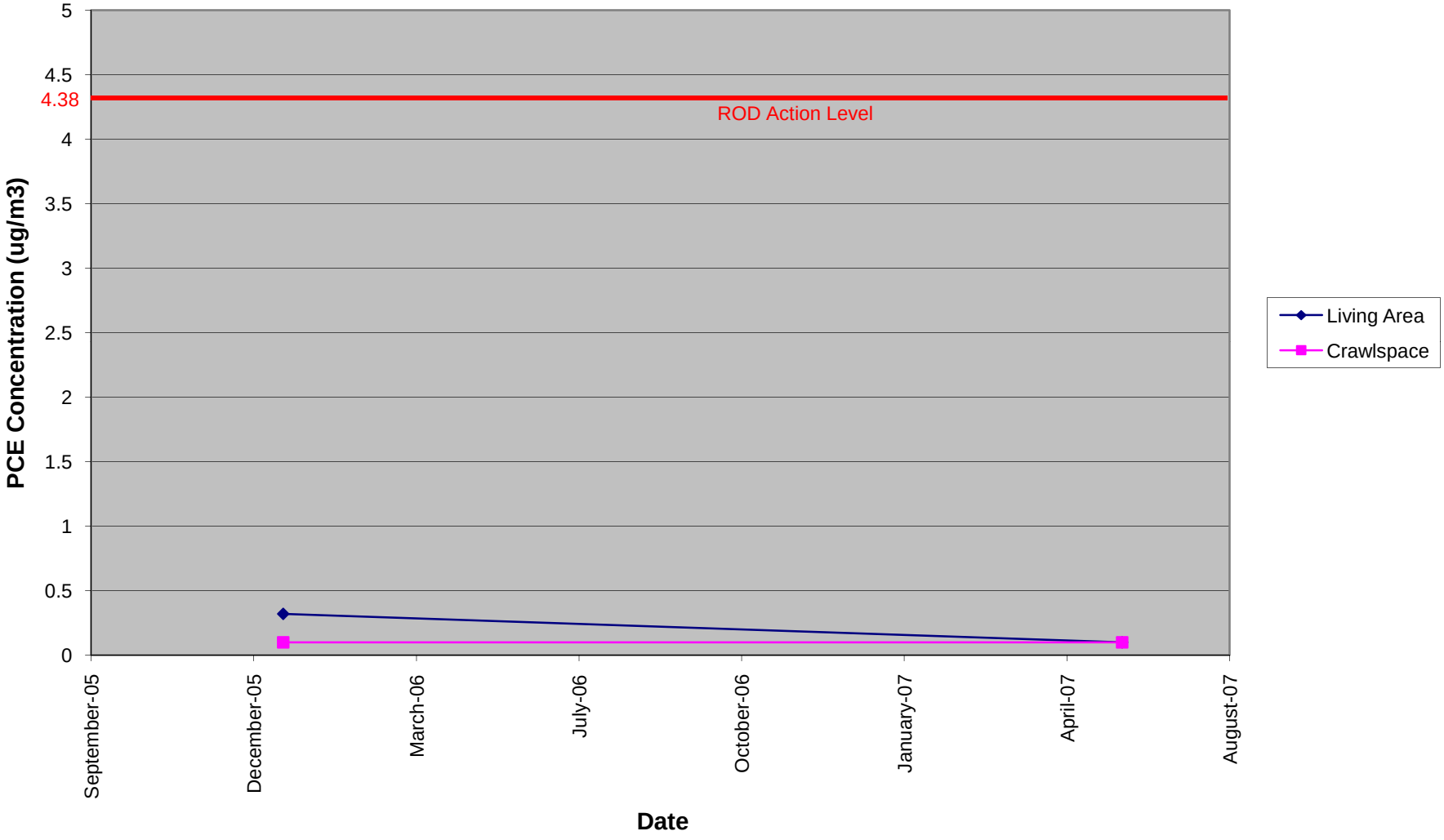
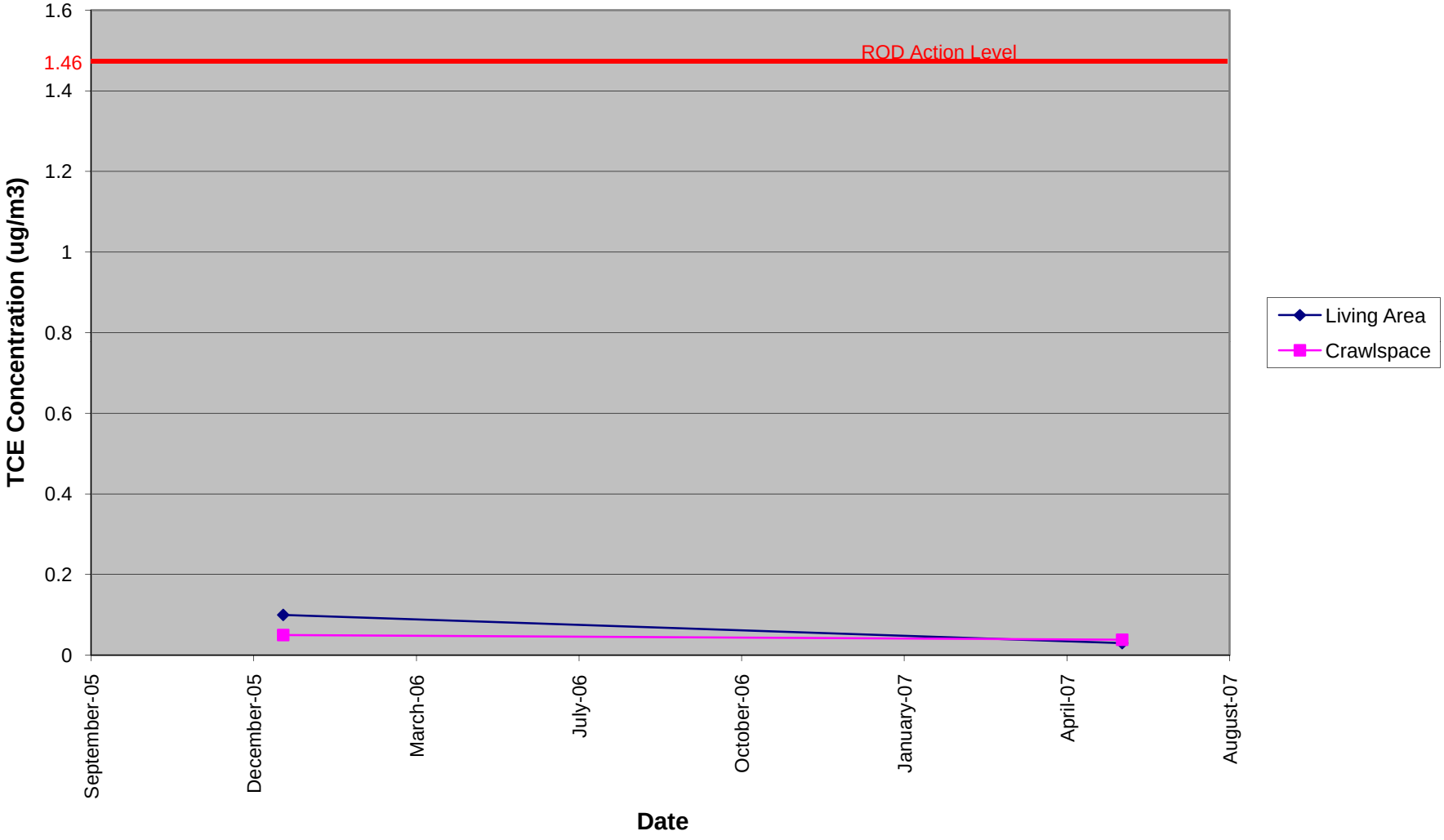
5
4
3
2
1.46
1
0
ROD Action Level
October-00
April-01
November-01
May-02
December-02
June-03
January-04
August-04
February-05
September-05
March-06
October-06
Date
Living Area
Crawlspace

208 O Street


PCE Concentration (ug/m3)
5
4.5
4.38
4
3.5
3
2.5
2
1.5
1
0.5
0
ROD Action Level
September-05
December-05
March-06
July-06
October-06
January-07
April-07
August-07
Date
Living Area
Crawlspace

208 O Street


1.6
1.46
1.4
1.2
1
0.8
0.6
0.4
0.2
0
ROD Action Level
TCE Concentration (ug/m3)
September-05
December-05
March-06
July-06
October-06
January-07
April-07
August-07
Date
Living Area
Crawlspace

APPENDIX E

Site Inspection Checklist and Interview Results

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Palermo Wellfield Superfund Site	**Date of inspection:** May 22, 2008
Location and Region: Tumwater, WA	**EPA ID:** WAD0000026534
Agency, office, or company leading the five-year review: EPA Region 10	**Weather/temperature:** Cloudy, 55˚F

Remedy Includes: (Check all that apply)

- ☒ Soil Vapor Extraction System at Southgate Dry Cleaners
- ☒ Wellhead Treatment System at Palermo Wellfield
- ☒ French Drain and Aeration Lagoon
- ☒ Public Notice of Groundwater Contamination
- ☒ Long-term Groundwater Monitoring
- ☒ Deed Restriction at Southgate Dry Cleaners

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

City of Tumwater

1. **City O&M site manager** Steve Craig (Name) Operations Manager (Title) May 7, 2008 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____ ☒ by email
   Problems, suggestions; ☐ Report attached _____
   See Five-Year Review Report
2. **City O&M staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____ ☐ by email
   Problems, suggestions; ☐ Report attached _____
3. **Other City staff** Dan Smith (Name) Water Resources Program Manager (Title) May 6, 2008 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____ ☒ by email
   Problems, suggestions; ☐ Report attached _____
   See Five-Year Review Report
4. **Other City staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____ ☐ by email
   Problems, suggestions; ☐ Report attached _____

Washington State Department of Ecology

5. **Ecology Project Manager** Laura Klasner (Name) Site Manager (Title) May 21, 2008 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____ ☒ by email
   Problems, suggestions; ☐ Report attached _____
   See Five-Year Review Report

II. INTERVIEWS, continued

6. **Ecology O&M Staff** Pam Marti (Name) Hydrogeologist (Title) May 2008 (Date)
Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____ ☒ by email
Problems, suggestions; ☐ Report attached _____
See Five-Year Review Report

7. **Other Ecology Staff** Scott Rose (Name) Acting Unit Supervisor (Title) May 2008 (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____ ☒ by email
Problems, suggestions; ☐ Report attached _____
See Five-Year Review Report

8. **Other Ecology Staff** Martha Maggi (Name) Hydrogeologist (Title) May 12, 2008 (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____ ☒ by email
Problems, suggestions; ☐ Report attached _____
See Five-Year Review Report

Washington Department of Health

9. **DOH Staff** Barbara Trejo (Name) Health Assessor/Hydrogeologist (Title) May 5, 2008 (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____ ☒ by email
Problems, suggestions; ☐ Report attached _____
See Five-Year Review Report

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents for Air Stripper (City of Tumwater)**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks O+M documents are computerized and kept at the City office in Tumwater

2. **Permits for Air Stripper**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits_____	☐ Readily available	☐ Up to date	☒ N/A

Remarks No permits are required

3. **Discharge Compliance Records for Air Stripper**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A

Remarks No air discharge sampling required. Water sampling data is maintained at the City office

4. **O&M Documents for French Drain and Lagoon (Ecology)**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☒ Monitoring/status reports	☒ Readily available	☒ Up to date	☐ N/A

Remarks These documents are available on the Ecology website

IV. INSTITUTIONAL CONTROLS

1. **Implementation and enforcement (Southgate Dry Cleaners)**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Not required
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☒ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☒ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached
The deed restriction is not in place

2. **Implementation – public notice of contaminated groundwater**

Notification performed? ☒ Yes ☐ No ☐ N/A
Documentation of notification available? ☒ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Not required
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☒ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached
EPA issued a factsheet to area well drillers

3. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks Currently, no deed restriction is in place for the Southgate Dry Cleaners. However, land use has not changed since the ROD.

