Tacoma Smelter Plume
Residential Yard Sampling and Cleanup Program



Final Program Design and Implementation Plan

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1. Introduction and Program Objectives

1.1 The Yard Program as Part of a Larger Cleanup Effort

The Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program (Yard Program) provides sampling, cleanup, and outreach for residential yards with high levels of arsenic and lead in the soil. The Washington State Department of Ecology (Ecology) is offering this settlement-funded, voluntary program within the most contaminated areas of the Tacoma Smelter Plume.

The Yard Program provides sampling, cleanup, and outreach for residential yards with high levels of arsenic and lead in the soil.

The Tacoma Smelter Plume is a large area of soil with arsenic and lead contamination. The Tacoma Smelter Plume is a 1,000 square mile area impacted by air emissions from the former Asarco smelter in Ruston, Washington (**Figure 1-1**). Air emissions from the smelter traveled with the wind and settled on surface soils throughout the Puget Sound Basin. Though the smelter has been removed, arsenic and lead still remain, posing a risk to human health, especially for children.

***Figure 1-1*: Tacoma Smelter Plume Area Map**

The Interim Action Plan is Ecology's cleanup plan for the overall Tacoma Smelter Plume. In June 2012, after incorporating public comment, Ecology issued the final Interim Action Plan. It outlines four approaches to cleaning up the plume and reducing human health risk. The four approaches are:

1. Cleaning up residential yards through the Yard Program.
2. Cleaning up school, childcare, and park play areas through the Soil Safety Program.
3. Encouraging voluntary cleanup by working with local governments and homeowners.
4. Raising awareness and helping people reduce contact with soil through outreach.

1.2 Objectives of the Yard Program

The main objective of the Yard Program is to reduce human health risk from arsenic and lead in soils.

The main objective of the Yard Program is to reduce human health risk from arsenic and lead in soils. Ecology will meet this objective through soil sampling, cleanup, and outreach.

Ecology needs soil sampling results to make a cleanup decision. Only areas that contain arsenic or lead above certain levels will qualify for soil cleanup. Ecology must have sampling results to know the arsenic and lead levels at a property. Arsenic and lead levels vary greatly throughout the Tacoma Smelter Plume. Therefore, it is not possible to predict the exact levels based on where a home is located or any other factors. However, predictive mapping has allowed Ecology to define the "Service Area" of the Yard Program. This Service Area defines the geographic scope of the Yard Program (**Figure 1-2**).

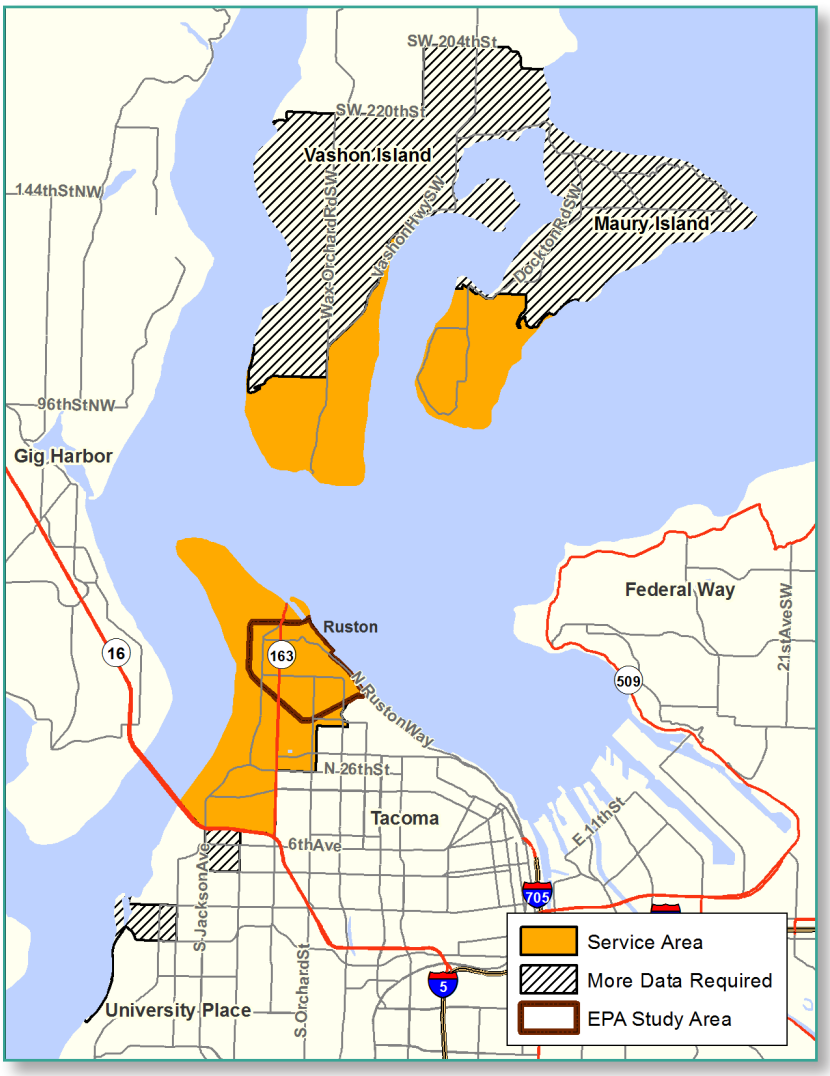


***Figure 1-2*: Service Area Map**

Cleanup lowers risk by reducing the potential for contact with arsenic and lead in soil. The purpose of cleanup is to reduce contact with high levels of contamination, not prevent it completely. Therefore, Ecology is targeting areas of yards with the highest arsenic and lead levels. Some areas of lower contamination will remain, but they pose a lower risk to human health.

Outreach helps residents reduce contact with contaminated soils. For everyone living in the plume, Ecology recommends "healthy actions" to reduce contact with contamination. Outreach is particularly important where yards do not qualify for cleanup, but still have some contamination. Even if the property does not qualify for cleanup, simple actions like covering bare dirt with sod or bark can reduce contact. Outreach also supports each step of the sampling and cleanup process, from recruiting homeowners into the program to providing information for maintaining their new yard.

1.3 Components of the Yard Program

The Yard Program consists of three main actions – soil sampling, yard cleanup, and outreach. This section briefly describes each part of the program. Chapters 5 to 7 provide more detail.

1.3.1 Soil sampling for yards within the Yard Program Service Area.

Soil sampling answers three key questions:

- What areas of the property are over Ecology's action level and qualify for cleanup?
- What kind of outreach do the owner and people living in the home need?
- Is there any deeper contamination left under areas where Ecology replaced the soil?

Yard Program Action Levels: An area of a yard will qualify for cleanup if it exceeds the action levels shown in **Table 1-1**.

Table 1-1: Tacoma Smelter Plume Soil Action Levels

Contaminant	Average	Maximum
Arsenic (ppm)	100	200
Lead (ppm)	500	1,000

ppm = parts per million

1.3.2 Soil cleanup for properties over the action level.

Cleanup primarily involves digging contaminated soils and taking them to a secure landfill. Capping is another cleanup method that Ecology will use to contain contaminated soils that remain below the maximum digging depth. Capping involves placing clean soil over contaminated soil. Capping may be used in areas where digging cannot be done, such as near foundations or near permanent vegetation. Both methods reduce the potential for human contact with contaminated soils. Ecology prefers permanent cleanup, such as digging up soils and taking them to a landfill. However, in areas where Ecology cannot dig, capping can still reduce risk.

1.3.3 Outreach for properties with contamination below the action level.

Many yards have contamination below the Yard Program action levels (**Table 1-1**), but above the statewide cleanup levels (**Table 1-2**) under Ecology's Model Toxics Control Act. Ecology will provide outreach materials when sending the sampling results to homeowners and residents of these yards. Ecology and local health departments may do further outreach for those properties with higher levels. This could include a phone call or a home visit.

Table 1-2: Statewide Cleanup Levels

Contaminant	Level
Arsenic (ppm)	20
Lead (ppm)	250

1.4 Purpose and Structure of the Yard Program Design

The purpose of this design document is to lay out how the soil sampling, yard cleanup, and outreach will work.

The purpose of this Program Design document is to lay out how the soil sampling, yard cleanup, and outreach will work. It provides both a big-picture overview of the program for the public, and all the details Ecology needs to get the program up and running.

The Yard Program history and design is presented in Chapters 2 through 7.

- **Chapter 2** gives background on the Asarco smelter and the Tacoma Smelter Plume, including past sampling, cleanup, and outreach.
- **Chapter 3** describes the design process and what we learned from similar cleanup projects around the country. Chapter 3 also explains key decisions such as how a property qualifies for cleanup, how deep Ecology will dig, and what areas Ecology cannot clean up.
- **Chapters 4, 5, 6**, and **7** are the central design pieces of the Yard Program.
  - **Chapter 4** discusses the overall implementation of the Yard Program.
  - **Chapter 5** describes the steps of soil sampling.
  - **Chapter 6** walks through the cleanup process.
  - **Chapter 7** explains outreach to homeowners and residents for contaminated yards that do not qualify for cleanup.

The rest of the document provides more technical details of the design.

- **Chapter 8** describes how Ecology will manage the data from this program.
- **Appendix A** provides a glossary of the terms and acronyms used in this document.
- **Appendix B** provides information on Ecology's mapping project, which helped to establish the Service Area boundaries and some of the sampling procedures.
- **Appendices C** through **E** provide more detail about sampling, cleanup, and outreach. **Appendices C** and **D** provide the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP), respectively, for the Yard Program. **Appendix E** has examples of the types of forms and letters Ecology may use during the Yard Program.
- **Appendix F** provides the Cultural Resources Protocol for both the Soil Safety Program and the Yard Program.
- **Appendix G** provides the regulatory and permitting requirements for the Yard Program.
- **Appendix H** provides the Area-wide Remediation Environmental Information System (AREIS) database manual.

2. History and Context for the Yard Program

This section gives a brief history of the Asarco smelter, the Tacoma Smelter Plume, and Ecology's management approaches. **Figure 2-1** provides a brief timeline of significant milestones to date. This section also provides context for why and how Ecology developed the Yard Program. A $94.6 million settlement with Asarco was key to funding this new program.

The Tacoma Smelter Plume Interim Action Plan (Ecology 2012) has further details on the history and management of the Tacoma Smelter Plume.

Figure 2-1: Timeline of Significant Milestones

2.1 Asarco Smelter History

Asarco's copper smelter operated for almost 100 years in Ruston, Washington, a small town within the borders of the City of Tacoma. The Tacoma smelter opened in 1890 as a lead smelter. Asarco purchased it in 1905 and converted it to a copper smelter. In 1912, the company added arsenic recovery facilities.

The Tacoma smelter specialized in processing ores with high arsenic levels. It recovered arsenic trioxide and metallic arsenic as byproducts of copper smelting. The process also produced slag, a hard, glassy material containing high levels of arsenic, lead, and other metals.

Air pollutants from the former Asarco smelter stack settled onto soils throughout the Puget Sound basin.

A large smokestack dispersed arsenic and lead across a wide area. Asarco released smelter emissions through a smokestack. The company replaced the original smokestack in 1917 with a 571 foot stack. Air emissions from the plant traveled with the wind and settled onto soils across more than 1,000 square miles of the Puget Sound Basin. Metals in the emissions, mainly arsenic and lead, settled on the surface soils. The smelter closed in 1986.

2.2 Asarco Smelter Superfund Cleanup

Part of the Asarco Smelter Superfund site, which is managed by the U.S. Environmental Protection Agency (EPA) is within the Tacoma Smelter Plume. The Asarco smelter site includes the smelter property and areas outside of it. One of these areas is the Ruston/North Tacoma Study Area (EPA Study Area). The EPA Study Area is about 950 acres of mostly residential properties in Ruston and north Tacoma adjacent to the smelter site.

In 1993, EPA began oversight of yard cleanups. Asarco did the cleanup under an agreement with EPA until 2009. Almost 3,000 properties and 1,000 rights-of-way were sampled. Of those, almost 2,000 yards and 450 rights-of-way had full or partial cleanup.

In 2009, after Asarco's bankruptcy, EPA took over cleanup. The U.S. Army Corps of Engineers (Corps) performed the work. By September of 2011, the Corps had sampled and cleaned up most of the remaining 266 properties. As of 2012, 19 homeowners have refused property sampling and 12 homeowners have refused cleanup in the EPA Study Area.

EPA only takes action where soil levels are over 230 parts per million (ppm) for arsenic or 500 ppm for lead. For areas below 230 ppm for arsenic and 500 ppm for lead, EPA uses "community protection measures" to address remaining risks. The measures address areas with arsenic between the state cleanup level of 20 ppm and EPA's action level of 230 ppm. Measures include:

- Annual notices to homeowners, realtors, local governments, and utilities
- Staffing a local information center
- Providing yard cleanup results to homeowners and residents, upon request
- Outreach about how to reduce contact with remaining contamination.

The Yard Program will clean up some properties not addressed during the Superfund cleanup. Ecology's action levels for the Yard Program are lower than EPA's action levels. Therefore, several hundred residential properties in the EPA Study Area may qualify for the Yard Program. Also, Ecology and the Tacoma-Pierce County Health Department (TPCHD) are taking over the outreach portion of EPA's community protective measures.

2.3 Early Studies of Tacoma Smelter Plume Contamination

Beginning in 1999, Ecology did a series of soil sampling studies within the Tacoma Smelter Plume. "Footprint Studies" in King, Pierce, Thurston, and Kitsap counties helped to define the nature and extent of the plume. Ecology also looked at child play areas to see if children were at risk. Findings from these studies (see **sidebar**) prompted Ecology to take action, starting with outreach programs and play area cleanups.

Data from the early plume studies also helped Ecology develop a map and understand overall patterns of contamination. Chapter 2 of the Interim Action Plan (Ecology 2012) discusses these studies in more detail.

The patterns of contamination guide Ecology's overall cleanup approach – cleanup where levels are highest and outreach where levels are lower.

Key Findings from Footprint Studies

1. Arsenic tends to exceed state cleanup levels more often than other metals. Lead is the other main contaminant.
2. Arsenic and lead are found mainly in the top six inches of soil.
3. In areas where soil has been moved or turned over, contamination can be deeper.
4. Undisturbed areas, such as forests, tend to have higher levels of contamination.
5. In general, levels are related to distance and direction from the former smelter. Levels decrease with distance and are higher along the dominant north-northeast and south-southwest wind directions.

2.4 Ecology's Early Actions

Outreach is based on lessons learned from others. Starting in 2000, Ecology began funding outreach programs at local health departments, first in King County, and then in Pierce County. Their work included assessing community needs and developing outreach materials and programs. Yard Program outreach is largely based on lessons learned over the past 12 years of working in different communities.

Play area cleanups are conducted under the Soil Safety Program. In 2005, the state legislature passed a law and provided funding to protect children from contaminated soils. As a result, Ecology started the Soil Safety Program in 2006. The Soil Safety Program provides settlement-funded soil sampling and cleanup for play areas at schools, licensed childcares, public parks, camps, and public multi-family housing. Ecology's experience with the Soil Safety Program has also helped to shape the Yard Program.

2.5 Asarco Bankruptcy Settlement

Ecology's Credible Evidence Report (Glass 2003) pinpointed the former Asarco smelter as the source of Tacoma Smelter Plume contamination. In 2004, Ecology notified Asarco of its status as the Potentially Liable Person under state cleanup law. Asarco responded with a letter denying responsibility for any area outside the EPA Study Area (Asarco 2004).

Asarco filed for bankruptcy in 2005. In September 2007, Ecology joined eight other states and the federal government in filing claims against Asarco for more than $1 billion in environmental damages and cleanup costs and began planning for the use of settlement funds.

In 2008, the Washington Legislature passed a law creating the Cleanup Settlement Account [Chapter 70.105D.130 Revised Code of Washington (RCW)]. This account holds money from court orders or settlements, and interest earned, for cleaning up specific sites. The legislature appropriates the funds every two years. In December 2009, the State of Washington received $94.6 million for future costs to clean up the Tacoma Smelter Plume.

The majority of the $94.6 million settlement will go towards Yard Program sampling and cleanup activities.

The state's claim against Asarco for the Tacoma Smelter Plume future costs included cleaning up yards with over 100 ppm arsenic, as well as outreach, technical assistance, and continuing the Soil Safety Program. Recognizing that cleanup of the whole plume was not feasible, Ecology prioritized contamination over 100 ppm.

Starting around 2009, Ecology began developing the Interim Action Plan and a ten-year financial plan as the framework for using the Asarco settlement. As explained in the Interim Action Plan, another priority is continuing the Soil Safety Program. In 2010, Ecology began funding the Soil Safety Program through the Asarco settlement.

2.6 Interim Action Plan Management Approach

This section describes how each of the Interim Action Plan approaches are interconnected, and where the Yard Program fits in. The Yard Program and Soil Safety Program use soil cleanup to reduce risk in areas of highest contamination. Outreach and technical assistance programs educate the public about how they can protect themselves. Outreach also supports the Soil Safety Program and Yard Program.

Continuing the Soil Safety Program reduces risk for large numbers of children. The action levels for the Soil Safety Program are lower than for the Yard Program. School and childcare play areas are often used by large numbers of children. Ecology believes that there are enough settlement funds to clean all the play areas in the Soil Safety Program service area over the cleanup level. Thus, Ecology set the Soil Safety Program action levels at the cleanup levels. As with the Yard Program, Ecology's goal is to reduce risk for a large number of children, rather than do full property cleanups.

Ecology has sampled over 1,000 play areas and completed "soil safety actions" at just over 100. Most play areas do not require cleanup. Soil safety actions can include both cleanup and measures such as having children wash their hands after playing outside.

The Soil Safety Program is ongoing and will later include private multi-family housing play areas. These play areas differ from single-family homes because more children may use them. Ecology may cleanup these play areas before the Yard Program reaches these properties.

Outreach raises awareness and promotes behaviors to reduce contact with soils. Ecology provides funding to local health departments in King, Pierce, and Thurston counties to run Dirt Alert programs. The Dirt Alert campaign uses consistent messages and graphics across a wide range of outreach tools and methods. Television ads alert people to the issue, while brochures provide more ideas for how to reduce contact with soil. Nail brushes help to remind kids to wash their hands well. Door hangers remind families to take shoes off at the door so as to not track in dirt.

Some outreach is broad-based, such as mass media advertising, brochure mailers, and booths at local events. Health departments also offer one-on-one outreach, such as home visits for soil testing and to communicate healthy actions.

The Yard Program design relies on lessons learned from the Dirt Alert and Soil Safety programs. Outreach is especially important for yards with contamination below the program action levels. Residents will need to know how to protect themselves because Ecology is not cleaning up these properties. For those yards qualifying for cleanup, outreach materials and messages will also help to:

- Encourage homeowners to sign up for sampling and cleanup
- Explain sampling results and how residents can reduce contact with contamination
- Ensure the long-term effectiveness of the cleanup.

Technical assistance addresses new developments that do not qualify for the Yard Program. The Yard Program only covers existing residential yards, not new developments, commercial, or vacant properties. Ecology is providing settlement-funded technical assistance to landowners doing cleanup during development. Activities like excavation and grading involve moving soils, so this is a good time to do cleanup.

2.7 Development of Residential Yard Program

The Yard Program is one of the four main strategies in the Tacoma Smelter Plume Interim Action Plan. The goal of the Interim Action Plan is to reduce human health risk through cleanup and outreach.

Cleaning up the highest contamination is the best use of cleanup funds.

The plume covers hundreds of thousands of properties, which is too large of an area to clean up. Ecology chose to focus limited cleanup funding on residential properties within the most contaminated areas of the plume. Yard cleanups protect people where they live and play. Cleaning up the highest contamination is the best use of cleanup funds.

The Yard Program uses two general approaches to lowering risk to human health:

- Physical cleanup such as removal and capping
- Outreach and education about healthy actions to reduce exposure to contaminated soils.

This program design provides more detail than the Interim Action Plan. Ecology released the Interim Action Plan for comment in the fall of 2011. At that time, Ecology made some decisions about overall program design and highlighted issues to cover in a more detailed design. Ecology finalized the Interim Action Plan in June 2012. The program design, described in **Chapters 4** through **6**, began in early 2012.

3. Program Design Process and Major Decisions

Overall Design Process 3.1 | Re-evaluating Earlier Design Decisions in the Interim Action Plan 3.2 | New Design Decisions 3.3

Ecology evaluated options and made many decisions during the program design process. Key decisions described in this chapter include:

- The boundaries of the Yard Program Service Area.
- The neighborhoods where soil sampling and cleanup will begin.
- Areas of a property Ecology will sample and cleanup.
- Procedures to collect and analyze soil samples.
- The depth Ecology will dig to remove contaminated soils.
- The options homeowners have during property restoration.

3.1 Overall Design Process

3.1.1 The Tacoma Smelter Plume Interim Action Plan guided the Yard Program design.

Ecology first outlined the Yard Program design in the Interim Action Plan. As explained in the Interim Action Plan, the program would cover neighborhoods with the highest contamination. It would use soil sampling results to inform cleanup decisions. It would also rely on outreach to those homeowners whose properties did not qualify for soil cleanup.

Some details of the program design have changed since the final Interim Action Plan (June 2012). **Chapter 3.2** explains these changes and why Ecology made them.

3.1.2 Ecology met with staff from other large-scale sampling and cleanup projects about lessons learned.

The purpose of the meetings with staff from other programs (**Table 3-1**) was to learn from agency representatives about how these programs worked and the types of issues

Table 3-1: Drawing on Past Experience from Similar Cleanup Programs

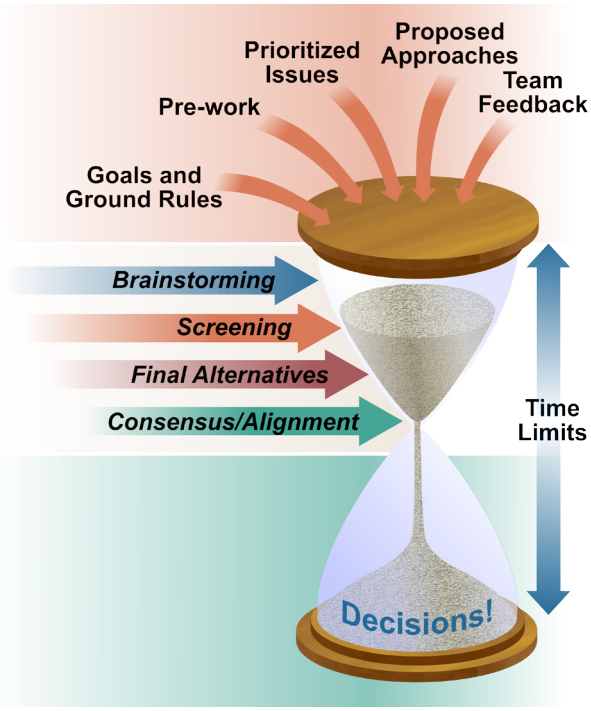
Project	Ruston/N. Tacoma Superfund Site	Everett Smelter Sampling & Cleanup	Omaha Lead Site Sampling & Cleanup
Agencies	**EPA & US Army Corps of Engineers**	**Ecology**	**EPA**
Activity	■ Conducted sampling and cleanup for over 2,000 properties. ■ Yard program service area includes the Superfund site. ■ Program is complete.	■ Ongoing sampling and cleanup for over 400 properties with arsenic and lead levels higher than in the Tacoma Smelter Plume. ■ Program is currently ongoing and will run through 2019.	■ Ongoing sampling and cleanup for over 45,000 properties. ■ Program began in 2005 and is currently ongoing.

they faced. These agencies described their experiences, and provided advice for running the Yard Program.

The main advice project staff provided was:

- **Communication with homeowners and residents is very important.** The cleanup process can be complex and frustrating. The homeowner should fully understand what they are agreeing to when they sign up for cleanup.
- **Homeowners should agree to a plan for restoring their property before cleanup starts.** Homeowners will have some flexibility in choosing what their property will look like after cleanup. However, Ecology and the homeowner need to decide on a firm plan before Ecology can go out to bid for a cleanup contractor.
- **X-ray fluorescence (XRF) is a good analytical device for the Yard Program.** The XRF is a portable tool that can measure arsenic and lead in the field. It should be accurate enough to show if soils exceed the arsenic or lead action levels during the excavation stage of the cleanup.
- **Large trees and shrubs should be left in place.** They are important to landscapes and replacing with smaller, less established plants may be contrary with Ecology's mission.
- **Consider community impacts when deciding how many cleanups to do in one area.** Consider traffic, dust control, noise, and how long a neighborhood will be affected.

***Figure 3-1*: Decision-making through the Charrette Process**



- **One contractor should have a maximum of 50 properties to clean up at one time.** They will need multiple crews to work at this pace. Fifty is also the most properties an Ecology field staff person should manage.

3.1.3 A charrette process helped Ecology's design team make key decisions.

Ecology used charrettes to make program design decisions. A charrette is a meeting that uses a method of organizing thoughts in a structured format using ideas from a diverse group. Charrettes help a group quickly get to solutions. This is done by weighing different options and working together to align around a preferred approach.

The core design team included Ecology and TPCHD staff, and consultants from Kennedy/Jenks Consultants and Geosyntec Consultants. The consultants structured the discussion process and set a schedule for making decisions. Some issues needed further research or relied on other design pieces. **Chapters 3.2** and **3.3** describes the main decisions that shape the overall program design.

3.1.4 Local stakeholders advised on how to make property restorations more environmentally friendly.

Cleanup is a good time to make changes to landscaping. Smart landscaping choices can have many environmental benefits such as reducing water consumption, stormwater runoff, and pesticide and fertilizer use. Ecology brought together a group representing local government, conservation groups, and master gardeners. They advised on many ideas for restoring properties after cleanup, as described in **Chapter 3.3.9**. Stakeholders included:

Smart landscaping choices can have many environmental benefits.

- City of Tacoma Environmental Services
- City of Tacoma's Urban Forester
- Pierce Conservation District
- Washington State University (WSU) Pierce Extension Master Gardeners Coordinator
- Stewardship Partners
- Non-agency native plant and rain garden experts.

3.2 Re-evaluating Earlier Design Decisions in the Interim Action Plan

The Interim Action Plan outlined what properties qualify for sampling and cleanup, and how Ecology will sequence the work. Ecology now has more information to refine the decisions presented in the Interim Action Plan. The following sections explain what differs and what remains the same from the Interim Action Plan.

3.2.1 The Yard Program Service Area is more focused and better defined.

The Interim Action Plan shows areas where arsenic in soil might be greater than or equal to (≥) 100 ppm. This was a rough estimate based on simple math and limited data. Ecology now has a map based on a statistical model and more soil data (**Figure 1-2**). For more details on the development of the Service Area and how it has changed since the Interim Action Plan, see **Appendix B**.

The Yard Program Service Area, shown in **Figure 1-2**, encompasses southern Vashon-Maury Island, Ruston, and northwest Tacoma south to Highway 16. The Service Area contains approximately 7,300 residential parcels. Around 2,700 of the parcels included in the Service Area are located within the EPA Study Area and have existing sampling data. This leaves about 4,600 parcels to be sampled under the Yard Program. Within the Service Area, we expect around one in six parcels to exceed 90 ppm arsenic, based on the model. This will allow most of our resources to go toward cleanup, rather than soil sampling.

Figure 1-2 also indicates areas (in hash marks) on Vashon-Maury Island and south of Highway 16. These areas require more data to be collected before they can either be included or excluded from the Service Area.

This Service Area map is a starting point for the Yard Program. We plan to rerun the model in the future using more data collected during the program.

3.2.2 The general sequence of sampling and cleanup will be the same.

Ecology will begin soil sampling in the areas with the highest probability of soil with arsenic levels above 100 ppm.

As the Interim Action Plan explains, Ecology already has data for the EPA Study Area, so cleanup will begin there. This area also has higher arsenic levels than predicted for other areas of the plume. The EPA Study Area will have its own cleanup sequence, beginning with areas where arsenic levels are highest and more homes have not had EPA cleanup work. See **Figure 4-2** in Chapter 4 for the preliminary sequence of cleanup inside the EPA Study Area.

Ecology has approached the sequence for sampling separately for each county. **Figure 4-2** also shows the sequencing map where the block groups are labeled in order of sequence starting with the letter A in each county. Cleanup will most likely follow in this same pattern. However, Ecology may review results over time and offer cleanup out of order if an area is found to have higher contamination than other areas.

The program plans to work simultaneously in King and Pierce counties. See **Chapter 4** for more details about sampling and cleanup sequencing.

3.2.3 The arsenic action level is 100 ppm but Ecology will compare results to a 90 ppm threshold.

The Interim Action Plan states that Ecology will clean up areas of properties with average arsenic ≥ 100 ppm in the soil. Ecology believes the risk associated with arsenic in soils ≥ 100 ppm are unacceptable for properties where people may be exposed.

Using a threshold of 90 ppm for arsenic, Ecology should find 75% of the properties that actually have ≥ 100 ppm arsenic in soil.

Soil sampling can sometimes miss some areas that actually have ≥ 100 ppm of arsenic. Ecology needs an average level for an area of a property (labeled a "unit") in order to tell if it qualifies for cleanup. A property can have different levels of arsenic and lead in different areas. Sometimes individual sample results are higher or lower than the actual average.

Using a threshold of 90 ppm for arsenic, Ecology should find 75% of the properties that actually have ≥ 100 ppm arsenic in soil. The more samples and the lower the threshold, the more likely Ecology will identify 100% of properties with ≥ 100 ppm. However, much of the cleanup funding would end up going to sampling properties rather than cleanup. Ecology believes a threshold of 90 ppm provides the best balance (**Table 3-2**). For lead, the threshold level is the same as the action level (500 ppm). This is because arsenic tends to be the driver for most Tacoma Smelter Plume cleanups.

Table 3-2: Threshold Levels for Arsenic and Lead

Contaminant	Minimum
Arsenic (ppm)	≥ 90
Lead (ppm)	≥ 500

3.2.4 Ecology will offer outreach to homeowners and residents for properties with 20 to 90 ppm arsenic.

Many properties will not qualify for cleanup, but will have arsenic and lead contamination above the state cleanup level of 20 ppm for arsenic and 250 ppm for lead. Ecology plans to offer outreach to these homeowners and residents. Ecology will also consider cleaning up to lower thresholds if funding remains at the end of the program. See **Chapter 7** for more about outreach for these homeowners and residents.

All homeowners and residents will receive "Dirt Alert" brochures, nail brushes, and contact information for their local health department. More targeted outreach will depend on who lives in the home and the condition of the property. Outreach may include the following:

- **For families with young children** – activity sheets, music videos with soil safety messages for kids, and other resources from the health department.
- **For properties with bare patches of soil or gardens** – a brochure on how to use landscaping materials to cover bare soils, a gardening brochure, and local health department advice.
- **For properties with arsenic and lead just under the threshold levels** – a call from the local health department or Ecology outreach staff to make sure residents know how to reduce contact with soil.

All homeowners and residents will receive "Dirt Alert" brochures, nail brushes, and contact information for their local health department.