IV. INSTITUTIONAL CONTROLS, continued

4. **Land use changes on site** ☐ Changes observed ☒ No changes observed
Remarks___Land use has not changed since the ROD. Asphalt pavement remains over the site._____

V. SOIL VAPOR EXTRACTION SYSTEM AT SOUTHGATE DRY CLEANERS

1. **Implementation**

☒ Installed and operated per ROD

☒ Documentation of results available

2. **Current Status**

☒ Status is: Decommissioned

☒ Record of current status available

Remarks_____

3. **Results** (summarize results of SVE system)
Approximately 425lbs of PCE removed by SVE system. Confirmation sampling detected residual PCE concentrations in soil above cleanup limits.

VI. WELLHEAD TREATMENT SYSTEM

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation
☒ Air stripping ☐ Carbon adsorbers
☒Filters_Air used by air strippers is filtered_____
☒ Additive (*e.g.*, chelation agent, flocculent)_A hypochlorite additive system is available, but is not required._____
☒ Others_Asorbic acid used to strip build-up (chlorite, etc.) from media in the strippers._____
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☒ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks_____

VI. WELLHEAD TREATMENT SYSTEM, continued	
2.	**Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks_____
3.	**Air Stripper and Appurtenances** ☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance Remarks___Maintenance was being conducted on day of site inspection._____
4.	**Discharge Structure and Appurtenances** ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks_____
5.	**Treatment Building(s)** ☐ N/A ☒ Good condition ☐ Needs Repair ☒ Chemicals and equipment properly stored Remarks_____
6.	**Current Status** Transfer from EPA to City complete? ☐ Yes Date of transfer: _____ ☒ No Expected date of transfer: ___?_____ Remarks_____
7.	**Results** (summarize monitoring data for Wellhead Treatment System) __System is performing as designed. No PCE/TCE has been detected in treated effluent._____

VII. SUBDRAIN AND TREATMENT LAGOON

1. **Inlet to Lagoon Pipe Inspected** ☒ Functioning ☐ N/A
Remarks Functioning, but could not be inspected due to vegetation.

2. **Inlet Pipe Riprap Rock Inspected** ☒ Functioning ☐ N/A
Remarks_____

3. **Siltation** Areal extent_____ Depth_____ ☐ N/A
☒ Siltation not evident
Remarks_____

4. **Erosion** Areal extent_____ Depth_____ ☐ N/A
☒ Erosion not evident
Remarks_____

5. **Outlet Weir** ☒ Functioning ☐ N/A
Remarks_____

6. **Aerators** ☒ All three functioning ☐ Less than three functioning ☐ None Functioning
Remarks Only 2 of the 3 aerators are operated at a time.

7. **Plantings** ☒ Growing and healthy ☒ Effectively reducing erosion
☒ Meeting aesthetic goals ☒ Invasive weeds controlled
Remarks_____

8. **Fencing** ☒ Intact, gates locked ☐ Damaged or unlocked
Remarks No signs on gold course side of the pond.

9. **Real Property and Easements**
Transfer from EPA to City complete?
☐ Yes Date of transfer: _____
☒ No Expected date of transfer: _____?_____
Remarks_____

VII. SUBDRAIN AND TREATMENT LAGOON, continued

10. **Results** (summarize monitoring data for Subdrain and Lagoon)
The system is not completely functioning as intended. The 3-foot compliance level is not met at two homes at the south end of Rainier Avenue. TCE/PCE has been detected in indoor air at homes in the area of the subdrain system.

VIII. LONG-TERM MONITORING

1. **Monitoring Wells**
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☒ Needs Maintenance ☐ N/A
Remarks Some wells require minor maintenance, but overall in good condition.

2. **Long-term monitoring data**
☒ Is routinely submitted on time ☒ Is of acceptable quality

3. **Long-term monitoring data suggests:**
☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining
☐ Biodegradation is occurring
Remarks There is little evidence that biodegradation is occurring. Insufficient data to assess if the groundwater plume is effectively contained. Limited monitoring points downgradient of "hot spot" at MW-ES-09.

IX. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

See Five-Year Review Report

IX. OVERALL OBSERVATIONS, continued	
B.	**Adequacy of O&M**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). The O+M activities conducted at the site appear to be adequate.
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, which suggest that the protectiveness of the remedy may be compromised in the future. The adequacy of the subdrain system in eliminating indoor air pathway at some houses in the Palermo neighborhood.
C.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Need to optimize long-term groundwater monitoring system to better assess plume migration and the effectiveness of the remedy for groundwater.

Palermo 2nd Five-Year Review
Site Inspection Sign-in
May 22, 2008

Name	Representing	Email Address
Dan Smith	City of Tumwater	
Steve Craig	" " "	
Pam Martin	Ecology	
Laura Klasner	"	
Chris Corn	EPA	
Lara Linde	Parametrix	
Scott Elkind	"	

PALERMO WELLFIELD SUPERFUND SITE
SECOND FIVE-YEAR REVIEW
INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD	
Name:	Dan Smith
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Interview Date:	May 6, 2008
Interview Type: (Phone / Visit / Email)	Questionnaire delivered via email
Interviewed By:	Self

The following general questions were adapted from the EPA's *Comprehensive Five-Year Review Guidance and Supplement for Evaluation of Institutional Controls.*

INTERVIEW QUESTIONS

1. ***What is your overall impression of the functioning of the remedy (subdrain and treatment lagoon, wellfield air stripper, and long-term monitoring) at the Site?***

   My overall impression is that the technology works well, serving multiple purposes to improve the overall water quality of Tumwater's water. Having no quantifiable detections of VOCs in the water distribution system, it's my impression that the treatments in place have been effective.

2. ***From your perspective, what effects have the remedies implemented at the Site had on the surrounding community?***

   The remedies in the Palermo Wellfield vicinity have only had positive effects, such as reducing the quantity of VOCs in the groundwater and working towards improvements in air quality and surface water quality.

3. ***Are you aware of concerns from the local community regarding the Site, its operation and administration, or overall protectiveness of the ROD remedies?***

   My office has been contacted over two issues relative to the treatment processes in place at Palermo. The greatest concern has been air quality. It's my understanding that these concerns were triggered by an EPA announcement that additional efforts were being undertaken to study air quality and, if necessary, improvements would be made to the treatments in place.

   The second issue related to surface water quality and pet safety. We received one phone call from a concerned citizen whose pet was frequently bathing in the conveyance swale behind the homes prior to the aeration ponds. With assistance from the EPA, the City was able to discuss the issue with the resident and I believe the concerns were handled appropriately.

4. ***Is information reaching the potential Site users or other groups? Do you feel well informed about the Site activities and progress for parts of the remedy that you are not directly involved in?***

I have not received any concserns from site users or other groups relating to the receipt of timely, informative materials covering site remediation activities and/or progress updates.

From the City's perspective, I feel that information is readily available upon request and when the EPA is planning an event. We are kept informed, usually due to the need to coordinate access and for informational requests from the EPA to the City. I believe we do receive notification when materials are sent to site users, but if we are not on the general mailing list, I would request that we are added.

5. ***Has the City of Tumwater responded to any complaints, violations, or other incidents related to the Site? If so, please give details of the events and results of the response.***

As described in Question 3, Water Resources has responded only to a relatively few number of complaints. A history of coliform detections within the distribution system (unrelated to site treatment activities) has caused the City to evaluate additional treatment needs, specifically disinfection of the entire system with 12.5% sodium hypochlorite. This permanent disinfection is under design and is coordinated with WA Department of Health (DOH).

6. ***Describe the regular inspection, monitoring, operations & maintenance (O&M), and schedule performed by the City of Tumwater?***

Steve Craig, Operations Manager, is the appropriate contact for this question.

7. ***What does on-site inspection and the monitoring data for the subdrain system and treatment lagoon, and wellfield air stripper system show? How well are they performing?***

Based on the latest report received from EPA (First 5-Year Review, August 2003), it appears that the treatments are effective at removing VOCs from the groundwater prior to entering the City's distribution system. Additional statements reflect that air and surface water quality are successful to varying degrees (risks remain within EPA's acceptable risk range), although more data is required to assess whether additional activities are necessary.

EPA and their consultants maintain all data collected at the site for this project. The City maintains data required by the DOH for compliance.

8. ***Have there been unexpected O&M difficulties or costs at the Site in the last five years?***

Steve Craig, Operations Manager, is the appropriate contact for this question.

9. ***Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines during the last five years? If so, do they affect the protectiveness or effectiveness of the remedy?***

Since the onset of the project, water quality monitoring (effluent, into the distribution system) has been reduced per DOH regulations based on a successful history of non-detects for VOCs in the distribution system. The City is now required to monitor for VOCs once every three years; however the City routinely monitors VOCs on a voluntary basis.

The reduction in monitoring does not appear to affect either the protectiveness or effectiveness of the treatment remedies.

10. ***Have there been opportunities for the City of Tumwater to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.***

Sampling efforts have been reduced per DOH regulations authorizing a reduced monitoring schedule based on the history of non-detects demonstrated. There have been no changes with operation and/or maintenance of the site. If anything, O&M activities have increased to ensure protection and continued operation of the assets.

11. ***Are you aware of any problems with the existing use restrictions or Institutional Controls (ICs)?***

I am not aware with any issues of the existing use restrictions or ICs.

12. ***Is the Site being used in a manner consistent with the land, groundwater, and other media restrictions? Are you aware of any breaches of the use restrictions/ICs?***

Yes, the site is being used in a manner consistent with all zoning requirements and conforms to all existing ordinances. I am not aware of any breaches of the use restrictions or ICs.