3.2.5 The environmental review for the Interim Action Plan covers the Yard Program.

Ecology did a State Environmental Policy Act (SEPA) review of the Interim Action Plan. In October of 2011, the agency issued a Mitigated Determination of Nonsignificance (MDNS). The MDNS provides measures to reduce impacts from the cleanup work, such as truck traffic, noise, and dust.

This design does not include any additional SEPA review because the Yard Program falls under the Interim Action Plan's SEPA. However, the mitigation measures listed in the MDNS are fairly general. **Appendix G** gives more details about how Ecology will apply these measures during cleanup.

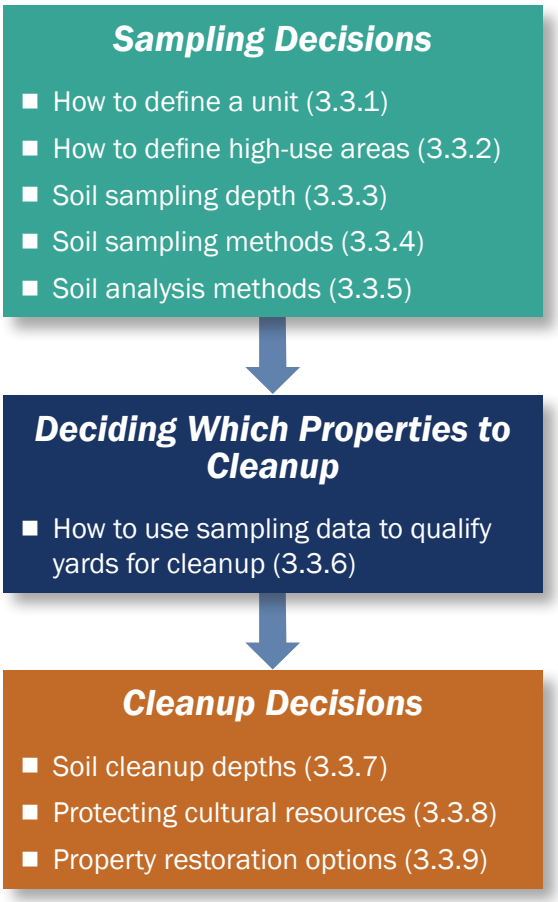
3.2.6 Ecology will meet the substantive requirements for local permits.

Under the Interim Action Plan, Ecology will comply with any laws, regulations, and other requirements that apply to Yard Program cleanup. State cleanup law – the Model Toxics Control Act – exempts Ecology from obtaining local permits. This can happen as long as the agency meets the "substantive requirements" – the spirit of the permit's intent. **Appendix G** lists the permits that could apply to the Yard Program, and their substantive requirements.

Ecology will apply for any permits required by federal regulations. The only expected federal permit is a Construction Stormwater General Permit under the Clean Water Act. There also may be requirements under Municipal Stormwater General Permits held by local jurisdictions that Ecology will need to comply with.

3.3 New Design Decisions

The Yard Program design provides details that build on the Interim Action Plan. This section highlights key decisions and briefly explains Ecology's reasons behind the decisions. For more details on the sampling and cleanup process, see **Chapters 5** and **6** and **Appendices C** and **D**. The graphic to the left shows the organization of this section.



3.3.1 How to define a unit for sampling and cleanup and how many units per property.

Risk from exposure to arsenic and lead in soil is directly related to both the level and extent of arsenic and lead in soil. People must come in contact with the arsenic and lead in soil to be at risk. The amount of exposure to arsenic and lead through contact depends on how much of arsenic and lead is in the soil and the amount of soil people are in contact with.

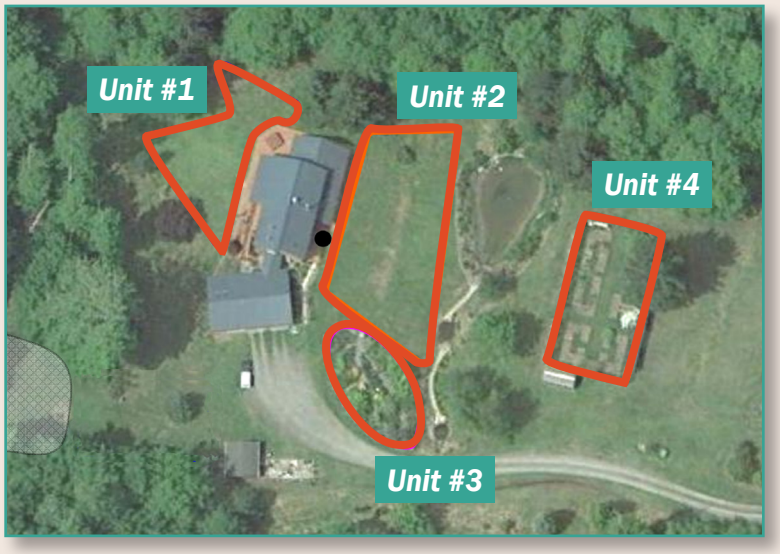
Ecology considered how to define units on small and large properties, as well as multifamily housing. For small properties we considered just one unit for the whole property, two units (front and backyard), and multiple units. Since the soil contamination is highly variable, one unit has the potential to miss a high contamination area. Logistically, it is difficult to cleanup small units on a small property. Hence, Ecology will divide small properties into two units.

Ecology will divide properties into units in order to make cleanup decisions. Samplers will take one composite sample (**Chapter 3.3.4**) from each unit. Based on the results, Ecology will decide to cleanup one or more units on a property. Defining a unit depends on the property's size and uses as shown in **Figure 3-2**. Only areas of the property that are accessible by construction equipment will be eligible for sampling and cleanup.

Figure 3-2: Example of Units by Parcel Size

0.2-acre Property

3-acre Property



LEFT: On small properties (up to 0.25-acre), up to two units will be defined. **RIGHT:** Large properties (>0.25-acre) will have up to four units defined, for a total of up to 0.25-acre. Therefore, the entire property will not be sampled.

Decision **Decision:** Standard-sized properties (up to 0.25 acres) will have up to two units.

Reason: Two units allow for a larger area to be cleaned up and also allow Ecology to separate units geographically.

Decision **Decision:** Larger properties (more than 0.25 acres) will have up to four units.

Reason: This gives Ecology the option to divide a property into smaller units. This will help focus cleanup where it is needed the most.

Decision **Decision:** Multifamily housing may have multiple units, up to the number of households living in the multifamily housing. Common play areas, garden areas (where residents regularly contact the soil), and gathering areas that are part of single-family residential developments will follow the same approach as for multifamily housing.

Reason: Provides flexibility to deal with a larger number of decision units in a setting where residents live in multiple households. Also provides sampling and cleanup of common areas that are part of a neighborhood of single-family properties.

Decision: Educational units, such as areas with permanent vegetation, may also be designated for sampling for informational purposes.

Reason: Property owners or residents may want to know arsenic and lead levels in areas not eligible for cleanup. Adding an educational unit allows Ecology to provide information on an area of interest to a homeowner.

3.3.2 How to define high-use areas for sampling and cleanup.

The Interim Action Plan states that the Yard Program should focus on cleaning up high-use areas. High-use areas are where residents are most likely to come in direct contact with contaminated soils. Ecology expects to be able to clean up more properties if cleanup is limited to high use areas.

Decision: The largest area Ecology will clean up on a given property is 0.25 acres.

Reason: On a larger property, people tend to spend more time in certain areas, like play areas or gardens. Cleaning up high-use areas still greatly reduces human health risk. This approach will allow Ecology to cleanup more properties since funding is limited. Cleaning up more properties reduces overall risk to more people. Most standard city lots have no more than 0.25 acre of area where residents may be exposed to soil.

Decision: Ecology will not clean up areas covered by permanent landscaping (**Chapter 6.1.2**).

Reason: Residents are less likely to come into direct contact with contaminated soil in these areas. Soil removal could damage or kill large trees and shrubs, which are difficult and costly to replace. It could also damage rock walls or other structures. In some cases, Ecology may provide mulch or other material to cover bare soils.

For properties larger than a quarter acre or for multifamily housing, sampling crews will define high-use areas with input from the homeowner or residents. The Sampling and Analysis Plan (**Appendix C**) has guidelines to assist sampling crews in working with homeowners to define high-use areas. **Appendix E** has a sample interview form that lists some features considered for defining high-use areas.

3.3.3 Soil sampling depth for Yard Program pre-cleanup sampling.

Ecology already has sampling data for most properties in the EPA Study Area. For all other properties, Ecology needs data to know if a unit needs cleanup.

Decision: Ecology will sample the top 6 inches of soil to make a cleanup decision. Ecology may also decide to sample the 6- to 12-inch below ground surface (bgs) interval at some properties at the edges of the Yard Program Service Area.

Reason: Contamination is usually in the top 6 inches of soil (**Table 3-3**). If it extends deeper, Ecology will identify it by digging out at least 12 inches of soil (**Chapter 3.3.7**). If soil exceeds the actions levels deeper than 12 inches, Ecology will know based on samples taken during cleanup.

Ecology may decide to sample the 6- to 12-inch bgs interval at some properties to determine if a 6-inch excavation could be adequate to meet Yard Program action levels as opposed to the 12-inch excavation. A 6-inch-only excavation would save money on cleanup costs.

Table 3-3: Comparison of Soil Sampling Depth Alternatives

Description	SHALLOW Sample from 0-6" only	MODERATE Sample from 0-6" and 6-12"	DEEP Sample from 0-6", 6-12", and 12-18"
Pros	■ Targets highest levels. ■ Targets soils most regularly contacted by residents. ■ Conserves more money for cleanup. ■ Allows use of hand tools. ■ Avoids deep utilities.	■ Reduces need to sample following cleanup. ■ Provides more certainty for designing cleanup. ■ Reduces cleanup costs if 6-12" sample is below threshold levels.	■ Reduces need to sample following cleanup. ■ Provides even more certainty for designing cleanup.
Cons	■ Unknown contaminant levels at depth. ■ Requires sampling following excavation to define residual levels.	■ Increases potential to encounter utilities. ■ Requires more time and money. ■ Increases potential for yard damage from equipment.	■ Greater potential to encounter utilities. ■ Requires even more time and money. ■ Greater potential for yard damage from equipment.

3.3.4 Soil sampling methods.

The soil sampling method has a large impact on time, cost, and ability to find contaminated soils. In general, the more precise the method, the longer it takes and the more it costs to sample a property. Ecology compared the three methods shown in **Table 3-4**.

Decision: Ecology will use composite sampling.

Reason: Composite samples are made up of multiple subsamples mixed together (**Figure 3-3**). One composite sample will give an estimate of the average arsenic and lead level in each unit. This is cost-effective because Ecology will analyze only one sample per unit.

Table 3-4: Comparison of Soil Sampling Methods

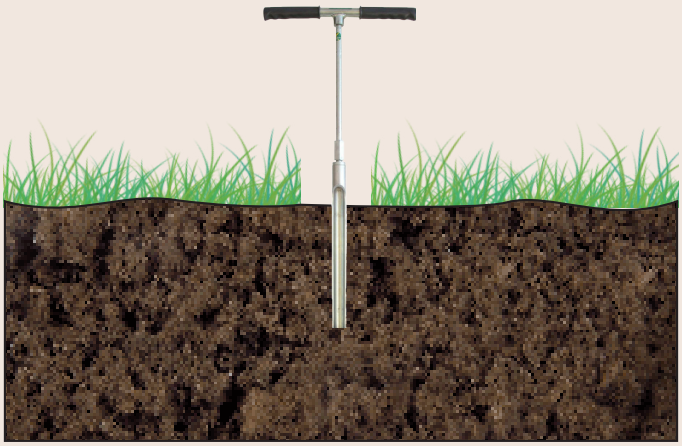
	Incremental sampling methodology (ISM)	Composite sampling	Discrete sampling
Description	ISM involves collecting at least 30 individual samples that are processed according to specific protocols into a single composite sample. The laboratory result for the ISM composite sample represents the average soil level for the entire unit.	Composite sampling combines soil from several sample locations into a single composite sample for laboratory analysis to provide an average level in soil (**Figure 3-3**).	Discrete (grab) sampling does not combine soil samples. The laboratory provides results for each sample location. These individual soil levels could be combined to calculate an average level for the unit as required by the Interim Action Plan.
Pros	ISM generally provides greater certainty of the average across the property. ISM is generally accepted by EPA and several state agencies for sampling of contamination over large areas.	Composite sampling is less costly than ISM. Composite sampling is less costly than discrete sampling because fewer samples would be analyzed.	Discrete sampling provides benefits in terms of ease of implementation (no compositing) and knowledge of actual levels at a particular sample point.
Cons	Field and laboratory costs are higher than those of other sampling methodologies.	The estimate of the average can be skewed by higher levels that occur in a few sampling locations.	The estimate of the average can be skewed by higher metals levels that occur in a few sampling locations.

Decision: Each composite will have eight subsamples.

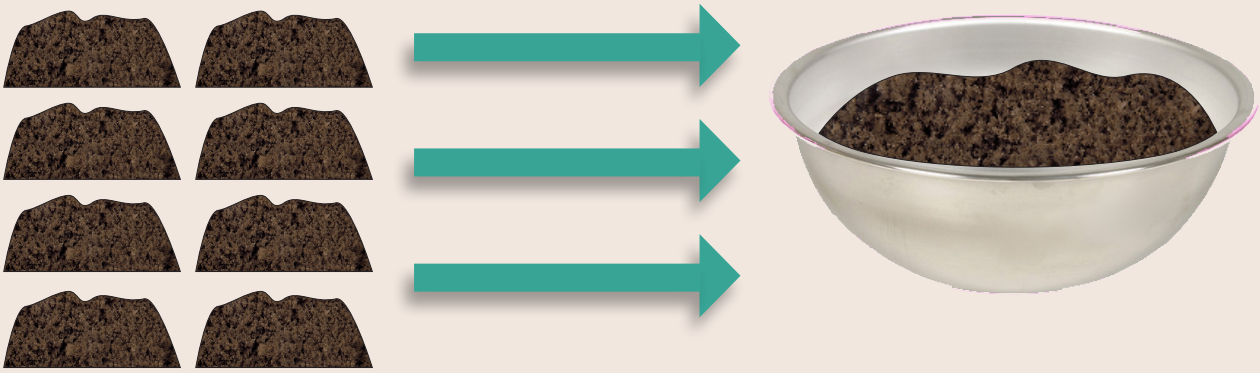
Reason: The more subsamples in a composite, the better the result will match actual levels in the soil. However, doubling the number of subsamples does not double accuracy. Eight subsamples balances accuracy with time and cost-effectiveness (**Appendix B**). Composite samples collected from educational units may have less than eight subsamples.

Figure 3-3: A Step-by-Step Approach to Composite Sampling

Step 1 Soil from each sample location is collected.



Step 2 Soil from each sample location is combined and mixed.



Step 3 Soil sample is taken from mixture and prepared for lab analysis.

3.3.5 Soil analysis methods.

Ecology looked at three methods for analyzing soil samples (**Table 3-5**). The method needed depends on the type of sample. Most sampling will happen before cleanup to tell if a unit qualifies for cleanup. During cleanup, samples taken after digging will show Ecology whether contamination remains. Depending on the levels, Ecology may need to dig deeper or lay a geotextile (fabric) barrier to identify where contamination remains.

Table 3-5: Comparisons of Soil Analysis Methodology

Description	X-Ray Fluorescence (XRF)	Fixed Analytical Laboratory	Mobile Analytical Laboratory
	The field sampling crew analyzes the soil onsite using an XRF instrument.	The field sampling crew sends samples to an accredited laboratory at a fixed location.	An onsite laboratory analyzes the samples.
Pros	■ Provides "real-time" results for soil arsenic and lead levels.	■ Uses analytical instruments that are more sensitive than XRF and achieves better accuracy at lower arsenic levels. ■ Ecology-accredited laboratories are available throughout the Puget Sound area.	■ Uses instruments that are more sensitive than XRF and can potentially provide results more rapidly than a fixed analytical laboratory.
Cons	■ Measurements not as accurate as an analytical laboratory at the Yard Program's 90 ppm threshold level. ■ The cost is expected to be similar to that of using a fixed analytical laboratory.	■ Shipment and analytical testing would require more time than onsite analytical methods.	■ Typically more expensive to set up and run than a fixed laboratory.

Decision: Samples taken before cleanup will be sent to a laboratory for analysis.

Reason: Laboratories have instruments that are more sensitive than XRF. They provide better accuracy at lower levels of arsenic and lead. This is important because Ecology also wants to know if a property has contamination over state cleanup levels. Laboratories will also be better equipped to handle the thousands of samples Ecology will take over the years.

Decision: For samples taken during cleanup, Ecology may use a fixed or mobile laboratory, or XRF.

Reason: It will depend on how quickly Ecology needs the results and whether field staff has time to run XRF samples. Ecology has not yet compared the costs of a fixed laboratory to setting up its own mobile laboratory.

3.3.6 How to use sampling data to qualify yards for cleanup.

Ecology developed rules to use sampling data for qualifying properties and units that will be cleaned up under the Yard Program. Since Ecology's sampling will differ from EPA's sampling, the approach to qualifying for cleanup will differ as well. Ecology considered comparing sampling data to threshold levels by unit or by parcel average both inside and outside of the EPA Study Area.

Outside EPA Study Area

Decision: Outside the EPA Study Area, Ecology will offer unit cleanup (**Figure 3-4**) if, for that property, the soil results are above the following Yard Program threshold levels:

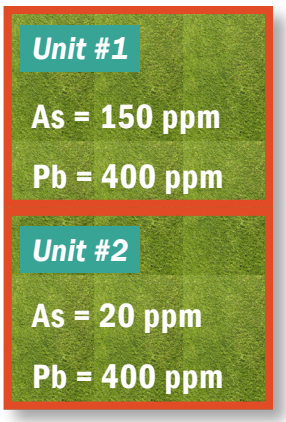
- Arsenic level in any one of the individual units is ≥ 90 ppm
- Lead level in any of the individual units is ≥ 500 ppm.

Reason: This will allow Ecology to address more yards than if we chose to look at the parcel average and will decrease risk for more residents. Some residences may have arsenic levels above threshold levels in one unit but much lower levels in other units. If a parcel average is used, some residences might not qualify for cleanup if the parcel average is below 90 ppm even though a unit may be well over 90 ppm. If evaluated on a unit basis, more properties will qualify for cleanup, and thus increasing risk reduction.

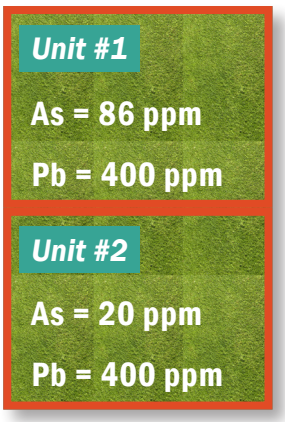
Figure 3-4: Using Sample Results to Qualify a Property for Cleanup Outside the EPA Study Area

Three examples showing both arsenic (As) and lead (Pb)

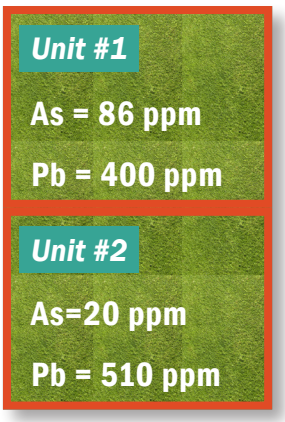
NOTE: Eligibility for cleanup is made for each unit independently



Unit #1 qualifies for cleanup since arsenic levels are ≥ 90 ppm. If a parcel average had been used, Unit #1 would not have qualified for cleanup because the average would have fallen below 90 ppm.



Property does not qualify for cleanup since no unit has ≥ 90 ppm for arsenic or ≥ 500 ppm for lead.



Unit #2 qualifies for cleanup since lead levels are ≥ 500 ppm.

Inside EPA Study Area

Ecology already has soil sampling data for many properties in the EPA Study Area. The data are from all sampling and cleanups done before 2009. Some properties had full or partial cleanups and some did not receive any cleanup.

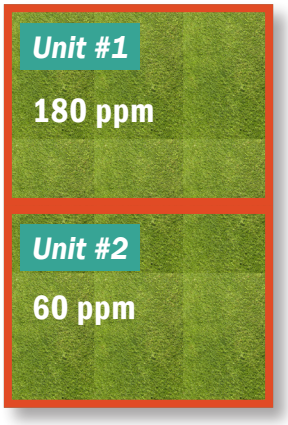
The existing data do not fit the way Ecology plans to sample and make cleanup decisions (**Chapter 5**). For example, past samplers divided properties into small units of around 900 square feet (Hydrometrics 1993). They then based cleanup decisions on the results for each unit. Ecology will make a cleanup decision based on the arsenic and lead levels for units defined on a differing basis – for example, a whole back yard or front yard (**Chapter 3.3.1**).

Decision: Inside the EPA Study Area, Ecology will offer property cleanup (**Figure 3-5**) if, for that property, the soil results are above the following Yard Program threshold levels at either the 0 to 6 or 6 to 12 inch depth intervals:

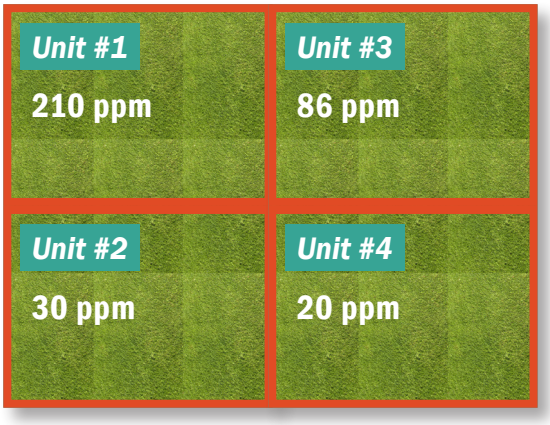
- Arsenic levels averaged over all of the units for the entire property are ≥ 90 ppm. Only units ≥ 90 ppm will be cleaned up.
- Lead levels averaged over all of the units for the entire property are ≥ 500 ppm. Only units ≥ 500 ppm will be cleaned up.
- Arsenic levels in any one of the individual units are ≥ 200 ppm.
- Lead levels in any of the individual units are ≥ 1,000 ppm.

Figure 3-5: Using Sample Results to Qualify a Property for Cleanup Inside the EPA Study Area

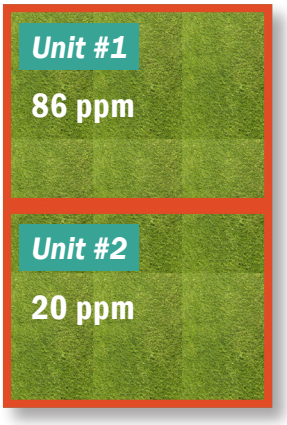
Three examples using arsenic levels only



Average = 120 ppm
Unit Maximum = 180 ppm
Property qualifies for cleanup since the average is ≥ 90 ppm. Only unit #1 would be cleaned up.



Average = 89 ppm
Unit Maximum = 210 ppm
Property qualifies for cleanup since a single unit is ≥ 200 ppm. Only unit #1 would be cleaned up.



Average = 53 ppm
Unit Maximum = 86 ppm
Property does not qualify for cleanup since the average is below 90 ppm and no single unit is ≥ 200 ppm.

Reason: Outside of the EPA Study Area, Ecology will evaluate yards on a unit basis—whether any single unit exceeds 90 ppm. However, since EPA used much smaller units, around 2,000 properties with single units ≥ 90 ppm would qualify for the Yard Program (**Table 3-6**). This would use all of the program's funding for an area where EPA has already performed many cleanups and reduced risk. Ecology will ensure that EPA Study Area properties with an average of ≥ 90 ppm, or units with very high levels (≥ 200 ppm arsenic or 1,000 ppm lead), are addressed. This allows Ecology to save money and address yards that are at risk outside of the EPA Study Area.

Table 3-6: Analysis of EPA Study Area Arsenic Data

	Number of Properties with One Unit ≥ 90 ppm	Number of Properties with Parcel Average ≥ 90 ppm or a Single Unit ≥ 200 ppm
No EPA Action	714	250
EPA Action	1,271	575
Full 6-inch Cap	0	–130
Total	1,985	695

NOTE: Properties with at least a 6-inch cap will be the lowest priority for cleanup. Ecology may offer cleanup in the future if funding is available.

***Figure 3-6:* Cap Provides Physical Barrier**

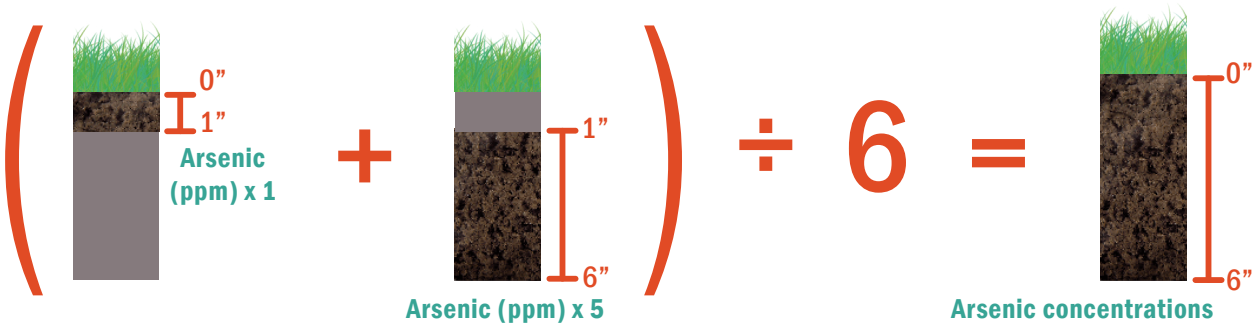
Decision: Properties with a 12-inch or thicker cap do not qualify for the Yard Program. Properties with a full 6-inch cap are the lowest priority for the Yard Program.

Reason: A six to 12-inch cap provides some barrier to human contact with contaminated soils below (**Figure 3-6**). Properties with contaminated soils at the surface pose a greater risk and are a greater cleanup priority.

Decision: Ecology will take a weighted average of the 0 to 1 inch and 1 to 6 inch samples to make cleanup decisions.

Reason: The EPA data divided the top six inches of a soil sample into two components, 0 to 1 inch and 1 to 6 inches. However, Ecology will sample soil in 6-inch depth increments. A weighted average will make cleanup decisions more consistent (**Figure 3-7**).

Figure 3-7: Weighted Average Calculation for Arsenic



Example Weighted Average Calculation:

0-1” = 200 ppm x 1 = 200

1-6” = 100 ppm x 5 = 500

Weighted average is:

0-6” = (200 + 500) ÷ 6 = 117 ppm

3.3.7 Soil cleanup depths inside and outside the EPA Study Area.

Past sampling shows that contamination can be high at depths of two feet or more inside the EPA Study Area. Further out from the former smelter, contamination tends to be in the top six inches in undisturbed soils. It also tends to have lower levels of arsenic and lead further away from the former smelter.

Decision **Decision:** Inside the EPA Study Area, Ecology will dig soils down to 18 inches if contamination above threshold levels is found that deep in the original samples.

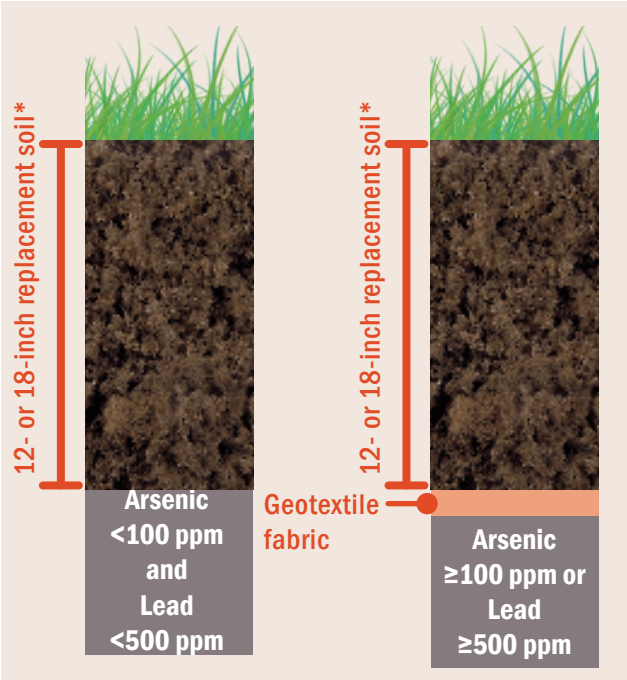
Reason: Digging soil down to 18 inches below the surface will cleanup most of the contamination. If levels remain above action levels deeper down, Ecology will place a geotextile barrier in the bottom of the excavation as a warning layer before filling the excavation with clean soil. The fabric and the 18 inches of replacement soil will protect residents from exposure (**Figure 3-8**).

Decision **Decision:** Outside the EPA Study Area, Ecology will dig soils down to 12 inches.

Reason: Digging soil to a depth of 12 inches below the surface will cleanup most contamination. If arsenic levels remain ≥ 200 ppm, Ecology will dig another six inches for a total of 18 inches. As with properties inside the EPA Study Area, if arsenic and lead levels remain above action levels at the bottom of the excavation, Ecology will place a geotextile barrier before filling in replacement soil (**Figure 3-8**).

***Figure 3-8*: Examples of Soil Cleanup with and without Geotextile**

*If arsenic remains ≥ 200 ppm, Ecology will dig another 6" to a maximum depth of 18".



3.3.8 How to protect cultural resources during cleanup.

State law and the Governor's Executive Order No. 05 05 require state agencies to consider how a project could impact cultural resources. The Cultural Resources Protocol (**Appendix F**) for the Yard Program and Soil Safety Program describes Ecology's cultural resources monitoring and reporting procedures. The protocol also describes Ecology's contact with the Washington Department of Archaeology and Historic Preservation (DAHP) and impacted tribes.

This section highlights four key decisions from the Cultural Resources Protocol.

Decision

Decision: Ecology will use maps that show the relative risk of finding cultural resources.

Reason: These maps will show neighborhoods where Ecology needs to consult with an archeologist prior to cleanup. Areas near bodies of water are more likely to have been inhabited by Native Americans.

Decision

Decision: Ecology will do cultural resources monitoring during cleanup but not sampling.

Reason: Digging up large areas of soil from 12 or 18 inches deep could unearth artifacts. In contrast, soil sampling will only disturb small amounts of soil. A typical sample will be six inches deep and one inch in diameter. Sampling staff will still be trained to recognize artifacts, also referred to as "finds."

Decision: Ecology will have an on-call archaeologist for the duration of cleanup work.

Reason: Ecology will work in some areas with a high probability of having cultural resources. Any time a find is unearthed, work will stop, and an archeologist will evaluate the area before work can restart. However, Ecology does not expect to need a full-time archeologist. More than a few finds would likely require revising the overall property cleanup approach.

Decision: Ecology field staff and contractors will have cultural resources training.

Reason: An archeologist or tribal representative cannot be at all cleanup sites. Therefore, field staff and contractors will need to know how to identify cultural and historical resources. They will know when to stop work, how to protect the site, and when to call in experts.

3.3.9 Property restoration options.

Soil cleanup requires first removing existing landscaping. For any cleanup, Ecology will at least replace the original landscaping. However, some homeowners may want to reduce their property's environmental impact by replacing lawns with plants and trees. They may also want a rain garden to capture runoff from their roof or pavement.