13. ***Has the surrounding land use, access, or other Site conditions changed since implementation of the remedy? Are you aware of any current or impending land and/or resource use changes or development plans that you feel may impact the protectiveness of the Site remedy?***

There have been no changes to the land use, access or other site conditions since the implementation of the remedy. To my knowledge, there are no development proposals or resource use changes pending that would impact the protectiveness of the site remedy.

14. Has formal transfer of personal or real property and easements for the subdrain system occurred in the last five years?

No, there has been no formal transfer of personal or real property and/or easements in the last five years. All such transfers occurred at the completion of the initial work upon full operation of the remedies.

15. Does the City of Tumwater have ordinances or regulations related to the use of groundwater or the municipal water supply?

Yes. The City of Tumwater enforces both the Wellhead Protection Ordinance (TMC 16.26) and the Aquifer Protection Overlay (TMC 16.24). These ordinances protect groundwater and the municipal water supply through prohibiting certain land uses within wellhead protection areas and throughout the city limits.

16. How does the City of Tumwater notify drillers regarding the presence of contaminated groundwater at the Site? Is this an ongoing notification?

Installation of new wells are regulated by the Environmental Health division of Thurston County. When the City is informed that a new well is being considered for siting, the City provides comments relative to the well location. The City prohibits new water systems (Group A or B) within the city limits and Urban Growth Area (UGA), provided that city utility service is readily available. This is an ongoing process outlined by the 1996 Coordinated Water System Plan.

17. What type of monitoring is currently being implemented to determine compliance with the use restrictions/ICs?

Any new developments, or retrofits of existing developments, triggering permits are vetted through the Development Review Process. The City ensures that all existing ordinances are applied to the project and known issues are relayed to the applicant.

18. Is the City required by EPA or Ecology to perform any additional analyses of groundwater from the wellfield prior to the 5-year review?

Outside of routine water quality monitoring required by DOH and special assessments from the EPA, such as UCMR, the City has not been required to perform additional groundwater analyses. The City also conducts routine monitoring of groundwater in a network of wellhead protection monitoring wells located throughout the city.

19. Are there any general or specific City ordinances that might be considered ICs for the Site?

Other than those ordinance referred to in Question 15, the City is also considering a prohibition of new well drilling city-wide. This would further address the ROD recommendation to prohibit the drilling of new wells within the affected area.

20. Do you feel any additional use restrictions/ICs are needed?

See Question 19.

21. Do Site circumstances warrant further coordination or periodic communication with the EPA or other agencies?

While there are no site circumstances that we feel warrant further coordination at this time, it is always possible that a situation may arise that would require additional coordination and restorative efforts. Communication with EPA, DOH and Thurston County Environmental Health should always be encouraged to ensure the proper use, operation and maintenance of the existing remedies.

22. Do you have any additional comments, suggestions, or recommendations regarding the Site's management or operation?

Should funding become available to address ongoing and escalating operational and maintenance costs incurred by the City for site remedies, the City requests that notification of the opportunity be made to the appropriate staff.

PALERMO WELLFIELD SUPERFUND SITE
SECOND FIVE-YEAR REVIEW
INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD	
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Interview Date:	May, 7 2008
Interview Type: (Phone / Visit / Email)	E-mail
Interviewed By:	Self

The following general questions were adapted from the EPA's *Comprehensive Five-Year Review Guidance and Supplement for Evaluation of Institutional Controls.*

INTERVIEW QUESTIONS

1. ***What is your overall impression of the functioning of the remedy (subdrain and treatment lagoon, wellfield air stripper, and long-term monitoring) at the Site?***

   In my opinion, the well field air stripper is effective since there has been no detection of VOCs in the finish water since treatment was implemented.

2. ***From your perspective, what effects have the remedies implemented at the Site had on the surrounding community?***

   The treatment remedies have provided educational opportunities for students from elementary schools to college level engineering programs to study water sources and treatment techniques first hand. This has been a positive addition to their environmental studies programs.

3. ***Are you aware of concerns from the local community regarding the Site, its operation and administration, or overall protectiveness of the ROD remedies?***

   I am not aware of any, but comments and concerns would have been referred to Dan Smith.

4. ***Is information reaching the potential Site users or other groups? Do you feel well informed about the Site activities and progress for parts of the remedy that you are not directly involved in?***

Activities from outside agencies or their representatives other than the city have been coordinated and scheduled appropriately allowing the city to schedule resources to assist as required.

5. ***Has the City of Tumwater responded to any complaints, violations, or other incidents related to the Site? If so, please give details of the events and results of the response.***

Yes, nonacute Coliform MCl violations within the distribution system, has required the city to chlorinate at all points of entry including the Palermo Treatment facility. The source of the Coliform has not been determined to have been caused by the Palermo facility or any other source water in use.

6. ***Describe the regular inspection, monitoring, operations & maintenance (O&M), and schedule performed by the City of Tumwater?***

The Palermo Treatment Facility is scheduled to be inspected weekly at a minimum. Preventative maintenance schedules have been established on a monthly, semiannual, annual and biannual basis for required maintenance. These maintenance items include, but are not limited to motor bearing greasing, pump packing adjustments, pH monitor cleaning/calibration, blower belt adjustments/replacement, valve maintenance and cleaning.

7. ***What does on-site inspection and the monitoring data for the subdrain system and treatment lagoon, and wellfield air stripper system show? How well are they performing?***

Refer to Dan Smith

8. ***Have there been unexpected O&M difficulties or costs at the Site in the last five years?***

Yes, difficulties with the overall design have lead to control valve failures due to freezing temperatures for both hydraulic and pneumatic operated valves that are located outside. We have also had difficulties with the air system that required the air compressor to be replaced and have added an air dryer system to protect pneumatic valves located outside.

The lagoon pumps have been replaced as failures have occurred.

9. ***Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines during the last five years? If so, do they affect the protectiveness or effectiveness of the remedy?***

Maintenance schedules have been primarily unchanged, but are continuously reviewed and adjusted based on the facilities overall performance. Reduced monitoring for VOCs was approved by DOH based historical data indicating the facilities effectiveness. Neither of these have affected the remedy.

10. ***Have there been opportunities for the City of Tumwater to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.***

Reduced VOC monitoring as approved by DOH reduced monitoring cost and time for the city.

11. ***Are you aware of any problems with the existing use restrictions or Institutional Controls (ICs)?***

None

12. ***Is the Site being used in a manner consistent with the land, groundwater, and other media restrictions? Are you aware of any breaches of the use restrictions/ICs?***

Yes, the site is being used in a consistent manner with regards to zoning and city ordnances.

13. ***Has the surrounding land use, access, or other Site conditions changed since implementation of the remedy? Are you aware of any current or impending land and/or resource use changes or development plans that you feel may impact the protectiveness of the Site remedy?***

There have been no changes to the surrounding land use or other site conditions. I am unaware of any changes or development plans that would affect the site.

14. ***Has formal transfer of personal or real property and easements for the subdrain system occurred in the last five years?***

I am unaware of any transfers of property or easements that have occurred for the project.

15. ***Does the City of Tumwater have ordinances or regulations related to the use of groundwater or the municipal water supply?***

Yes, refer to Dan Smith for detailed information.

16. ***How does the City of Tumwater notify drillers regarding the presence of contaminated groundwater at the Site? Is this an ongoing notification?***

Well drilling is regulated by Thurston County Environmental Health and is coordinated with city through Public Works Water Resources.

17. ***What type of monitoring is currently being implemented to determine compliance with the use restrictions/ICs?***

Proposed projects are reviewed by a development review process to ensure that all regulations and ordinances are followed.

18. ***Is the City required by EPA or Ecology to perform any additional analyses of groundwater from the wellfield prior to the 5-year review?***

Other than the DOH monitoring requirements and EPA requirements for UCMR there have been no other sampling requirements for the city.

19. ***Are there any general or specific City ordinances that might be considered ICs for the Site?***

Refer to Dan Smith.

20. ***Do you feel any additional use restrictions/ICs are needed?***

The area could benefit from new restrictions on well drilling within the City's service area.

21. ***Do Site circumstances warrant further coordination or periodic communication with the EPA or other agencies?***

Not at this time.

22. ***Do you have any additional comments, suggestions, or recommendations regarding the Site's management or operation?***

None.

PALERMO WELLFIELD SUPERFUND SITE
SECOND FIVE-YEAR REVIEW
INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD	
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Interview Type: **(Phone / Visit / Email)**	e-mail
Interviewed By:	NA

The following general questions were adapted from the EPA's ***Comprehensive Five-Year Review Guidance and Supplement for Evaluation of Institutional Controls.***

INTERVIEW QUESTIONS

1. What is your overall impression of the functioning of the remedy at the Site?

The Washington Department of Health (DOH) has received little information about the functioning of the remedies over the last five years. The limited information, however, seems to suggest that solvent contaminated groundwater continues to migrate from the source area in the uplands area to the lowlands.

2. From your perspective, what effects have the remedies implemented at the Site had on the surrounding community?

Reduced contaminant levels in the local drinking water supply.

3. Are you aware of concerns from the local community regarding the Site or overall protectiveness of the ROD remedies?

DOH is not aware of any concerns from the community.

4. Is information reaching the potential Site users or other groups? Do you feel well informed about the Site activities and progress for parts of the remedy that that you are not directly involved in?

DOH has not been well informed about the site remedies (e.g. status of groundwater cleanup in the uplands or lowlands) and does not know if others have more information. However, at EPA's request, we have been active participants in the EPA vapor intrusion evaluation and feel that the participating community members have been kept informed about that work and the findings.

5. Has the Department of Health responded to any complaints, violations, or other incidents related to the Site? If so, please give details of the events and results of the responses?

Over the last 5 years, DOH has not responded to any complaints, violations, or other incidents.

6. What does the monitoring data for the indoor air sampling show in the last five years?

The indoor air monitoring data suggests that solvent contaminated groundwater poses, in theory, a very low to low increased inhalation risk at some homes overlying the contaminated groundwater. That risk, however, could be as small as zero.

7. How do you evaluate and publish your findings? Are they available to the public?

In the past, DOH findings about the site were published in health consultation reports. These were made available to the community. Over the last 5 years, DOH health findings regarding the vapor intrusion pathway have been summarized and included in EPA's fact sheets and letters to the individual homeowners whose homes were tested. DOH has discussed with EPA summarizing our findings in a new health consultation report. However, EPA has asked us to hold off on that task for now.

8. Can you suggest additional steps that may need to be considered regarding protectiveness or effectiveness of the remedy?

EPA should consider whether the current remedies will reduce solvent levels in the shallow solvent contaminated groundwater that underlies the Palermo neighborhood.

9. Do Site circumstances warrant further coordination or periodic communication with the EPA, Ecology, or other agencies?

Periodic updates would be useful.

10. Do you have any additional comments, suggestions, or recommendations regarding the Site?

Future plans for addressing the vapor intrusion pathway should be clarified.