The property will be restored after soil has been excavated.

Decision: Homeowners can replace lawn with mulch and plants if the cost is the same as replacing original landscaping.

Reason: Reducing lawn area can save water and lower the use of fertilizers and pesticides. For the same price of replacing a lawn, Ecology may provide some plants and mulch covering.

Decision: Ecology is exploring partnering with local agencies to run a rain garden pilot program.

Reason: Rain gardens can reduce storm water runoff that flows into local waterways. A typical rain garden consists of about a two foot hole, filled with a soil and compost mixture to help water absorb into the ground. It has a pipe that directs water in, an overflow, and the surface is covered in plants (see photo). In order to maximize cleanup funding and treat homeowners equitably, Ecology is only paying for the parts of rain garden construction that can be integrated into cleanup. This includes removing soil, backfilling with a rain garden mix, and installing a mulch layer and plants equal to the value of the original lawn or landscaping. This represents the majority of the cost of a rain garden.

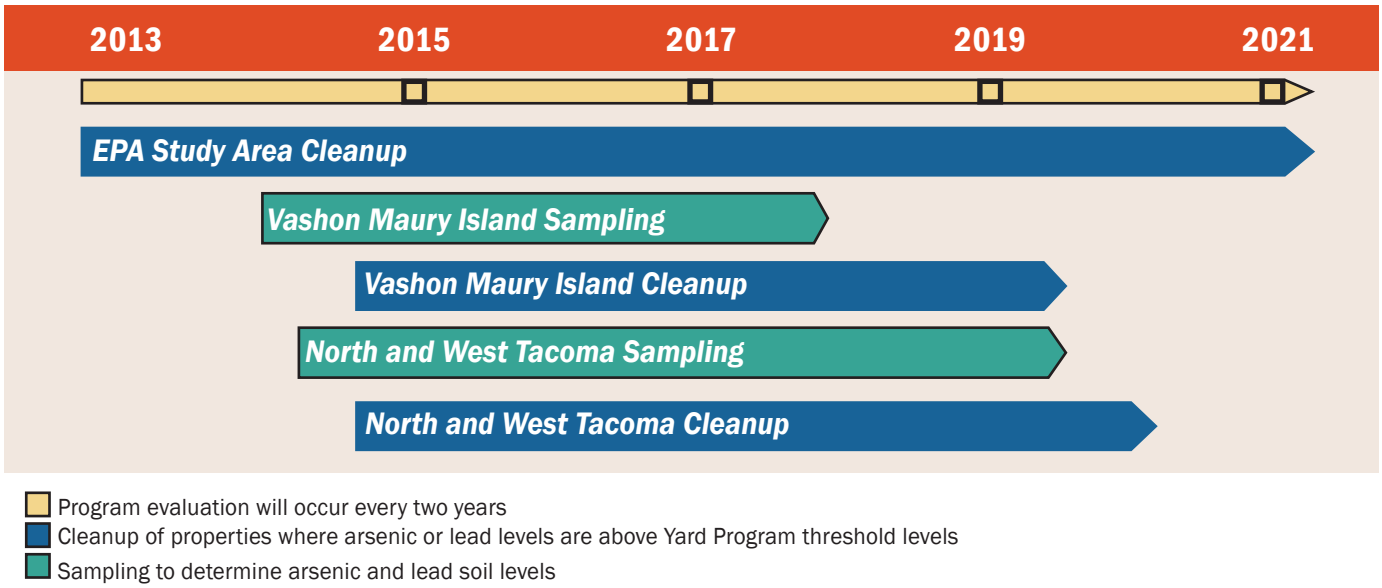
Residential rain garden in Puyallup, Washington. Photo courtesy of WSU Extension.

We are relying on Master Gardeners, the Conservation District, or other local partners to advise on rain garden designs and consult with homeowners on directing stormwater to the gardens. Ecology will not reroute downspouts or drains due to liability and because it would take resources away from other yard cleanups. Based on the results of the pilot, Ecology may continue offering rain gardens.

4. Overall Yard Program Implementation

This section describes the timeline for the program and the sequence of sampling and cleanup activities. **Figure 4-1** shows the estimated timeline for Yard Program implementation.

Figure 4-1: Yard Program Timeline



4.1 Yard Program Service Area Map

During a separate process related to the program design, a map was created using existing data to model the areas where it is predicted that arsenic in soil will be above 100 ppm. This Yard Program Service Area map is shown as **Figure 1-2** in **Chapter 1**.

The Yard Program Service Area is divided into three geographical subareas. The three subareas are distinct from one another geographically and have differing sets of available data based on previous work completed under separate programs. The three subareas are shown on the map (**Figure 4-2**) with their sequenced order as the EPA Study Area, King County on Vashon-Maury Island, and Pierce County outside of the EPA Study Area. By dividing the Yard Program Service Area into three distinct subareas, Ecology will be able to work with more construction crews at one time. Each of the three subareas will have their own priority within the Yard Program and work will be occurring in more than one subarea at a time (**Figure 4-1**).

Each of the three subareas will have their own priority within the Yard Program and work will be occurring in more than one subarea at a time.

The geographical areas are divided into block groups. The block groups are census defined areas. They contain approximately 300 to 800 parcels per block group. These block groups have been assigned a letter through the modeling process that developed

the map. The modeling process has three main parameters: arsenic threshold, percent of parcels over the arsenic threshold, and probability that a given percent of parcels will be over the arsenic threshold. The model allows the user to set two parameters constant and see how the third varies. **Figure 4-2** shows the sequenced order that was assigned when the probability is set at 20% and the threshold at 90 ppm and the percent of parcels over 90 ppm varies. We call the percent of parcels exceeding the "exceedance rate." We use this exceedance rate to sequence sampling in the block groups for the King and Pierce county subareas, where "A" has the highest exceedance rate in each county. In both subareas, we will start sampling the block groups labeled "A" first and then proceed in alphabetical order. For further explanation of how the ranking was decided, see **Appendix B**.

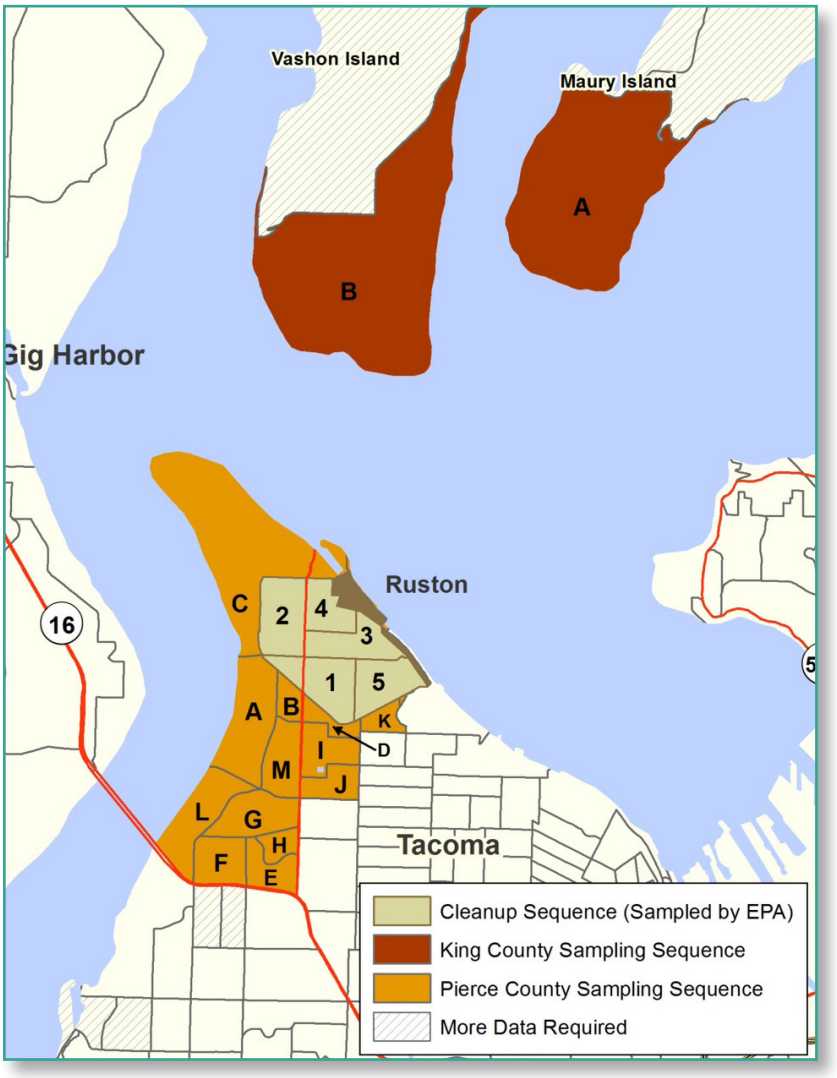


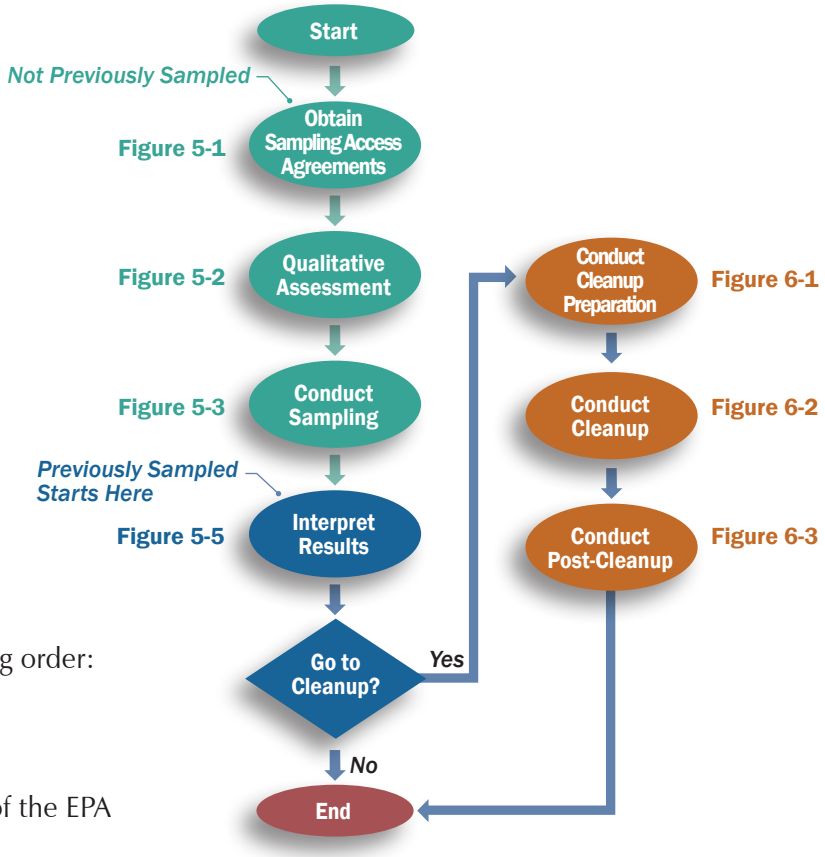
***Figure 4-2*: Sequencing of Sampling and Cleanup Within the Service Area**

The block groups are divided into access groups. As the block groups contain a large number of parcels, they may need to be further divided into access groups. The access groups will be assigned a second letter. Ecology plans to divide a block group into access groups of approximately 100 parcels. This will provide the sampling teams a manageable number of properties to track for access, sampling, and cleanup. This division into access groups will be evaluated as the sampling program progresses and the number of parcels per group may be adjusted.

4.2 Summary of the Yard Program Process

This section presents a summary of the Yard Program process. A detailed explanation of the program is included in **Chapters 5** and **6**, which also include several flow charts to aid in illustrating the step-by-step approach to the sampling and cleanup process. The overall process is shown in **Figure 4-3**. Separate flow charts are provided for each individual portion of the program.

Figure 4-3: **Property Sampling and Cleanup Overview**



For properties not previously sampled, Ecology will send access agreements to the homeowners through a mailing. Once access is gained, a qualitative assessment of the property will be conducted and the properties will be sampled (**Chapter 5.2.1**). Once the sampling and analysis is complete and the results are interpreted, the homeowners and residents will be sent those results. All properties with arsenic levels ≥ 20 ppm in the soil will receive additional outreach materials along with the results. Those properties with arsenic or lead levels above the Yard Program threshold levels will have the opportunity for cleanup. Ecology will schedule an appointment to start the cleanup planning process and then complete the cleanup plan.

The subareas are prioritized in the following order:

- Cleanup in EPA Study Area
- Sampling on Vashon-Maury Island
- Sampling within Pierce County outside of the EPA Study Area.

There are two different starting points in the process depending on what geographical area a property is in and if there are previous sampling data available for that property. Outside the EPA Study Area and on Vashon-Maury Island, the process will start with obtaining access agreements for sampling (**Figure 5-1**).

In the EPA Study Area, most properties have already been sampled. These properties will start the process for interpreting results as shown in **Figure 5-5**. Each homeowner will be sent an initial letter with their results that indicate if they may qualify for the Yard Program.

There are different starting points in the process depending on what geographical area a property is in and if there are previous sampling data available for that property.

By starting in the EPA study area and using existing data Ecology can start cleanup projects faster, save money on sampling costs, and continue to collect data outside of the EPA Study Area.

4.3 Cleanup of the EPA Study Area

The EPA Study Area has previous sampling data from the work done by the EPA. Ecology used the available data to determine neighborhood priorities and if properties will be addressed by the Yard Program. By starting in this area and using existing data, Ecology will start cleanup projects faster, save money on sampling costs, and continue to collect data outside of the EPA Study Area. **Figure 4-2** shows the EPA Study Area and the cleanup sequence of neighborhoods where Ecology will start contacting residents about the Yard Program.

Ecology has prioritized cleanup of neighborhoods where arsenic levels are highest and the homes have not had EPA cleanup work. In order to better use funding, Ecology will also offer cleanup to homeowners whose yards had partial cleanup work under the EPA program but still have contamination remaining above the Yard Program threshold levels.

Ecology will assess the available data from each property using the methods presented in **Chapter 5.2** and **Figure 5-5**.

For each property Ecology will:

- Determine if the property results are above or below the threshold levels.
- Determine if new sampling is required due to major soil movement or change in the property since EPA sampled.
- Send results and letters explaining if the property will be further evaluated by the Yard Program or if the property does not qualify for the Yard Program (see **Appendix E** for examples).

If the property qualifies for further evaluation by the Yard Program, the homeowner will receive:

- Information on how to schedule an appointment with Ecology.
- At least three opportunities to schedule an appointment to discuss the Yard Program and a cleanup plan for the property.

4.4 Sampling Outside of the EPA Study Area

Areas outside of the EPA Study Area do not have previous sampling data. They will start the process at the top of the flow chart with obtaining access agreements (**Figure 5-1**). As shown in the timeline (**Figure 4-1**), access and sampling will start on Vashon-Maury Island and then will start in Pierce County outside of the EPA Study Area shortly thereafter. The sampling of these areas will run concurrently. For multifamily housing, older properties built prior to 1986 (during the time the former smelter operated) will be prioritized for sampling over newer multifamily housing.

4.5 Neighborhood Screening

Ecology intends to prioritize and conduct sampling as described. However, Ecology may also conduct sampling randomly along the border of the Yard Program Service Area in order to improve mapping predictions. This sampling is called **neighborhood screening**. The purpose of neighborhood screening will be to provide data for updating the Yard Program Service Area map and may result in the elimination or inclusion of neighborhoods from the Yard Program.

The purpose of neighborhood screening will be to provide data for updating the Yard Program Service Area map and may result in the elimination or inclusion of neighborhoods in the Yard Program.

Neighborhoods with a 10% exceedance rate that are outside of the current Yard Program Service Area will be considered for neighborhood screening. After a neighborhood is selected, access and sampling will occur and will follow the same path as shown in **Figure 4-3**, beginning with obtaining access for sampling.

If a neighborhood is selected for neighborhood screening, homeowners may not see any difference in the Yard Program process. For neighborhood screening, the same steps will occur except that Ecology will contact homeowners to sample properties once. They will continue contacting homeowners until enough information is gathered to update the map.

4.6 Yard Program Evaluation and Update

Ecology will endeavor to evaluate and update the map and evaluate the program at least every two years. As new data are collected, it will be input into the model in order to update the map. This evaluation may change the sequence of the block groups and also may change the Service Area boundary.

Tools that will be used to evaluate the program will be surveys provided to participants in the program. Two surveys that we plan on sending are:

- Survey of the outreach provided to those properties with arsenic soil levels between 20 and 90 ppm.
- Survey of the properties that received cleanup.

Ecology will use these surveys, along with the performance measures (see **sidebar**), to help refine and improve materials and programs provided to the public.

Program Progress Evaluation

At least every two years, Ecology will evaluate:

- ☐ What is the program participation rate?
- ☐ How fast is sampling progressing?
- ☐ How many properties require cleanup actions?
- ☐ How many properties agree to cleanup action plans?
- ☐ How does new data change the map and the sequence of the block groups?
- ☐ How effective is the community outreach?
- ☐ Are behavior changes made in occupants of properties that have arsenic between 20 and 90 ppm?
- ☐ How satisfied are the sampling and cleanup customers?
- ☐ How do the data compare to the model? Does it need to be refined?
- ☐ Is the database being used in the way it was intended?

4.7 Performance Measures

Ecology will evaluate the effectiveness of the Yard Program each fiscal year and update an annual report. The report will be sent to stakeholders. In this report, Ecology will track performance measures for access, sampling, and cleanup.

Performance for access agreements sent and signed.

Table 4-1: Access Agreement Performance Measures

Date Measured	Access Agreements Sent	Percent Response
June 30, 2013	0	0%
June 30, 2014	1,000	75%
June 30, 2015	1,000	75%

Performance is measured for the number of access agreements sent out by the sampling teams and by the percentage of "yes" or "no" responses for sampling. **The performance measure is that, beginning in 2014, at least 1,000 access agreements are sent out annually with a return rate of at least 75%** (**Table 4-1**).

If the number of access agreements sent out or the percentage of responses is less than the performance measure, Ecology will evaluate and may revise the process and approach of gaining access to properties.

Table 4-2: Sampling Performance Measures

Date Measured	Percent Sampled Within One Month of Access
June 30, 2013	100%
June 30, 2014	100%
June 30, 2015	100%

Performance for sampling.

Performance is measured for the number of properties sampled each year. Ecology expects, each year, to sample 100% of those properties that provide Ecology access. **The performance measure is that 100% of properties where access agreements have been signed will be sampled within one month of the receipt of the signed agreement** (**Table 4-2**).

If the number of properties sampled is less than the performance measure, Ecology will re-evaluate and may revise the sampling process. If the time period for sampling is greater than one month, Ecology will assess the reasons and may revise the timeframe or process.

Table 4-3: Reporting Performance Measures

Date Measured	Percent Reported Within Two Months of Sampling
June 30, 2013	100%
June 30, 2014	100%
June 30, 2015	100%

Performance for reporting results.

The performance measure is that each homeowner shall be sent the results of sampling within two months of the sampling date (**Table 4-3**). If the actual time period for receipt of sampling results is greater than two months, Ecology will document the reasons and may re-evaluate or revise the timeframe or process.

Table 4-4: Cleanup Performance Measures

Date Measured	Completed Cleanups	Percent Cleaned Up Within One Year of Cleanup Plan
June 30, 2013	0	100%
June 30, 2014	15	100%
June 30, 2015	100	100%

Performance for cleanup.

Ecology expects, each year, to clean up 100% of those properties with signed cleanup plans. **The performance measure is that each property where cleanup plans have been signed shall be completed within one year of signature** (**Table 4-4**). If the number of cleanups completed is less than the performance measure, Ecology will re-evaluate and may revise the cleanup plan process.

5. Property Access, Assessment, and Sampling

This chapter describes the process of gaining access, performing qualitative assessments, sampling, and interpreting the results.

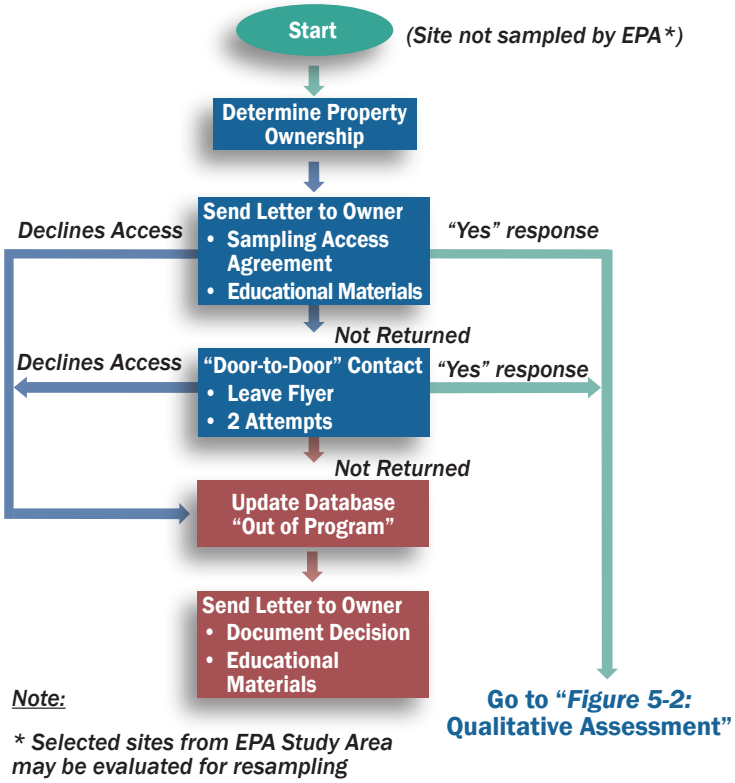
5.1 Property Access for Sampling

This section only applies to yards outside of the EPA Study Area. Ecology does not have sampling results for these yards yet.

The size of the Yard Program Service Area and the limited funding available has influenced Ecology's approach to obtaining property access. Ecology will batch properties together into groups called access groups. The access groups will consist of around 100 properties located in the same neighborhood (**Chapter 4.1**).

The Yard Program is voluntary, which allows for homeowners to refuse access. Ecology has the ability to offer sampling and cleanup on a one-time basis. **Figure 5-1** shows the overall process for gaining access to properties for sampling. Prior to contacting homeowners, Ecology will obtain information on current ownership, current property uses, and property development or soil disturbance.

Figure 5-1: Obtain Sampling Access Agreements



For each access group, Ecology will:

- Input property information into the AREIS database and assign the property a unique property identifier (**Chapter 8**).
- Check to see if TPCHD or Ecology records show prior contact with this homeowner.
- Provide a homeowner three opportunities to sign the access agreement.

Access agreements will be mailed to homeowners (property owners or homeowners associations for multifamily housing) before the sampling activities. Access agreements must be signed to allow sampling teams onto the property. The access agreements will include questions that help the teams be better prepared for sampling each property. Mailings will also include educational materials to introduce Ecology's program and describe healthy actions to reduce exposure to contaminated soil. Examples of access agreements for sampling and outreach materials are provided in **Appendix E**.

Ecology will go door-to-door in attempt to contact homeowners who do not respond to the initial mailing.

Ecology will make three attempts to gain access. Ecology will first mail access agreements to homeowners.

- If there is no response from a homeowner to the mailing, Ecology representatives will knock on the door of the property.
- If no one is home at the time of the property visit, the sampling team will leave a door hanger on the front door explaining the program and requesting participation.
- If there is still no response from the homeowner, the sampling team will attempt the "knock and talk" a second time.
- If at any time during the process a homeowner declines property access this will be noted in the database and the homeowner will not be contacted for access again.

Once a homeowner has refused sampling, they will not be able to join the program later. In cases where homeownership changes, the new owner may be able to re-enter the program, as resources allow.

If a homeowner does not respond to Ecology or declines to participate in the Yard Program, Ecology will send a letter that documents their decision. This letter will include educational materials on healthy actions that residents can take to reduce their risk.

It is important that homeowners take advantage of the opportunity to participate when requested by Ecology.

5.2 Qualitative Assessment and Sampling

This section only applies to yards outside of the EPA Study Area. Ecology does not have sampling results for these yards yet.

Ecology's goal is to have properties sampled within one month of receiving the signed access agreement.

After the homeowner grants access, Ecology will make an appointment with the homeowner or resident to schedule the qualitative assessment and sampling. Ecology's goal is to have properties sampled within one month of receiving the signed access agreement. The homeowner or resident may choose if they want to be present during sampling. If a homeowner chooses not to be present, then, Ecology will ask for a phone interview to find out more about the yard areas on the property.

Upon arrival at a property, the sampling team will announce themselves and provide the homeowner or resident outreach materials (see **Appendix E** for examples). The sampling team will conduct the remaining portion of the qualitative assessment and then proceed to sampling.

If the homeowner is not present, the sampling teams will proceed with the qualitative assessment and sampling, when property access is possible. The sampling teams will leave outreach materials and a message to let the homeowner know what occurred during the visit.

5.2.1 The qualitative assessment gathers information about a property.

Ecology will use information about the property to design the sampling plan. This information will be gathered before and at the time of sampling. This process is shown in **Figure 5-2**. The more information that the sampling team has before arriving on site, the better prepared they will be on the date of sampling.

Ecology will use information provided by the homeowner to understand the property history and current uses. This information may come from the access agreement form, a phone interview, or during sampling if the homeowner or resident is present. The information will be used to determine if soil is accessible for sampling, to identify high-use areas, and to develop property-specific sampling plans.

The information will be used to determine the number of units and high use areas. The sampling team will determine whether the property is a small lot (≤0.25 acres), large lot (>0.25 acres), or multifamily housing. With the exception of multifamily housing, lot size then determines the number of units per property.

- Small lots will be divided into one to two separate units.
- Large lots will be divided into one to four separate units.

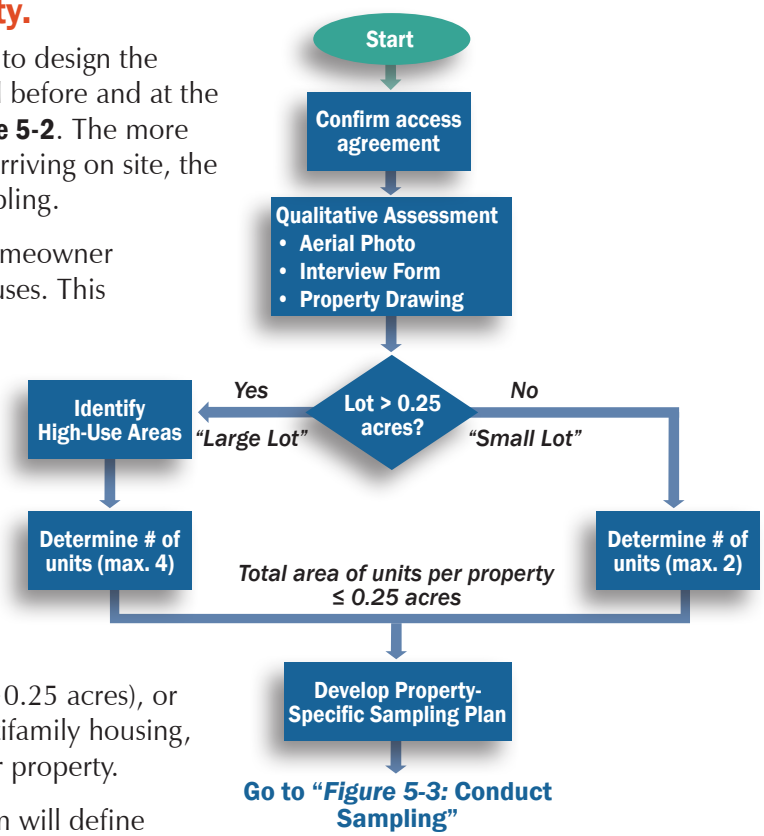
The sampling team will define units (**Chapter 3.3.1**) based on the physical layout of the property and similar use areas. For a small lot of less than 0.25 acre, units will typically consist of the front and back yards.

For large lots and multifamily housing, the sampling teams will determine the high use areas. **High-use areas are those parts of the yard where people spend substantial time**, such as lawn and play areas, seating areas, and some types of gardens. **Figure 3-2** shows examples of units for both small and large lots. Multifamily housing will be similar to large lots, except the number of units will be up to the number of households living in the multifamily housing.

If requested by the homeowner, the sampling team may also define and collect samples from up to two additional "educational units." Educational units may include areas that are wooded or permanently landscaped, such as hedges, perennials, or other areas of dense vegetation. Ecology will collect samples for homeowner information only. Ecology will not clean up educational units under the Yard Program.

Samplers will check and inventory the locations of buildings, outbuildings, driveways, walkways, paths or other pavements, landscaped beds, steep slopes, septic tanks or drainfields, wooded areas, wetlands, livestock areas, and

Figure 5-2: Qualitative Assessment



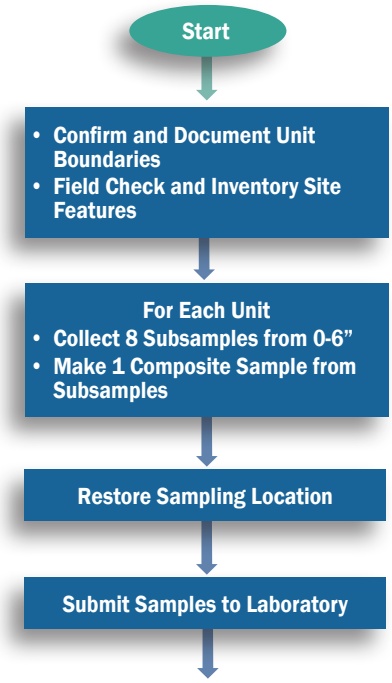
Qualitative Assessment

The qualitative assessment will involve:

- Reviewing property-specific questions on the access agreement
- Reviewing aerial photographs of the property
- Reviewing the AREIS database
- Input from the homeowner or resident

other areas excluded from the cleanup program. These areas may be sampled as education units. A qualitative assessment could show that no sampling is necessary. This may occur if there are no accessible soils, or if all the accessible soils are in areas excluded from the cleanup program and no educational units are identified (see **Chapter 6.1.2** and **Appendix C** for areas excluded from the cleanup program). If no sampling is performed Ecology will record the decision in the AREIS database and notify the homeowner.

Figure 5-3:
Conduct Sampling



5.2.2 Sampling process.

After the qualitative assessment is complete, samplers will prepare a site specific sampling plan and take samples. Samplers will restore yards to approximately their original condition by filling in sampling holes and replacing sod or other ground cover. Sampling should be completed within a few hours, but possibly over a two-day period. **Figure 5-3** depicts the overall sampling activities.

Samplers will make field sampling maps for each property. Samplers will mark and label an aerial photograph with the units and the site specific features. If the aerial photograph does not clearly show the yard, then samplers will make a site drawing showing labeled units and site features. Ecology will provide homeowners with the final field sampling maps after interpreting the sampling results (**Chapter 5.3**). See **Appendix E** for an example of a field sampling map.

Samplers will either collect a Global Positioning System (GPS) point at the front door of the residence or use the center of the property to link the location with the sampling data. Samplers will record the GPS coordinates on the field sampling report.