PALERMO WELLFIELD SUPERFUND SITE
SECOND FIVE-YEAR REVIEW
INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD	
Name:	Martha Maggi
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Interview Date:	5/12/2008
Interview Type: **(Phone / Visit / Email)**	Email
Interviewed By:	

The following general questions were adapted from the EPA's ***Comprehensive Five-Year Review Guidance and Supplement for Evaluation of Institutional Controls.***

NOTE by M. Maggi: Many of these questions have been answered in detail by Pam Marti of my staff, who (as consultant to Ecology's Toxics Cleanup Program) has most recent first hand knowledge of remedy operation and maintenance. I was asked to answer these questions because I was formerly assigned this site when I was a Toxics Cleanup Program site manager, approx. 1998-2004. I will only add a few remarks where I can recall facts, and that are not covered by P. Marti.

INTERVIEW QUESTIONS

1. What is your overall impression of the functioning of the remedy (subdrain and treatment lagoon, and wellfield air stripper) at the Site?

During my tenure as site manager, overall, the remedy seemed to be functioning but not meeting remedial action goals of lowering the water table sufficiently. There were problems with consistent operation of the lagoon aerators.

2. From your perspective, what effects have the remedies implemented at the Site had on the surrounding community?

The residents have had to enter into access agreements (easements) for periodic access to their properties for monitoring and maintenance.

3. Are you aware of concerns from the local community regarding the Site, its operation and administration, or overall protectiveness of the ROD remedies?

N/A

4. Is information reaching the potential Site users or other groups? Do you feel well informed about the Site activities and progress for parts of the remedy that that you are not directly involved in?
N/A

5. Has Ecology responded to any complaints, violations, or other incidents related to the Site? If so, please give details of the events and results of the responses?

N/A

6. Describe the regular inspection, monitoring, operations & maintenance (O&M), and schedule performed by Ecology?

See Pam Marti's comments.

7. What does on-site inspection and the monitoring data for the subdrain system and treatment lagoon show? How well are they performing?

See Pam Marti's comments.

8. Have there been unexpected O&M difficulties or costs at the Site in the last five years?

N/A

9. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines during the last five years? If so, do they affect the protectiveness or effectiveness of the remedy?

N/A

10. Have all outstanding recommendations provided in the latest 2007 Status Report been resolved regarding lagoon security and physical component operation? Accessing monitoring and sampling locations of the subdrain?
N/A

11. Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.

N/A

12. Are you aware of a consultation with the Washington State Department of Fish and Wildlife regarding depth of the lagoon for fish passage?

Yes. A Fish & Wildlife biologist inspected and provided criteria for EPA to follow in constructing the lagoon. I recall that fish shocking identified anadromous species and that F&W was concerned about the height of the rip rap outfall with respect to fish passage. I do not know if F&W requirements were met.

13. Has Ecology taken any action regarding deed restrictions at Southgate Dry Cleaners?

N/A

14. Are you aware of any problems with the existing Institutional Controls (ICs)? Enforceability, etc.?

I don't recall the IC's in place.

15. Is the Site being used in a manner consistent with the land, groundwater, and other media restrictions? Are you aware of any breaches of the use restrictions/ICs?

N/A

16. Has the surrounding land use, access, or other Site conditions changed since implementation of the remedy? Are you aware of any current or impending land and/or resource use changes or development plans that you feel may impact the protectiveness of the Site remedy?

N/A

17. What type of monitoring is currently being implemented to determine compliance with the ICs?

N/A

18. Where is information about ICs kept? Do you have an IC tracking system or other applicable database system?

During my tenure as project manager, Ecology's Toxics Cleanup Program Headquarters maintained files on IC's; I am unaware whether these still exist.

19. Are there any general or specific ordinances that might be considered ICs for the Site?

N/A

20. Do you feel any additional ICs are needed?

Possibly crawlspace ventilation if this is not already a control in place.

21. Do Site circumstances warrant further coordination or periodic communication with the EPA or other agencies?

In my opinion, there should be regular communication and coordination between the State, EPA and the City of Tumwater in order to circumvent problems.

22. Do you have any additional comments, suggestions, or recommendations regarding the Site's management or operation?

Because the remedy has not met RAO's, EPA should evaluate any possible enhancements to the remedy. The issue of indoor air contamination was unresolved during my time as site manager; further indoor sampling should be considered to compare with earlier sampling. I recall that measured indoor air concentrations (TCE and/or PCE) were between MTCA and CERCLA risk levels.

PALERMO WELLFIELD SUPERFUND SITE
SECOND FIVE-YEAR REVIEW
INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD	
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Interview Type: **(Phone / Visit / Email)**	Email
Interviewed By:	Lara Linde (Parametrix)

The following general questions were adapted from the EPA's ***Comprehensive Five-Year Review Guidance and Supplement for Evaluation of Institutional Controls.***

INTERVIEW QUESTIONS

1. What is your overall impression of the functioning of the remedy (subdrain and treatment lagoon, and wellfield air stripper) at the Site?

Department of Ecology assumed the lead for monitoring the subdrain system and treatment lagoon from the EPA in December 2002. Results since December 2002 indicate that groundwater elevations have been lowered three or more feet below the ground surface for the homes in the central and northern portion of the trunk drain. However, the performance criteria do not appear to have been met for the two homes at the southern end of the trunk drain.

Total depths measured in the cleanouts indicated that sediment was accumulating in the perforated portion of the drain system. In the fall of 2006, the City of Tumwater removed sediment from several of the cleanouts. Total depths measured in the catch basins and lagoon have not been significantly different from the original depths.

PCE and TCE concentrations in the treated surface water samples have been below the remediation goals.

2. From your perspective, what effects have the remedies implemented at the Site had on the surrounding community?

My involvement with the community is limited to contacting the property owners and residents along the west side of Rainier Ave. where the French drain is located to gain access for monitoring purposes.

3. Are you aware of concerns from the local community regarding the Site, its operation and administration, or overall protectiveness of the ROD remedies?

I have not received many inquires from the residents or property owners regarding the operation of this site.

4. Is information reaching the potential Site users or other groups? Do you feel well informed about the Site activities and progress for parts of the remedy that that you are not directly involved in?

I would like to be informed about activities conducted by EPA and their contractors in the Palermo neighborhood. I was not aware that EPA was involved in groundwater sampling in this area. It has caused some confusion between myself, residents along Rainier Ave. and City of Tumwater staff. I have a particular interest in water quality results from the monitoring wells and piezometers in the Palermo neighborhood. Sharing of Ecology and EPA monitoring data seems like it would be beneficial to both groups.

Also the project sign on the east side of the lagoon, along the golf course, has been damaged for some time.

5. Has Ecology responded to any complaints, violations, or other incidents related to the Site? If so, please give details of the events and results of the responses?

Not to my knowledge.

6. Describe the regular inspection, monitoring, operations & maintenance (O&M), and schedule performed by Ecology?

Ecology conducts regular monitoring and inspections on a semi-annual basis to determine if the subdrain system and treatment lagoon are operating within the remediation goals. Monitoring includes the following activities:

- Measure depth-to-groundwater in 12 piezometers (PZ-704 through PZ-728) and eight trunk drain cleanouts (CO-1 through CO-8) to determine if the subdrain system has lowered the static groundwater elevation beneath the homes at the base of Palermo bluff to at least three feet below the ground surface.
- Measure total depth in CO-1 through CO-8 and three catch basins (CB-1, CB-2, CB-3) to determine if sedimentation has occurred in the trunk drain or tightline pipe. Measure total depth of the treatment lagoon along three cross-sections (A1, A2, A3) to determine if sedimentation or scouring has occurred in the lagoon.

- Measure flow rates and collect water samples for chemical analysis from three drain cleanouts (357, 358, 359), three outfalls to the treatment lagoon (360, 350, 362), and three surface water stations (356, 361, 364) to assess the contaminant removal performance of the system and compliance with remediation goals. Locations of the sample stations as well as the sample identification numbers are described in the following table.

Sample Station Identification and Descriptions, Palermo Subdrain System.

Sample Identification	Sample Station Description
Flow in Subdrain System – South to North	
357	Cleanout CO-6 (southernmost station within trunk drain)
358	Cleanout CO-4 (central station within trunk drain)
359	Cleanout CO-1 (northernmost station within trunk drain)
360	Tightline pipe outfall (influent from subdrain system to treatment lagoon)
361	Lagoon effluent
364	Lagoon watercourse discharge to Deschutes River
Inflows to Treatment Lagoon Other Than the Subdrain System	
350	M Street storm drain outfall
356	Watercourse flow upstream of the treatment lagoon
362	M Street terminus catch basin outfall (rarely flows)

7. What does on-site inspection and the monitoring data for the subdrain system and treatment lagoon show? How well are they performing?

Refer to answer 1.

8. Have there been unexpected O&M difficulties or costs at the Site in the last five years?

Maintaining correct contact information for the property owners and residents along Rainier Ave has been difficult.

Total depths measured in the cleanouts indicated that sediment was accumulating in the perforated portion of the drain system. In the fall of 2006, the City of Tumwater removed sediment from several of the cleanouts.

Maintenance of the lagoon area and the three aerators has provided its share of difficulties. Vegetation growth on the lagoon banks has made finding and maintaining the survey makers used to measure the lagoon depth difficult. The City of Tumwater has also had difficult time keeping the aerators operating.

9. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines during the last five years? If so, do they affect the protectiveness or effectiveness of the remedy?

Ecology's monitoring schedule has remained the same.

10. Have all outstanding recommendations provided in the latest 2007 Status Report been resolved regarding lagoon security and physical component operation? Accessing monitoring and sampling locations of the subdrain?

I'm not sure which report you're referring to.

11. Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.

Not to my knowledge.

12. Are you aware of a consultation with the Washington State Department of Fish and Wildlife regarding depth of the lagoon for fish passage?

No.

13. Has Ecology taken any action regarding deed restrictions at Southgate Dry Cleaners?

Not to my knowledge.

14. Are you aware of any problems with the existing Institutional Controls (ICs)? Enforceability, etc.?

Not to my knowledge.

15. Is the Site being used in a manner consistent with the land, groundwater, and other media restrictions? Are you aware of any breaches of the use restrictions/ICs?

Not to my knowledge.

16. Has the surrounding land use, access, or other Site conditions changed since implementation of the remedy? Are you aware of any current or impending land and/or resource use changes or development plans that you feel may impact the protectiveness of the Site remedy?

A more secure fence was installed on the west side of the lagoon at the end of M Street. Public access to the lagoon is much more restricted.

17. What type of monitoring is currently being implemented to determine compliance with the ICs?

I have no knowledge of this.

18. Where is information about ICs kept? Do you have an IC tracking system or other applicable database system?

I have no knowledge of this.

19. Are there any general or specific ordinances that might be considered ICs for the Site?

I have no knowledge of this.

20. Do you feel any additional ICs are needed?

I have no knowledge of this.