Samplers will divide properties into units and collect one composite sample from each unit. For each unit, samplers will collect subsamples of soil from eight random locations using hand tools, from a depth interval of 0- to 6-inches below ground surface (bgs). Samplers will not collect subsamples from areas excluded from the cleanup program (**page 6-4**). Samplers will mix all eight subsamples into one composite sample for that unit (**Figure 3-3**). The subsamples will consist of small holes that will be re-filled following sampling (for photos of sampling, see **Figure 5-4**).

Assessment and Sampling Responsibilities

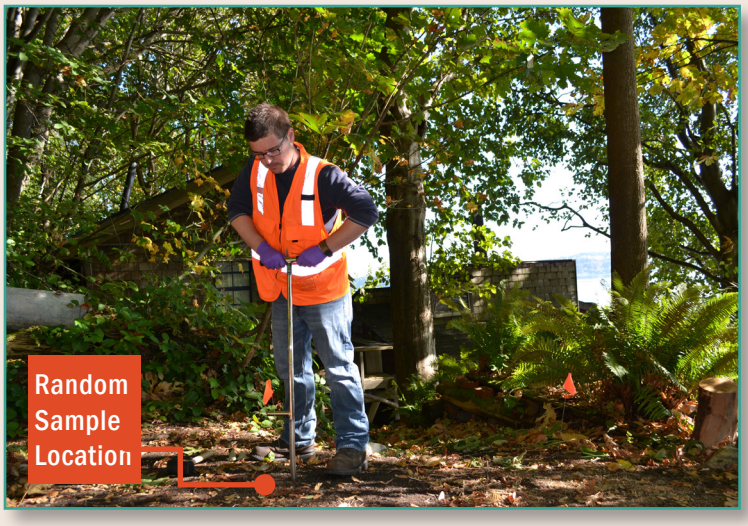
Homeowners or residents will be responsible for:

- Confirming high-use areas on the property
- Securing pets
- Providing information about utilities.

The sampling team will be responsible for:

- Scheduling an appointment for assessment and sampling
- Defining boundaries of the units
- Maintaining or replacing property to approximate original condition
- Abiding by the Health and Safety Plan to conduct work in a safe manner
- Maintaining reasonable property access for the homeowner or resident.

Figure 5-4: What Soil Sampling Looks Like



Field crews will take the soil samples at eight random locations.

Samples will be collected from between 0-6" soil depth.

Soil from all eight locations will be combined together (composited) and analyzed as a single sample.

Ecology may also collect composite samples from a depth interval of 6- to 12-inches bgs at some properties. Ecology may use these samples to determine if a 12-inch dig is required.

Ecology may also collect samples for information purposes only from educational units. The results for these samples will not be used for cleanup decisions.

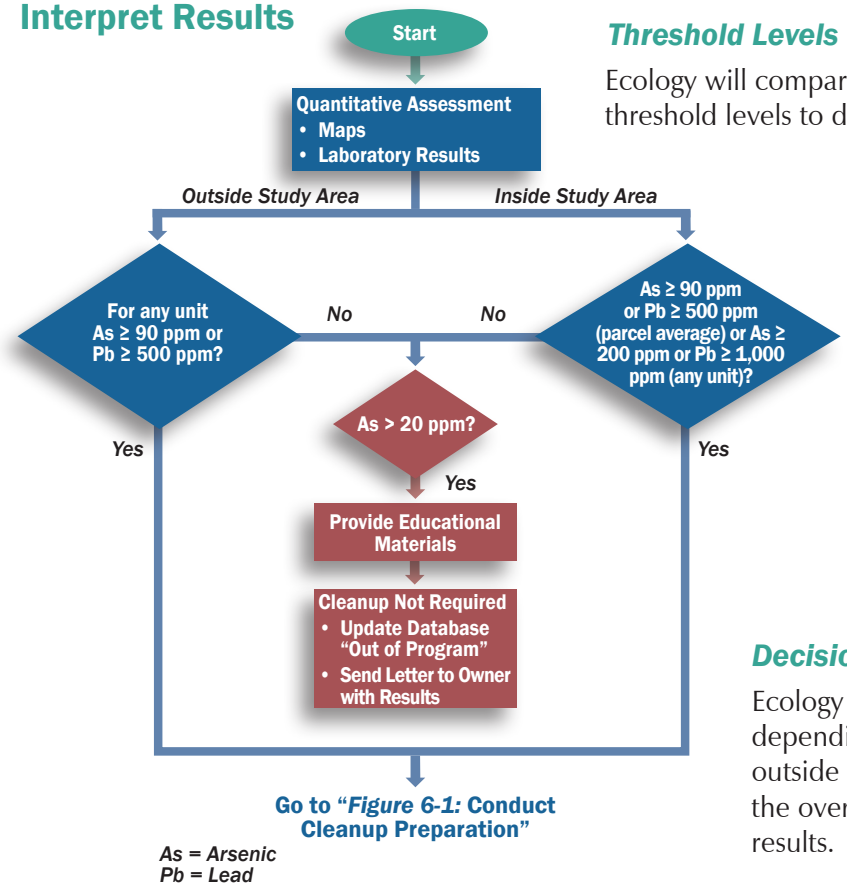
Composite samples will go to an analytical laboratory for arsenic and lead analysis. The Sampling and Analysis Plan (SAP) (**Appendix C**) and Quality Assurance Project Plan (QAPP) (**Appendix D**) detail the soil sampling and analysis methods.

5.3 Interpretation of Sampling Results

This section applies to yards within and outside of the EPA Study Area.

Ecology will first evaluate the laboratory results and verify the data using the QAPP guidelines (**Appendix D**). Next, Ecology will decide whether a yard or unit qualifies for cleanup.

Figure 5-5:
Interpret Results



Threshold Levels

Ecology will compare sampling results to the following threshold levels to decide whether to do cleanup:

- Arsenic threshold = 90 ppm
- Lead threshold = 500 ppm.

The arsenic action level is 100 ppm, but Ecology is comparing sampling results against a threshold of 90 ppm. Soil sampling can sometimes miss areas that actually have ≥ 100 ppm of arsenic. Using a lower threshold ensures Ecology will cleanup more yards over the action levels (see **Chapter 3.2.3** for more background on threshold levels).

Decision Criteria

Ecology will use slightly different criteria depending on whether a yard is inside or outside of the EPA Study Area. **Figure 5-5** shows the overall process for reviewing sampling results.

Yards meeting any of the following criteria within the top 12-inches of soil will qualify for cleanup:

- **Inside EPA Study Area:**
  - Average (whole parcel) arsenic ≥ 90 ppm
  - Average (whole parcel) lead ≥ 500 ppm
  - Any unit arsenic ≥ 200 ppm
  - Any unit lead ≥ 1,000 ppm.
- **Outside EPA Study Area:**
  - Any unit arsenic ≥ 90 ppm
  - Any unit lead ≥ 500 ppm.

After Ecology has reviewed the data, it will send the final map and results to the homeowner and resident and load them into the AREIS database. Ecology's goal is to send homeowners their results within two months of sampling. Homeowners will receive outreach packages tailored to their sample results. **Table 5-1** presents the type of materials homeowners and residents should expect to receive. **Appendix E** shows examples of sampling reports, letters, and outreach materials. **Chapter 7** describes how Ecology will provide outreach to homeowners with arsenic and lead below threshold levels.

Table 5-1: Post-Assessment Results Homeowners Can Expect

Arsenic < 20 ppm and Lead < 250 ppm	Arsenic ≥ 20 ppm, but < 90 ppm or Lead ≥ 250 ppm but < 500 ppm	Arsenic ≥ 90 ppm or Lead ≥ 500 ppm (property average inside EPA Study Area or any unit outside EPA Study Area)
Homeowners and residents will be sent sampling results and a letter stating results are below state cleanup levels. No cleanup actions will be taken.	Homeowners and residents will be sent sampling results and a letter stating results are below Yard Program action levels but above state cleanup levels. The Yard Program is not able to address them through cleanup actions at this time. Homeowners will receive outreach materials (**Chapter 7**).	Homeowners and residents will be sent sampling results and a letter stating results are above Yard Program threshold levels. Ecology intends to schedule a visit with the homeowner to create a cleanup plan. Homeowners will receive outreach materials containing details on the cleanup process. It may be several years before cleanup will occur.

NOTE: Results and maps will differ inside and outside the EPA Study Area.

5.4 Review of Properties Sampled by EPA

Properties in the EPA Study Area will be eligible for the Yard Program as described in **Chapter 4**. EPA's program has already sampled most yards in this area. Some of these yards have already had cleanup actions taken. Ecology does not want to repeat cleanup work. However, it does want to lower the risk in yards where arsenic remains ≥ 100 ppm in the top twelve inches of soil. To do this, Ecology is evaluating EPA sampling results and reassessing some properties to decide if new sampling is needed (**Chapter 3**).

Ecology will interpret the EPA data using the guidelines in **Chapter 5.3**. The guidelines for review of EPA data and qualification for cleanup is different from properties that Ecology will sample, due to the difference in sampling methodologies.

Ecology has calculated a weighted average for the top six inches of soil. For yards sampled by the EPA, Ecology calculated a simple weighted average of data from 0- to 1-inch and 1- to 6-inches to get a value for the 0- to 6-inch depth (**Chapter 3.3.6**). For fill soil brought in by the EPA, Ecology assumed an arsenic level of 20 ppm when calculating the weighted average.

Using the weighted average, Ecology calculated the parcel average and the unit maximum. Ecology will use these values to decide which units qualify for cleanup. Any unit with a full six-inch cap of clean soil on top of the contaminated layer will be the lowest priority for cleanup.

Ecology will evaluate EPA Study Area yards for changes. Ecology will review each property by comparing sampling results to aerial photographs and current parcel maps. If Ecology finds major changes, such as a new home or subdivided parcel, and past results showed contamination above threshold levels, then new sampling will be offered to the homeowner. Ecology will also offer sampling for yards not previously sampled by EPA.

If new sampling is needed, that yard will begin the Yard Program soil sampling process described in this chapter, starting with property access (**Chapter 5.1**).

If no new sampling is needed, Ecology will send homeowners the EPA results. As Ecology interprets results by neighborhood, homeowners will receive outreach packages tailored to their sample results (**Table 5-1**). Properties within the EPA Study Area will receive slightly different packages from the other areas of the Yard Program. **Appendix E** shows an example of a sample packet with EPA results and maps, a letter, an appointment form, and outreach materials. **Chapter 7** describes how Ecology will provide outreach to homeowners with arsenic and lead below threshold levels.

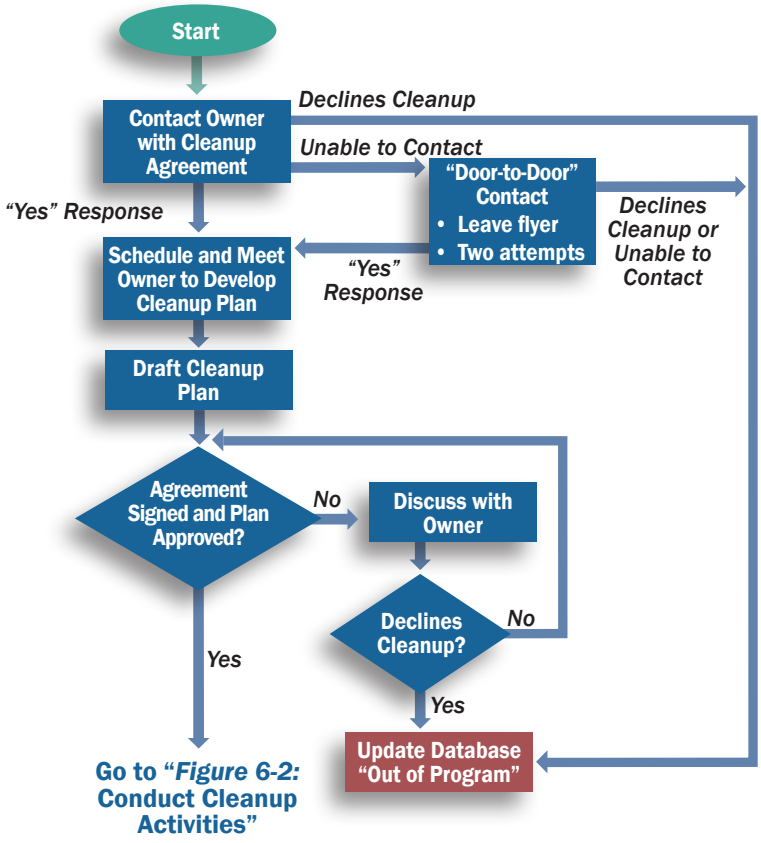
6. Property Cleanup

Cleanup Preparation 6.1	Cleanup Construction 6.2	Post-Cleanup Activities 6.3

This chapter describes the process and procedures for yard cleanups. Ecology will track cleanups by property, rather than by homeowner so that, if ownership changes, we can make sure that a property that needs cleanup gets done. Simplified flowcharts for the cleanup preparation, cleanup implementation, and post-cleanup activities are shown in **Figures 6-1**, **6-2**, and **6-3**, respectively.

Ecology will cleanup properties where arsenic and lead levels are above threshold levels. If sampling (**Chapter 5**) shows arsenic and lead levels lower than the threshold levels, then Ecology will not prepare a cleanup plan for the property. Ecology will send a summary report (**Chapter 6.3.3**) to the homeowner documenting that arsenic and lead levels are below threshold levels.

***Figure 6-1:* Conduct Cleanup Preparation**



6.1 Cleanup Preparation

This section explains the planning and coordination needed before cleanup begins. **Figure 6.1** summarizes Ecology's cleanup preparation process including homeowner's involvement in the cleanup planning. The following sections discuss:

- Outreach to homeowners.
- Developing a cleanup plan, including a property visit and a meeting with the homeowners, and homeowner review and acceptance of the cleanup plan.
- Cultural resource and permitting activities.
- Hiring a cleanup contractor.

6.1.1 Outreach to homeowners.

As discussed in **Chapter 5.3**, Ecology will send homeowners their sampling results and explain whether or not the yard is eligible for cleanup. Homeowners will also receive information about healthy actions they can take to protect themselves until cleanup takes place. Because sampling will far outpace cleanups, homeowners may have to wait several years before cleanup begins.

Ecology will communicate with homeowners regarding the results of sampling and whether or not the property is eligible for cleanup.

6.1.2 Scheduling a home visit and developing the cleanup plan.

Homeowners must agree in writing to the cleanup plan before cleanup activities can take place.

As a neighborhood is selected for cleanup, Ecology will review the sampling results for the yards in that neighborhood. Ecology will attempt to contact homeowners (property owners or homeowners associations for multifamily housing) following a similar process as was used to obtain access agreements for sampling (**Figure 5-1**).

Ecology will make three attempts to schedule the first home visit. The attempts for a home visit may vary depending on the homeowner contact information available at the time.

- Ecology's first attempt will be through an outreach package that includes an appointment form, a phone call, or email.
- If there is no response from a homeowner to the first attempt, outreach teams will attempt a second contact by mail, phone, email, or knocking on the door of the property.
- If there is no response from the second contact method, Ecology will attempt a third time by knocking on the door of the property and leaving a door hanger on the front door explaining the program and requesting participation.
- If there is no response from the homeowner after three attempts, Ecology will mail a final letter and record in the AREIS database that there was "no response" after three attempts.

If the homeowner can be reached, Ecology will schedule a home visit with them to discuss sampling results, explain the cleanup program, and begin developing the property cleanup plan. These yards will then move to the cleanup process laid out in this chapter.

If a homeowner refuses cleanup, they will not be able to join the program later. In cases where homeownership changes, the new owner may request to re-enter the program and participation will depend on available resources.