21. Do Site circumstances warrant further coordination or periodic communication with the EPA or other agencies?

I would like to be more informed about activities conducted by EPA and their contractors in the Palermo neighborhood.

22. Do you have any additional comments, suggestions, or recommendations regarding the Site's management or operation?

Reduce total depth measurements of the lagoon to once a year.

PALERMO WELLFIELD SUPERFUND SITE
SECOND FIVE-YEAR REVIEW
INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD	
Name:	Laura Klasner
Title:	Site Manager, Toxics Cleanup Program
Organization:	State of Washington, Department of Ecology
Street Address:	PO Box 47775
City, State, Zip:	Olympia, WA 98504-7775
Telephone No.:	360-407-6265
E-Mail Address:	lkla461@ecy.wa.gov
Interview Date:	5-21-08
Interview Type: **(Phone / Visit / Email)**	email
Interviewed By:	

The following general questions were adapted from the EPA's ***Comprehensive Five-Year Review Guidance and Supplement for Evaluation of Institutional Controls.***

Note by L. Klasner (May 13, 2008): I was asked to fill out this form because I am the current Ecology, Toxics Cleanup Program site manager for this cleanup site. However, because I have been involved as site manager for this particular cleanup site only briefly (less than one day), I recommend you refer to the interview records filled out by others. Many of these questions have been answered in detail by Pam Marti (consultant to Ecology's Toxics Cleanup Program) and Martha Maggi (former site manager for Ecology's Toxics Cleanup Program). Both P. Marti and M. Maggi have worked closely with the site and have first hand knowledge of remedy operation and maintenance.

Please do not hesitate to call me with questions. I am happy to track down information for the 5 year review process or future project needs. I can be reached by phone (360-407-6265) or email (lkla461@ecy.wa.gov).

Note by L. Klasner (May 21, 2008): I understand that I am submitting this form past the due date of May 15, 2008. However, I have since had the opportunity to do some file review and have responded to the questions. I thought it would be helpful for EPA and Parametrix to have my input.

INTERVIEW QUESTIONS

1. What is your overall impression of the functioning of the remedy (subdrain and treatment lagoon, and wellfield air stripper) at the Site?

From what I understand, the system is functioning and some remedial action objectives (RAOs) are being met. However, the following RAOs are not being achieved:

- depth to groundwater does not meet the performance goal of at least 3 feet below ground surface in the southern portion of the Palermo neighborhood (pg 4-5 of First Five-Year Review and Annual Status Reports by Ecology - EAP)
- shallow groundwater perchloroethylene (PCE) and trichloroethylene (TCE) concentrations underneath homes exceed remediation goals of

0.027 µg/L TCE and 0.05 µg/L PCE (pg 7-3 of ROD and Groundwater Long-Term Monitoring 2006 Annual Report)

- aquifer PCE and TCE concentrations throughout the site exceed remediation goals of 5 µg/L TCE and 5 µg/L PCE (Table 7-1 of ROD and Groundwater Long-Term Monitoring 2006 Annual Report)

I am especially concerned about the risk of vapor intrusion. I have not reviewed air sampling data, but understand that PCE and TCE have been detected in indoor air in homes in the past.

2. ***From your perspective, what effects have the remedies implemented at the Site had on the surrounding community?***
I don't know. Up to this date, I have not interacted with the community.

3. ***Are you aware of concerns from the local community regarding the Site, its operation and administration, or overall protectiveness of the ROD remedies?***
I don't know. Up to this date, I have not interacted with the community.

4. ***Is information reaching the potential Site users or other groups? Do you feel well informed about the Site activities and progress for parts of the remedy that that you are not directly involved in?***
I don't know if information is reaching potential Site users or other groups. Based on my review of Ecology files for this Site, it appears that Ecology has <u>not</u> been receiving information on Site activities or progress for parts of the remedy that Ecology is not directly involved in. Ecology files contain only one outside report (Groundwater Long-Term Monitoring 2006 Annual Report) following the First Five-Year Review (2003).

5. ***Has Ecology responded to any complaints, violations, or other incidents related to the Site? If so, please give details of the events and results of the responses?***
I don't know. There are none listed in the Ecology's TCP-SWRO Central Files in the past 5 years.

6. ***Describe the regular inspection, monitoring, operations & maintenance (O&M), and schedule performed by Ecology?***
Please refer to comments by P. Marti (Ecology-EAP).

7. ***What does on-site inspection and the monitoring data for the subdrain system and treatment lagoon show? How well are they performing?***
Based only on the performance goal of a 3 foot minimum depth to groundwater, the subdrain system is working in most, but not all, areas. Depth to groundwater does not meet this performance goal in the southern portion of the Palermo neighborhood (pg 4-5 of First Five-Year Review). The treatment lagoon monitoring data indicate that discharge to the Deschutes River is meeting the performance goal of 2.7 µg/L TCE and 0.8 µg/L PCE (Table 7-1 of ROD).

8. ***Have there been unexpected O&M difficulties or costs at the Site in the last five years?***

Please refer to comments by P. Marti (Ecology-EAP).

9. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines during the last five years? If so, do they affect the protectiveness or effectiveness of the remedy?
Please refer to comments by P. Marti (Ecology-EAP).

10. Have all outstanding recommendations provided in the latest 2007 Status Report been resolved regarding lagoon security and physical component operation? Accessing monitoring and sampling locations of the subdrain?
I do not know. We would like to discuss these during the May 22, 2008 Site visit, if possible. As I understand it, the following are suggestions that have been made by P.Marti in Ecology's 2007 Status Report and her Second Five-Year Review Interview Questionnaire:

- Clear thick vegetation near piezometers at base of wooded bluff (PZ-704, PZ-709, PZ-715) to improve access
- Closely monitor cleanouts (CO-3, CO-4, CO-5, CO-6, CO-7, CO-8) to prevent sediment accumulation
- Replace west survey marker for cross-section A-3 of lagoon
- Recover central aerator from lagoon bottom and put back into operation
- The project sign along the east side of the lagoon needs to be replaced
- Vegetation along lagoon banks needs thinning/trimming to help find and maintain survey markers
- Reduce total depth measurements at lagoon to once per year
- Better sharing of EPA groundwater quality data from groundwater sampling

11. Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.
Please refer to comments 11 & 22 by P. Marti (Ecology-EAP).

12. Are you aware of a consultation with the Washington State Department of Fish and Wildlife regarding depth of the lagoon for fish passage?
No

13. Has Ecology taken any action regarding deed restrictions at Southgate Dry Cleaners?
Not to my knowledge.

14. Are you aware of any problems with the existing Institutional Controls (ICs)? Enforceability, etc.?
N/A

15. Is the Site being used in a manner consistent with the land, groundwater, and other media restrictions? Are you aware of any breaches of the use restrictions/ICs?
I do not know.

16. Has the surrounding land use, access, or other Site conditions changed since implementation of the remedy? Are you aware of any current or impending land and/or resource use changes or development plans that you feel may impact the protectiveness of the Site remedy?
I do not know.

17. What type of monitoring is currently being implemented to determine compliance with the ICs?
N/A

18. Where is information about ICs kept? Do you have an IC tracking system or other applicable database system?
N/A. Ecology's database (ISIS) does have the ability to document and track institutional controls at sites.

19. Are there any general or specific ordinances that might be considered ICs for the Site?
N/A

20. Do you feel any additional ICs are needed?
There may be a need for crawlspace ventilation.

21. Do Site circumstances warrant further coordination or periodic communication with the EPA or other agencies?
Yes. I suggest regular communication and coordination between Ecology, EPA, and the City of Tumwater. Also, I'd like to receive information on recent activities. Ecology has received minimal documentation/communication of ongoing activities or issues since the First Five-Year Review (2003).

22. Do you have any additional comments, suggestions, or recommendations regarding the Site's management or operation?
Because the remedy has not met RAOs, EPA should evaluate possible enhancements to the remedy.

PALERMO WELLFIELD SUPERFUND SITE
SECOND FIVE-YEAR REVIEW
INTERVIEW QUESTIONNAIRE

INTERVIEW RECORD	
Name:	Scott Rose
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E-Mail Address:	sros461@ecy.wa.gov
Interview Date:	
Interview Type: **(Phone / Visit / Email)**	
Interviewed By:	

The following general questions were adapted from the EPA's ***Comprehensive Five-Year Review Guidance and Supplement for Evaluation of Institutional Controls.***

INTERVIEW QUESTIONS

1. What is your overall impression of the functioning of the remedy (subdrain and treatment lagoon, and wellfield air stripper) at the Site?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

2. From your perspective, what effects have the remedies implemented at the Site had on the surrounding community?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

3. Are you aware of concerns from the local community regarding the Site, its operation and administration, or overall protectiveness of the ROD remedies?

No.

4. Is information reaching the potential Site users or other groups? Do you feel well informed about the Site activities and progress for parts of the remedy that that you are not directly involved in?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

5. Has Ecology responded to any complaints, violations, or other incidents related to the Site? If so, please give details of the events and results of the responses?

Not that I'm aware of.

6. Describe the regular inspection, monitoring, operations & maintenance (O&M), and schedule performed by Ecology?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

7. What does on-site inspection and the monitoring data for the subdrain system and treatment lagoon show? How well are they performing?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

8. Have there been unexpected O&M difficulties or costs at the Site in the last five years?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

9. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines during the last five years? If so, do they affect the protectiveness or effectiveness of the remedy?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

10. Have all outstanding recommendations provided in the latest 2007 Status Report been resolved regarding lagoon security and physical component operation? Accessing monitoring and sampling locations of the subdrain?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

11. Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes, cost savings, and/or improved efficiency.

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

12. Are you aware of a consultation with the Washington State Department of Fish and Wildlife regarding depth of the lagoon for fish passage?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

13. Has Ecology taken any action regarding deed restrictions at Southgate Dry Cleaners?

Not that I am aware of.

14. Are you aware of any problems with the existing Institutional Controls (ICs)? Enforceability, etc.?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

15. Is the Site being used in a manner consistent with the land, groundwater, and other media restrictions? Are you aware of any breaches of the use restrictions/ICs?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

16. Has the surrounding land use, access, or other Site conditions changed since implementation of the remedy? Are you aware of any current or impending land and/or resource use changes or development plans that you feel may impact the protectiveness of the Site remedy?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

17. What type of monitoring is currently being implemented to determine compliance with the ICs?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

18. Where is information about ICs kept? Do you have an IC tracking system or other applicable database system?

Information regarding ICs for a site are typically tracked in our ISIS database.

19. Are there any general or specific ordinances that might be considered ICs for the Site?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

20. Do you feel any additional ICs are needed?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

21. Do Site circumstances warrant further coordination or periodic communication with the EPA or other agencies?

I have only been recently involved in this site. Due to my lack of familiarity with the site, I have no comment.

22. Do you have any additional comments, suggestions, or recommendations regarding the Site's management or operation?

No

APPENDIX F

Ecology and WDOH Comments to Five-Year Review

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
Division of Environmental Health
Office of Environmental Health Assessments
234 Israel Road S.E. Town Center 3 PO Box 47846 Olympia, Washington 98504-7846
Tel: 360.236.3184 Toll Free: 1.877.485.7316 FAX: 360.236.2251
* TDD Relay Service: 1.800.833.6388*

Health Consultation Memorandum

September 11, 2008

TO: Chris Cora
U.S. Environmental Protection Agency

FROM: Barbara Trejo
Washington Department of Health

SUBJECT: Final Second Five-Year Review Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Background and Statement of Issues

The U.S. Environmental Protection Agency (EPA) recently provided the Washington Department of Health (DOH) with its August 18, 2008, *Final Second Five-Year Review Report, Palermo Wellfield Superfund Site, Tumwater, Washington.* The purpose of the second five-year review is for EPA to determine whether the remedial actions being implemented at this site are protective of human health and the environment. DOH appreciates the opportunity to review and comment on this version of the report.

The site includes the Palermo Wellfield and the Palermo neighborhood, a residential community, located within the Deschutes River Valley and the adjacent uplands located to the west of the valley. The uplands contain predominantly commercial properties including the Southgate Mall and two existing Washington Department of Transportation (DOT) properties. The Palermo Wellfield, where trichloroethylene (TCE) was detected in the municipal water supply in 1993, is located in the Palermo neighborhood.

TCE and tetrachloroethylene (PCE) have been found at various locations in upland soils. Some of those contaminants entered groundwater and migrated eastward, below the Palermo neighborhood. In addition, shallow groundwater containing PCE and TCE was found to surface near the base of the Palermo bluff, ponding as surface water in the yards and crawlspaces of some of the homes in the Palermo residential neighborhood in the valley.

EPA has conducted some cleanup activities at the site including a wellhead treatment system (using air stripping technology) at the Palermo Wellfield, a soil vapor extraction (SVE) system at

the Southgate Dry Cleaner (one of a number of potential source areas), and a french drain system in the Palermo neighborhood to lower the water table below homes and property near the Palermo bluff. EPA also conducts long-term groundwater monitoring at the site and is evaluating the groundwater to indoor air pathway in the Palermo neighborhood.

DOH initially became involved at the Palermo site in the mid-1990s when it reviewed EPA's site inspection report. A health consultation report summarizing DOH's findings and recommendation to fill site data gaps was completed in 1996. In 1999, during the later part of the remedial investigation, EPA requested that DOH review EPA's draft proposed site plan. As part of that health consultation, DOH identified some health related issues including potential exposures to contaminants via the groundwater to indoor air pathway in the Palermo neighborhood. EPA began evaluating the groundwater to indoor air pathway in 2001 when it sampled indoor air at some homes. DOH evaluated this indoor air data and completed another health consultation report in 2002, summarizing its conclusions and recommendations, which included a determination that it was not clear whether the source of the TCE and PCE in indoor air was the contaminated groundwater or an unrelated background source. DOH also concluded exposures to the detected levels of PCE and TCE in indoor air in 2001 posed no apparent public health hazard. Since then, DOH has continued working with EPA to assess the vapor intrusion pathway in the Palermo neighborhood.

Discussion

DOH was only able to conduct a cursory review of the report because EPA only allowed a short time to review the five-year report, which contains limited supporting information and data. Nonetheless, DOH did identify some concerns about the site and the report.

Based on information presented in the five-year review report, it does not appear that the site has been fully characterized. The figures presented in the report suggest that the groundwater monitoring system is not adequate for determining the lateral extent of the TCE and PCE plumes in most of the compass directions across the site (see figures 4-4 and 4-5). Information provided in EPA's June 1999, ***Final Remedial Investigation for the Palermo Wellfield Superfund Site, Tumwater, Washington*** (see figures 4-9 and 4-10) suggests that vertical extent of contamination might also be unknown across the site.

TCE and PCE contaminated soil appears to be limited to the upland area of the site. EPA's June 1999 RI report (see Figures 4-1 through 4-4) suggests there are a number of potential sources of TCE and PCE in the upland areas (e.g., two DOT facilities, Southgate Mall, vicinity of Brewery City Pizza, and a Chevron Station) based on various sampling events. However, it is not clear that the extent of soil contamination is well defined at any of these locations. EPA's soil cleanup efforts appear to have been focused mainly on the Southgate Dry Cleaner facility. The rationale for this decision is unclear given that contaminated soil at the other locations could also contribute to groundwater contamination and potentially affect indoor air quality.

Lack of understanding about the groundwater plume boundaries, contaminated soil boundaries, and the potential impact of contaminated media on indoor air quality in the upland areas are significant data gaps that need to be addressed by EPA.

The following numbered items summarize some additional DOH concerns and recommendations:

1. **Five-Year Review Summary Form, Issues –** It is noted that no deed restriction exists for the Southgate Dry Cleaner, which is an important issue if contamination remains at the site. However, as noted above, it does not appear that the Southgate Dry Cleaner is the only contaminant source area at the site. EPA should consider using deed restrictions at the other sources too to prevent releases or possible exposures to contaminants in the future.

2. **Five-Year Review Summary Form, Recommendations and Follow-up Actions** – EPA is recommending a deed restriction <u>or</u> soil sampling for the Southgate Dry Cleaner property. However, a deed restriction alone might not be an adequate follow-up action if PCE or other contaminants remain in the soil because these contaminants could be posing a potential threat to indoor air at the dry cleaner and other nearby buildings. DOH recommends that EPA conduct additional soil characterization work, including soil gas testing, at the dry cleaner.

3. **Five-Year Review Summary Form, Recommendations and Follow-up Actions** – It is noted that indoor air monitoring continues to insure concentrations remain below 1.46 micrograms per cubic meter (µg/m3). The contaminant this level relates to is not mentioned but based on later report information it appears this is the remedial action objective (RAO) for trichloroethylene (TCE). It should be noted that this level is almost two orders of magnitude higher the MTCA TCE cleanup level (0.022 $\mu g/m^3$). EPA should indicate in the five year review whether it will conduct some type of action to reduce contaminant levels when contaminant levels exceed RAOs.

4. **Section 4.1, Remedy Selection** – The report notes that the MTCA Method B air cleanup level for tetrachloroethylene is 4.38 µg/m3 (see item 2, description of "selected remedy"). However, Ecology's CLARC database indicates that level is 0.42 $\mu g/m^3$. The report should be corrected.

5. **Section 4.1, Remedy Selection -** The report indicates that attainment of the soil remediation goal at Southgate Dry Cleaners was evaluated in the past based on PCE concentrations in vapor discharged from the remediation system (see item 4). Attainment of the soil remediation goal should be based on soil results, not vapors.

6. **Section 4.2.4, Component 4** – The report indicates that areas of PCE contaminated soils remain at the Southgate Mall, near the dry cleaner after the soil vapor vacuum system was decommissioned in June 2000. This is based on one confirmation soil sample collected after the decommissioning. One confirmation sample is inadequate for assessing cleanup success at the property and whether the soils continue to pose a health risk. EPA should define the

initial lateral and vertical extant of contaminated soil at Southgate Mall and develop a soil sampling plan to assess current contaminant levels.

7. **Section 4.3.4, Component 5 – Long-Term Groundwater Monitoring** – Figure 4-4 and 4-5 do not appear to be correctly constructed (shallow and deep wells were used together to construct groundwater concentration and flow maps). Correctly constructed figures are necessary for understanding groundwater flow and potential exposures and to evaluate possible health risks.

8. **Section 4.3.4, Component 5 – Long-Term Groundwater Monitoring** – It is noted in the report that "[c]omparison of the long-term monitoring data to the RI data implies that the removal of residual PCE in soil by the SVE system operated from March 1998 to June 2000 has resulted in decreased PCE concentrations in groundwater downgradient of Southgate Dry Cleaners." However, when looking at Figure 4-5, it appears that no monitoring wells are located directly downgradient of the dry cleaner. These facts should be noted in the revised report.

9. **Section 6.4.1, Key Data Trends** - The report notes that, based on indoor air sampling results since 2004, concentrations of PCE and TCE appear to be generally decreasing over time in indoor air at most sampling locations in the Palermo neighborhood. However, a number of homes have only been sampled twice so this conclusion is not well supported. In addition, there are some locations, such as at 206 O Street, where levels have been fluctuating above the remedial goal. These facts should be noted in the revised report.

10. **Section 7.1.2, Subdrain System and Treatment Lagoon** – The report notes that only one TCE exceedance occurred in May 2004 and one PCE exceedance occurred in December 2004. What is exceeded is uncertain. However, DOH assumes it is the remedial goal. This finding is inconsistent with the results presented on Table 7-1, which shows a number of TCE and PCE exceedances of the respective remediation goals.

11. **Section 7.1.4, Long-Term Groundwater Monitoring, First Sentence** – The report notes that the Palermo Wellfield is capturing the groundwater contaminant plumes. However, this conclusion is not supported by Figure 4-4 and the 2004 through 2007 *Groundwater Long-Term Monitoring Reports*, which suggest that the Palermo Wellfield is not capturing all the contaminated groundwater. This situation could pose a health risk if the contaminated groundwater is pulled toward other water supply wells, such as the Pabst Brewery wells, located northeast of the site, or discharging into the nearby Deschutes River.

12. **Section 7.1.4, Long-Term Groundwater Monitoring** –DOH agrees with EPA that the groundwater monitoring network needs to be re-evaluated. DOH recommends that EPA summarize that evaluation in a technical memorandum and provide DOH with an opportunity to review the findings and recommendations.

13. **Section 7.2.2.1, Potential Inhalation Risks** - The report notes that although indoor air concentrations are above the calculated MTCA Method B cleanup level, they are below

remediation goals in the ROD, which are within the acceptable risk range of 1E-4 to 1E-6. However, Table 7-1 indicates that there are some exceedances. The portions of the report where this is noted, including sections 7.1.2, 7.4.2, 7.2.2.1 and 7.2.2.2, should be corrected.

14. **Section 7.2.2.1, Potential Inhalation Risks** – DOH understands that the EPA Region 10 risk assessment unit is still using a TCE slope factor of 0.4 per mg/kg-day, which is consistent with the slope factor currently used by DOH.

15. **Table 7-2** – This table includes monitoring well MW-ES-9, which is not a shallow monitoring well, so using it to compare with indoor air levels is inappropriate.

16. **Section 9, Recommendations and Follow-up Actions** - This section should be modified to address DOH's recommendations as noted above.

17. **Section 10, Protectiveness Statement** – The protectiveness statement should be revised to reflect the issues and recommendations as noted above.

Conclusion

Because of the issues and data gaps, described above, DOH cannot determine whether the remedial actions conducted by EPA at the Palermo Superfund site are protective of human health. As a result, the site poses an indeterminate public health hazard.

Recommendations

EPA should address DOH's comments and recommendations as summarized in the discussion section above. DOH will evaluate any new data or other information that becomes available to determine whether the site might pose a current or future public health hazard.

cc: Laura Klasner, Washington Department of Ecology

RECEIVED
AUG 29 2008
Environmental
Cleanup Office

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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CERTIFIED MAIL
7006 3450 0001 6754 9904

August 27, 2008

Mr. Chris Cora
U.S. Environmental Protection Agency
Region 10
1200 6th Ave, Suite 900, ECL-115
Seattle, WA 98101-3140

Dear Mr. Cora:

Re: DRAFT Final Second Five-Year Review Report, Palermo Wellfield Superfund Site, Tumwater, WA, August 18, 2008

Thank you for the opportunity to review the draft Five-Year Review Report. **Ecology does not agree that the remedy at the site currently protects human health and the environment**. Please consider the following comments in finalizing the report:

1. First 5 Year Review, Unresolved Issues:

    a. Ecology's understanding of the Operation and Maintenance (O&M) transition point is, as stated in the National Contingency Plan (40 CFR 300.435(f)), O&M measures are initiated after the remedy has achieved the remedial action objectives and remediation goals in the Record Of Decision (ROD), and is determined to be operational and functional. The ROD remedial action objectives and remediation goals have not been met. As pointed out in the September 2, 2003, 5 Year Review comments by Ecology to the Environmental Protection Agency (EPA), **please make a note in the report that Ecology has not accepted full operation and maintenance responsibility. Ecology agreed to perform monitoring on a temporary basis as indicated in Ecology's letter to EPA, dated May 14, 2002.**

    b. References are made to the risk range of 10^{-6} to 10^{-4} being within the acceptable range for EPA. **However, because the Model Toxics Control Act (MTCA) is an Applicable, Relevant, and Appropriate Requirement (ARAR), the acceptable risk for any single contaminant at the site is 10^{-6} and anything over that level is**

unacceptable. This should be stated in the report. MTCA does make an exception in the case of maximum contaminant levels (MCLs), which are acceptable if they do not exceed the 10^{-5} risk level (ex. Sections 7.2.2.1 and 7.3).

2. Wellhead treatment system at Palermo Wellfield:

   a. Ecology agrees plume capture should be re-evaluated. **Prior to the plume capture analysis, the monitoring network should be expanded in order to fully delineate, monitor, and evaluate capture of the plume.**

   b. **A process and communication protocol should be established between necessary parties that requires evaluation of how future proposed wellfield developments will affect plume capture and water quality.**

3. Soil vapor extraction (SVE) system and institutional controls at Southgate Dry Cleaner site:

   a. Because contaminated soils remain on site, Ecology agrees an institutional control is needed to prevent exposure to subsurface contamination and to ensure that a non-permeable surface is maintained for protection of groundwater. **Ecology understands that EPA will assume responsibility for finalizing the environmental covenant/deed restriction.**

   b. Because only one confirmation sample was collected and it confirmed contamination remaining on site above the remediation goals, **further sampling should be performed to evaluate the extent and magnitude of contamination left on site following SVE shutdown. MTCA Method B cleanup levels for soil (protective of groundwater for drinking water use, leaching pathway) are 0.054 milligrams per kilogram (mg/kg) tetrachloroethylene (PCE) and 0.022 mg/kg trichloroethylene (TCE). These values should be used for delineating soil contamination and for establishing what area needs to be included in the environmental covenant/deed restriction.**

4. French drain (subdrain) system in Palermo neighborhood:

   a. **The vapor intrusion exposure pathway is complete in at least portions of the Palermo neighborhood because indoor air concentrations have exceeded the acceptable limit of 10^{-6} excess cancer risk. Ecology agrees that indoor air monitoring should be continued. Ecology requests further discussion with the EPA and Department of Health (DOH) on the effectiveness of the remedy and possible further action.** The subdrain was installed in January 2001 in order to decrease vapor intrusion into the Palermo neighborhood homes. The Record of Decision (ROD) remediation goals set to lower the risk of human exposure through indoor air were (1) to lower the groundwater table to 18 inches below crawlspaces or 3 feet (ft) below ground surface (bgs) and (2) to establish indoor air cleanup levels of

4.38 microgram per cubic meter ($\mu g/m^3$) PCE and 1.43 $\mu g/m^3$ TCE. The subdrain has been effective in lowering groundwater to 18 inches or 3 ft below bgs in all areas except for the southwest corner of the Palermo neighborhood. For example, the most recent water level measurement from a piezometer in this area, PZ-722, indicates artesian conditions (+0.45 ft above ground surface). Other piezometers in this area (ex. PZ-715 and PZ-716) are inaccessible due to vegetation overgrowth. Shallow groundwater samples collected from the neighborhood subdrain and monitoring network (ex. CO-6/Station 357, PZ-721, PZ-724, PZ-728, MW-ES-09) exceed groundwater PCE and/or TCE remediation goals with stable or fluctuating TCE concentration trends and slightly decreasing PCE trends. In addition, six homes along the western edge of the Palermo neighborhood have exceeded indoor air remediation goals in 2001 and/or 2004. Three of these homes had higher crawl space concentrations than living area concentrations, which indicates an upward gradient typical of vapor intrusion. The available data indicates fluctuating indoor air concentrations in these homes.

b. **Sections 7.1.2, 7.2.2.1, 7.2.2.2, and 7.4.2 inaccurately summarize indoor air exceedances and should be corrected.**

c. **Ecology understands that the City of Tumwater will be responsible for re-establishing access to piezometers so that this area of concern can be monitored.**

d. **As new information is released about the toxicity of TCE, the remediation goals should be updated. Meanwhile, indoor cleanup levels of 0.42 $\mu g/m^3$ PCE and 0.022 $\mu g/m^3$ TCE are the ARARs, established under MTCA Method B, that should be applied as remediation goals.** The ROD remediation goals for PCE and TCE in indoor air rely on slope factors that result in less stringent indoor air cleanup levels than required by MTCA. Ecology understands that EPA's carcinogenicity assessment for TCE has been withdrawn and is currently undergoing re-evaluation. Please refer to the attached Ecology document, "Trichloroethylene Toxicity Information." **Note: All homes sampled in the Palermo neighborhood have exceeded MTCA B indoor air cleanup levels for PCE and/or TCE.**

e. **Ecology recommends further evaluation regarding the protectiveness of the remedy for the ditch downgradient of the aeration lagoon. Please clarify that Ecology did not move or change the point of compliance (Sections 4.3.2.2 and 6.4.1), but did add an additional monitoring location.** A point of compliance for lagoon discharge was not established in the ROD. The report states that Ecology moved the point of compliance for surface water discharge from the aeration lagoon effluent point to approximately 2,000 feet downstream closer to the Deschutes. In 2003, Ecology added a sampling point at the culvert prior to discharge into the Deschutes (Station 364) to monitor whether concentrations exceeding remediation goals at the lagoon effluent sampling point (Station 361) were decreasing before they reached the Deschutes River. Data indicates surface water reaching the Deschutes

has consistently met surface water cleanup criteria. The question still remains; however, whether this remedy can be considered protective of human health, the environment, and surface waters of the state. The reach between the aeration lagoon and the Deschutes River maintains year-round flow and serves as habitat for fish and other aquatic organisms.

f. **In accordance with the 2006 EPA National Recommended Water Quality Criteria for Priority Toxic Pollutants, 0.69 µg/L PCE and 2.5 µg/L TCE are required for human health, consumption of water and organisms and should be used as remediation goals.** ROD remediation goals for surface water are 0.8 micrograms per liter (µg/L) PCE and 2.7 µg/L TCE.

5. Long-term groundwater monitoring:

Investigations to date and the current monitoring network have not fully delineated the vertical and lateral extent of the plume. Therefore, Ecology agrees that the monitoring network should be re-evaluated to better assess contaminant plume migration and remediation. Specific concerns include:

a. **Potential TCE and PCE source areas to the Palermo Wellfield should be investigated, included in the monitoring network, and evaluated for remedial action.** For example, the 1999 Remedial Investigation (RI) and 2001 Final Trip Report identify sources of TCE and/or PCE in soil and/or groundwater that potentially contribute to the site at the following locations:

   i. WDOT Testing Lab, 1655 South 2nd Avenue
   ii. WDOT Maintenance Facility , 5720 Capitol Boulevard
   iii. Brewery City Pizza (reported former dry cleaners or potential smear zone), 150 Capitol Boulevard
   iv. Former WDOT facility at 701 Trosper Road (or 5325 Littlerock Road)

   Groundwater gradients determined in the 1999 RI indicate groundwater flow from these locations travels towards the Palermo Wellfield. In addition, groundwater flow and contaminant transport modeling summarized in the 1999 RI indicates several of these facilities are likely sources to the Palermo Wellfield plume.

b. **A monitoring well(s) should be placed downgradient of the Southgate Dry Cleaners to evaluate and monitor the long-term effectiveness of the SVE source removal.**

c. **Figure 4-5 should be modified to indicate that PCE has been found at CO6.** Figure 4-5 represents PCE concentrations in groundwater and shows that PCE "cleans up" before it reaches the Palermo bluffs or neighborhood. This is misleading. Subdrain sampling results (CO6/Station 357) indicate PCE is

consistently present at concentrations above the remediation goal in shallow groundwater downgradient of the bluffs in the Palermo neighborhood.

d. Vertical Delineation: Figures 4-4 and 4-5 incorrectly merge data from a series of wells ranging between 7.5 and 123 ft bgs to contour TCE and PCE plume concentrations. **Groundwater contamination from wells screened at similar elevations should be grouped and evaluated separately (ex. contouring the plume at different depth intervals and cross-sections).**

e. **Interpretation of Results:** Throughout the report, generalized statements are made that concentrations of both PCE and TCE appear to be decreasing in groundwater throughout the entire site (Sections 4.3.2.2, 4.3.4, and 6.4.1). These statements are not supported by the data without clarification. **Neither natural attenuation or treatment of the plume by the pump and treat remedy appear to be remediating the plume at significant rates.**

PCE – Significant decreases in PCE coincide with source removal during the operation of the SVE (March 1998 to June 2000) in monitoring wells MW-ES-04 and MW-ES-06 as well as subdrain sampling stations 357, 358, 359, and 360. However, the data in most sampling locations following this initial source removal indicate slightly decreasing, stable or fluctuating concentrations.

TCE –Monitoring well, subdrain, piezometer, and town well groundwater contaminant data does not support a general decreasing trend. Most wells have fluctuating or stable TCE concentration trends. As an exception, and not a plume-wide trend, data from a couple wells indicate decreasing concentrations (ex. MW-ES-03 and MW-ES-05). Conversely, MW-UI data indicate increasing TCE concentrations.

6. Other:

a. Figures: The former DOT maintenance facility, located at 701 Trosper Road, should be added.

b. Ecology recommends schedule coordination of sampling events (ex. subdrain, lagoon, long-term monitoring network, indoor air, etc.).

c. Figure 4-2: The Station 364 sampling point should be moved to the west side of the road just before water enters the culvert which discharges to the Deschutes River. Also, please include Station 361 on the map at the lagoon discharge point.

d. Section 4.3.2.2: A total of twelve (not ten) sampling events have been conducted for the subdrain and lagoon, with the latest round occurring in June 2008.

e. Appendix D should include house numbers so that it corresponds with Table 7-1 and Figure 7-1.

Because of the concerns outlined above, **Ecology does not agree that the remedy at the site currently protects human health and the environment** (Section 10, Protectiveness Statement). **Because the remedy is not protective, further action should be taken at the site.** Ecology requests that EPA address the comments summarized above. In addition, Ecology understands that Washington State Department of Transportation is a potentially responsible party (PRP) for TCE contamination at the site. Therefore, **Ecology requests that this site be transitioned into a PRP-financed site and the Superfund State Contract be amended or terminated (40 CFR 35.6805(u)).**

Please do not hesitate to contact me with questions. I can be reached at 360-407-6265 or lkla461@ecy.wa.gov.

Sincerely,

Laura Klasner

Laura Klasner
Site Manager
Toxics Cleanup Program
Southwest Regional Office

LK/ksc:5 yr Review ECY Comments Palermo

Attachment: October 2004. TCE Background. Ecology.

cc: Barbara Trejo, DOH
Lisa Pearson, Ecology
Rebecca Lawson, Ecology

File: TCE_PCE_Oct2004_Final.doc

Trichloroethylene Toxicity Information (TCE) CAS # 79-01-6

BACKGROUND INFORMATION

No trichloroethylene (TCE) toxicity values are currently available on the IRIS database. TCE toxicity values and sources of information have historically varied. These differences have contributed to some confusion as to which toxicity factor to use for calculating cleanup levels. WAC 173-340-708 (7) and (8) specifies the appropriate sources of toxicity information as IRIS, HEAST, and NCEA.

In August 2001, EPA published a new health risk assessment for TCE[1]. The TCE toxicity values and supporting documentation have been reviewed and endorsed by NCEA's Superfund Technical Support Center and reviewed by EPA's Science Advisory Board. The Office of Research and Development (ORD), EPA, working with the National Academy of Sciences (NAS) are preparing responses to the Science Advisory Board's comments on TCE. The IRIS review process will occur after the ORD / NAS evaluation has been completed.

Trichloroethylene Toxicity Information (TCE) CAS # 79-01-6				
Oral Cancer Potency Factor (CPFo) / Oral Slope Factor (SFo) [(mg/kg-day)$^{-1}$]	Inhalation Cancer Potency Factor (CPFi) / Inhalation Slope Factor (SFi) [(mg/kg-day)$^{-1}$]	Oral Reference Dose (RfDo) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Source of Information
0.02 - 0.4	0.02 - 0.4	0.0003	0.01 (0.04 mg/m^3)	EPA, 2001 NCEA Draft Health Risk Assessment

The Office of Environmental Assessment (OEA), EPA Region 10, advises human health risk assessors to utilize the 2001 external review draft of the TCE health risk assessment until a formal assessment and accompanying cancer and non-cancer toxicity values are incorporated into the IRIS database. This assessment relied on animal studies, as well as human epidemiological studies that were not available when the cancer assessments were prepared for EPA's now-withdrawn provisional values or Cal-EPA's current cancer toxicity values. The use of the toxicity values in this document was endorsed by NCEA's Superfund Technical Support Center[2]. The assessment has been subject to a public comment period as well as formal review by the Science Advisory Board. The EPA Office of Research and Development, with support from the National Academy of Sciences, will prepare responses to the SAB comments and evaluate studies that have become available since the external review draft was published. The IRIS review process will occur after this ORD/NAS evaluation has been completed.

[1] Trichloroethylene Health Risk Assessment: Synthesis and Characterization (External Review Draft). U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington Office, Washington DC, EPA/600/P-01/002A, 2001.

[2] E-mail message from Ann Parker of the NCEA Superfund Technical Support Center to Sarah Levinson of EPA Region 1 dated June 20, 2003 (copy available from EPA Region 10 upon request).

Following are the TCE toxicity values from the EPA 2001 external review draft health risk assessment.

Oral Cancer Potency Range [(mg/kg-day)$^{-1}$]	Inhalation Cancer Potency Range [(mg/kg-day)$^{-1}$]	Oral Reference Dose (mg/kg-day)	Inhalation Reference Concentration (mg/m3)**
0.02 - 0.4	0.02 - 0.4*	0.0003	0.04

* Converts to an inhalation unit risk range of 5.7E-6 – 1.1E-4 [(ug/m3)$^{-1}$].
** Converts to a reference dose of 0.01 mg/kg-day.

RECOMMENDATION

Consistent with EPA Region 10 Office of Environmental Assessment, and until a cancer potency factor is incorporated into the EPA IRIS database, TCE cleanup levels under MTCA should use 0.4 (mg/kg-day)$^{-1}$ as the cancer potency factor (slope factor) for ingestion and inhalation of trichloroethylene in risk assessments and in calculating risk-based cleanup levels. This slope factor represents the high end of the oral and inhalation cancer potency range in EPA's Trichloroethylene Health Risk Assessment: Synthesis and Characterization (External Review Draft). The quantitative characterization of cancer risk to humans from TCE exposure is likely to be enhanced in the future with the emergence of further studies and additional analyses of human variability and susceptibility. At this time, using the high end of the oral and inhalation cancer potency range is reasonable and protective, given the best available science, and is appropriate for use in MTCA equations, based on the following reasons:

- The draft assessment concluded that "TCE is highly likely to be carcinogenic in humans." While the qualitative assessment of cancer risk appears strong, there are many uncertainties in the current ability to quantitatively characterize cancer risks to humans from TCE exposure. The results of human epidemiological studies showed a considerably wide range of possible slope factors, contributing to the inclusion of a slope factor range in the draft assessment, rather than a single estimate of the relationship between exposure and risk. It is not clear that even the high end of the slope factor range represents a true upper bound estimate of risk.
- The quantitative characterization of cancer risk to humans from TCE exposure is likely to be enhanced in the future with the emergence of further studies and additional analyses of human variability and susceptibility.
- The draft assessment concludes that it appears that children's metabolism may alter their susceptibility to TCE, and that this is an uncertainty that cannot be reduced without additional studies being performed. Therefore, the selection of the high end of the slope factor range is a reasonably prudent decision for the protection of children who may be exposed to TCE.
- Exposures to certain chemicals other than TCE were found to increase TCE's toxicity or potency, and vice-versa. These include exposure via ingestion to such commonly used substances as alcohol and acetaminophen, as well as to other sources of the metabolites of TCE.
- Certain individuals (e.g., diabetics) may be at higher risk for TCE's adverse effects.
- The EPA 2001 TCE health risk assessment (page 1-7) includes the following supportive language:

  > The range of cancer slope factors has not been reduced to a single number. A range is reasonable in view of the risk factors that can modify the effects of TCE in different populations.... For most cancer risk factors, however, data that would allow differential risks to be quantified are lacking...Because the modifying effect of most risk factors cannot be quantified at this time, this assessment proposes instead that risk assessors use the upper end of the slope factor range for

susceptible populations having risk factors for TCE-induced cancer. Although the extremes of the slope factor range are not based on data from more- or less-susceptible populations, this approach emphasizes the possibility of different risks in different circumstances, identifies risk factors that may increase susceptibility to TCE's effects, and provides a practical way to adjust risk estimates to reflect differential susceptibility.

The Draft TCE Toxicity Assessment is available online at:
http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=23249

The Science Advisory Board's Review is available online at:
http://www.epa.gov/science1/pdf/ehc03002.pdf

Examples of national uses of the 2001 TCE Health Risk Assessment

Risk-based chemical screening tables developed and used by EPA Region 3 (http://www.epa.gov/reg3hwmd/risk/human/index.htm), Region 6 (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) and Region 9 (http://www.epa.gov/region09/waste/sfund/prg/index.htm) all cite the high end of the slope factor range, to prevent screening out site-related chemicals that may pose significant risk.

EPA's Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (November 29, 2002; http://www.epa.gov/correctiveaction/eis/vapor.htm) incorporates the high end of the slope factor range for evaluating risks from exposure to TCE via the vapor intrusion pathway.

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Tetrachloroethylene Toxicity Information
(Perc, PCE, Perchlorethylene)
CAS # 127-18-4

BACKGROUND INFORMATION

Some of the toxicity information for tetrachloroethylene is summarized in the table below. Changes in the toxicity information reflect the dynamic nature of the databases as new information becomes available and is evaluated.

Tetrachloroethylene Toxicity Information (Perc, PCE, Perchlorethylene) CAS # 127-18-4				
Oral Cancer Potency Factor (CPFo) / Oral Slope Factor (SFo) [(mg/kg-day)$^{-1}$]	Inhalation Cancer Potency Factor (CPFi) / Inhalation Slope Factor (SFi) [(mg/kg-day)$^{-1}$]	Oral Reference Dose (RfDo) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Source of Information
0.54	0.021*	Not available	Not available	Cal-EPA
0.54	0.021	Not available	Not available	NCEA Provisional, Withdrawn
Not available	Not available	0.01	Not available	IRIS

*converted from a unit risk of 5.9E-6 per ug/m3.

- The oral reference dose for tetrachloroethylene, available in IRIS and reflected in CLARC V 3.1, is 0.01 mg/kg-day. Cancer potency factors for tetrachloroethylene have never been available on IRIS. However, the information associated with the development of cancer potency factors for tetrachloroethylene is being reviewed by the IRIS program. Until cancer potency factors are incorporated in IRIS, NCEA has agreed that the use of Cal-EPA oral and inhalation cancer potency factors are appropriate and should be used for future assessments. The oral cancer potency factor for tetrachloroethylene listed in CLARC V 3.1 [0.051(mg/kg-day)$^{-1}$] is based on a withdrawn NCEA value and should no longer be used under MTCA cleanups. EPA issued an Office of Solid Waste and Emergency Response (OSWER) technical memorandum on June 12, 2003 (OSWER No. 9285.7-75; From Elizabeth Southerland to Dr. Marcia Bailey) which supports the use of the Cal - EPA cancer potency information, based on input from NCEA toxicologists.

RECOMMENDATION

The current carcinogenic risk values to be used in calculating cleanup levels for tetrachloroethylene under MTCA (from the OSWER technical memorandum No. 9285.7-75) are:

- Inhalation Unit Risk, 5.9E-6 per ug/m3 (converted to an inhalation cancer potency factor of 0.021 per mg/kg-day); and
- Oral Cancer Potency, 0.54 per mg/kg-day.

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