If a homeowner does not respond to Ecology or declines to participate in the Yard Program, Ecology will send a letter that documents their decision. This letter will include educational materials on healthy actions that residents can take to reduce their risk.

The initial home visit will include the following activities:

- Discuss the soil sampling results.
- Review and discuss components of the cleanup plan.
- Inspect the property to identify areas to be included as part of the cleanup, areas that the homeowner may choose not to be included in the cleanup, areas to be excluded from the cleanup program (i.e., areas under decks/concrete, aquatic areas, and specific areas that require care or special consideration during cleanup).
- Identify aboveground and underground structures and utilities (septic tanks, irrigation systems, underground storage tanks, electrical lines, water lines, pressurized gas lines, wastewater lines, etc.) at the property.
- Develop an initial draft of the cleanup plan, including a list of vegetation/landscaping structures that will remain, be removed, replaced in kind, or reinstalled after soil removal.
- Collect photographs and measurements of the property.
- Discuss the schedule for development and review of the cleanup plan, cleanup activities, length of cleanup, and post-cleanup activities.
- Discuss warranty period and homeowner responsibilities during and after the cleanup process.

Cleanup plan first home visit

Ecology will schedule a home visit to discuss the sampling results and cleanup program, and begin developing the cleanup plan. This meeting will typically last about one hour (see **sidebar** for details). Ecology will ask homeowners for input on areas of the yard they do not want Ecology to dig up or any potential hazards to workers.

Ecology also needs to know whether they would like their original landscaping restored, or more eco-friendly landscaping installed. Ecology will pay for the cost of more eco-friendly landscaping up to the cost of restoring the original landscaping. Ecology can try to arrange for the homeowner to meet with a Master Gardener to learn more about landscaping options.

Homeowners should also let Ecology know about any changes they plan to make to their yard before cleanup. This could include removing a tree stump, shed, or deck. Ecology does not recommend building new structures or adding landscaping before cleanup, as it would change the cleanup design and make soil removal difficult.

At the end of the first home visit, Ecology will provide a list of action items and let the homeowner know when they can review a draft cleanup plan for their yard.

Cleanup plan development

After the meeting, Ecology will design a cleanup plan using the sampling results and information from the home visit. Ecology will mail the cleanup plan to homeowners. The cleanup plan will include the following:

- Cleanup plan and drawing.
- A list of vegetation, structures, and materials to be protected, left in place, removed, or removed and replaced during cleanup activities.
- An aerial photograph or site drawing noting the action (protect in place, remove, replace, etc.) for plants, structures, or other things in the yard.
- A form for signature that approves the plan and gives Ecology and Ecology's cleanup contractor access to the property to perform the cleanup work outlined in the plan drawing.
- Warranty information and homeowner responsibilities after cleanup.

Appendix E includes a sample cleanup plan.

Some areas will be excluded from cleanup. Ecology will not clean up some parts of the property if they are hard to reach, or could create hazards. Also, Ecology will not cleanup areas where possible exposure is low and cleanup costs would be high. County or city ordinances may also exclude an area from cleanup.

Soils will be excavated from accessible high-use areas. Soil will not be excavated from under paved structures, sidewalks, retaining walls, etc.

Ecology will not clean up permanently landscaped areas. These include rock gardens, structures, walls of any construction, woody vegetation, perennials, or areas of dense, natural vegetation. In areas with trees or other permanent vegetation, Ecology may:

- Hand-scrape surface soil to avoid damage to vegetation; replace with clean soil and at least 1 inch of surface cover (grass, gravel, or mulch)
- Cover undisturbed soil with 4- to 6-inches of surface cover (gravel or mulch).

If a homeowner, would like an area with permanent landscaping cleaned up, the homeowner must remove the plants to allow Ecology to access the soil. Ecology will not remove permanent landscape trees, plants, or stumps.

After the initial home visit, the homeowner will receive a draft cleanup plan for review. The homeowner should review the plan and do one of the following:

- Sign the cleanup plan and return it to Ecology.
- Contact Ecology to discuss changes, corrections, or questions and then sign.
- Request a home visit from Ecology to discuss the cleanup plan and sign it.
- Contact Ecology to decline cleanup.

Ecology will make an effort to accommodate changes; however, all changes may not be possible. If the homeowner declines cleanup or if Ecology cannot make changes requested by the homeowner, this will be recorded in the database. Ecology will send a letter to the homeowner documenting the decision and providing outreach materials on healthy actions the homeowner can take.

Property areas that will not be cleaned up under the Yard Program:

- Under permanent structures such as buildings with foundations, decks with limited access underneath (less than three feet from the ground), pools/hot tubs, or structures that can not be moved.
- Under concrete, asphalt, pavers or other cap material, such as sidewalks, driveways, patios, or parking structures.
- Areas in, around, or under permanent landscape structures, including retaining walls, rock walls, terraces, etc.
- Above or immediately adjacent to underground tanks or drainfields.
- In, around, or under aquatic features, such as wetlands, ponds, streams, creeks, beaches, or other areas.
- Above, in, or below steep slopes (i.e., greater than approximately 33% slope and 10 feet high). County development standards will also be referenced for steep slope requirements.
- Areas in, around, and/or under livestock barns, sheds, corrals, pastures, or other livestock structures.
- Within the drip line or root ball of large trees, bushes or shrubs that remain in place during cleanup activities. Stumps that cannot be easily removed will be left in place.
- Adjacent to and/or under unstable, weak, or compromised foundations.
- In, around, or under temporary structures (i.e., woodpiles, animal kennels, lawn equipment, etc.) that the homeowner/resident is not willing to move or allow Ecology and/or its contractor to easily relocate.
- Areas that are specifically excluded by the homeowner.

After Ecology has developed a draft plan, the homeowner will receive a copy for review and comment.

If the homeowner asks, Ecology will schedule a second home visit to obtain a signed cleanup plan. Some homeowners may wish to talk to Ecology staff in person about changes to the draft cleanup plan. The purpose of this visit is to work with the homeowner to finalize the plan and get their signature. **This second home visit is optional.**

Ecology will provide many chances for homeowners to ask questions and return their signed cleanup plan. Homeowners may scan and return the plan by email, regular mail, or in person by asking for a home visit. Homeowners may also bring signed cleanup plans to an Ecology open house, which may be held in the area during cleanup.

The homeowner will lose the opportunity for cleanup if they do not sign it after two attempts by Ecology to address homeowner concerns. Ecology will send a letter to the homeowner documenting the decision and providing outreach materials on healthy actions the homeowner can take.

Ecology will add the property to the cleanup schedule when the homeowner approves and signs the cleanup plan.

6.1.3 Ecology will review cultural resources.

Ecology will coordinate with the Washington Department of Archeology and Historic Preservation (DAHP) and Native American Tribes to respect cultural resources. Once Ecology has a signed cleanup agreement, Ecology will review documented cultural resources according to the Yard Program's Cultural Resources Protocol (**Appendix F**). Ecology will use the following information for the review:

- Homeowner interview questions about any known cultural resources
- DAHP's model that predicts the probability of an area having prehistoric resources
- Washington Information System for Architectural and Archaeological Records Data (WISAARD) record search
- Historic map research (Sanborn and General Land Office Maps).

Ecology will provide the compiled information to DAHP and tribal staff. DAHP and the tribal staff can alert Ecology and the archaeologist if known or suspected archaeological sites are present in the cleanup area and if an archaeologist is required during excavation.

Ecology will coordinate with DAHP and Native American Tribes to respect cultural resources.

6.1.4 Permit requirements will be met.

Ecology will work with state and local agencies to address permitting requirements.

Ecology is working with state and local jurisdictions to address permit requirements. **Appendix G** provides more information about these requirements. Where possible, Ecology will use a programmatic approach to address permit requirements. In some cases, Ecology may be able to obtain programmatic permits that cover the whole project. Ecology or the cleanup contractor will follow these requirements. If Ecology cannot obtain programmatic permits, we expect to address permit requirements for groups of yards as they are scheduled for cleanup.

The cleanup contractor will be hired by Ecology through the public works procurement process.

6.1.5 Ecology will put cleanup plans out for bid.

After the cleanup plan is signed and the cultural resources and permitting reviews are completed, Ecology will hire cleanup contractors through the public works procurement process. This process involves publishing a bidding document in local newspapers and websites so that interested contractors can offer a bid to do the work. Ecology will assemble cleanup plans for a number of properties within access groups and prepare specifications defining the work the contractor will perform. Contractors will provide sealed bids to Ecology and Ecology will award a contract to the lowest qualified bidder.

Construction contractors will plan for and document the following:

- ***Equipment staging and storage plan:*** how equipment will be staged and stored, including non-working hours and security measures. Ecology may identify certain areas as available to contractors for staging and storage.
- ***Erosion and sediment control plan:*** the controls the contractor will use to minimize stormwater runoff from each property.
- ***Transportation plan:*** transportation routes, including any controls, flaggers, etc., that will be used to minimize traffic disruption and protect drivers in the area.
- ***Import soil specifications:*** source and nature of import fill material, including periodic testing requirements to assure that import fill material is clean.
- ***Disposal site selection:*** All contaminated soil excavated from properties will be required to be disposed in a permitted nonhazardous waste landfill. Ecology may make prior arrangements for disposal facilities to accept contaminated soil from the Yard Program.

Before beginning yard cleanups, the contractor will document their work plans (see **sidebar**). To minimize impacts to the community, Ecology will require contractors to take the following actions:

- Cover haul trucks containing excavated soils with tarps to minimize potential spillage during soil transport
- Stop work during heavy precipitation to limit the potential for vehicles to transport mud offsite
- Schedule normal work hours between 8:00 a.m. and 5:00 p.m. weekdays and, if authorized by Ecology, from 9:00 am to 7:00 p.m. weekends to reduce noise impacts
- Equip large construction equipment with mufflers to limit noise.

Normal work hours will be between 8:00 a.m. and 5:00 p.m. weekdays.

6.2 Cleanup Construction

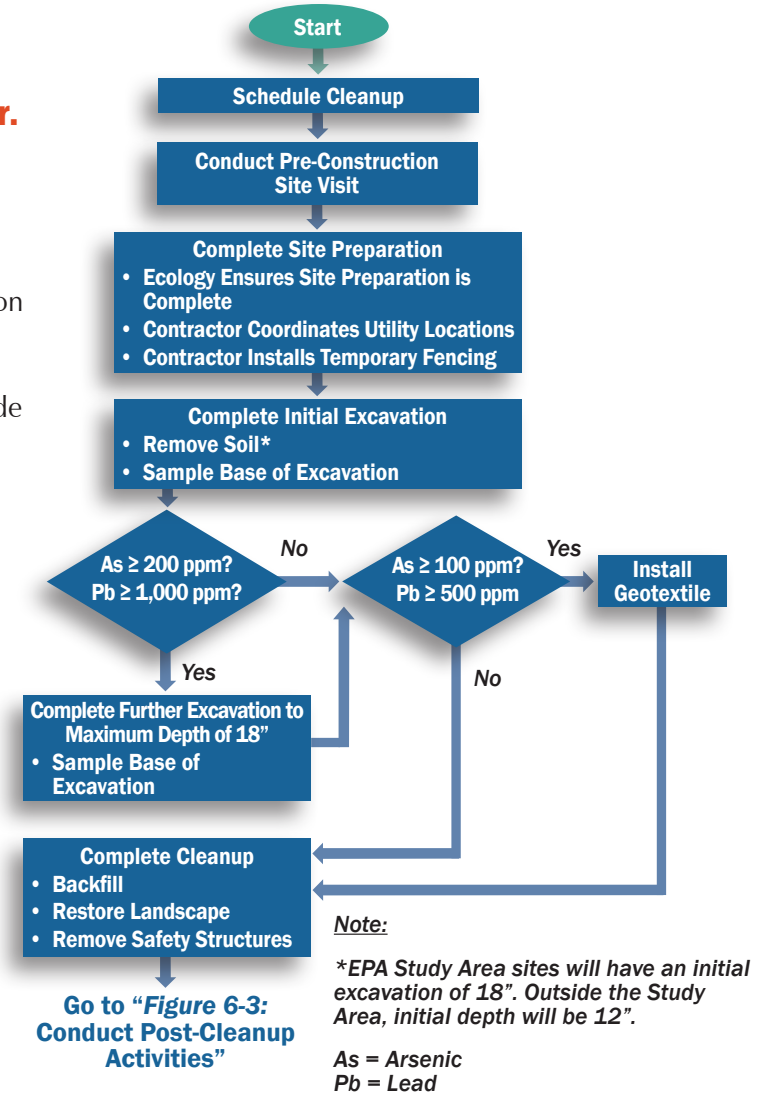
This section describes the steps to be taken during the soil cleanup process. **Figure 6.2** shows the major steps of this process.

6.2.1 Coordination with homeowner.

After hiring a contractor, Ecology will contact the homeowner to schedule a pre-construction visit. This visit will include Ecology staff and the construction contractor. They will review the cleanup plan with the homeowner and decide on a cleanup schedule. Before cleanup can begin, the homeowner must prepare the property as agreed to during the home visit. This may include moving vehicles, small structures like sheds, or animals. Homeowners will also need to remove any large stumps or diseased vegetation if the homeowner wants that portion of the property cleaned up.

After the homeowner has prepared the property, the contractor will schedule the location and marking of property utilities, such as electric, gas, water, and sprinkler systems. After utilities are marked, the cleanup contractor will install temporary safety structures on the property. These structures will include signs and fences to mark and limit access to work areas. They may also include markers that show which landscaping needs removal or protection. The surrounding areas will have temporary erosion and sediment controls put in place by the contractor. The contractor will record special concerns of the homeowner.

Figure 6-2: Conduct Cleanup Activities



6.2.2 Cleanup activities.

Cleanup can begin when temporary safety structures, such as fencing, and erosion and sediment controls are in place. As defined in the cleanup plan, the contractor will excavate and remove ground cover and the top 12- to 18-inches of underlying soil. After soil removal, Ecology will take a composite soil sample from the top 6-inches of newly exposed soil in each unit. The samples will be analyzed for arsenic and lead.

A composite soil sample will be collected at the base of the excavation to document arsenic and lead levels.

Example of Yard Cleanup and Restoration

If arsenic levels are greater than 200 ppm or lead levels are greater than 1,000 ppm after digging to 12 inches, another 6-inch layer of soil will be removed, up to 18-inches total. If arsenic levels remain greater than 100 ppm or lead levels remain greater than 500 ppm, the contractor will place a geotextile fabric at the base of the excavation. The geotextile will be installed as a visual barrier to the contaminated soil below. Inside the EPA Study Area where contamination tends to go deeper, the contractor will initially remove 18 inches of soil and no additional soil will be excavated.

After excavation and placement of any needed geotextile fabric, the contractor will backfill excavated areas with clean imported soil or other cover (e.g., gravel fill or mulch) to the original ground surface level. Contractors will then restore the yard as described in the cleanup plan the homeowner signed. The contractor will remove any temporary safety structures and erosion and sediment controls after backfilling and restoration.

6.2.3 Responsibilities of parties involved in the cleanup.

Table 6-1 on the next page shows the responsibilities of Ecology, its contractors, and the homeowner during cleanup. Defining these roles will help the cleanup run smoothly and efficiently.

6.2.4 Protection Monitoring during cleanup.

Soil removal and restoration could cause short-term pollutant impacts to the surrounding area. Pollutants could be released during construction through airborne dust or from soil erosion by surface water. Contractors must minimize these impacts, and Ecology will oversee the contractors' measures.

Contractors will minimize dust by lightly watering soil or using mist sprays. Ecology will use a "no visible dust outside the work area" standard. The contractor will control water application to ensure that mud, erosion, or runoff does not occur. Also, the contractor will decontaminate construction vehicles and sweep tracked soil off sidewalks and roads.

Ecology may conduct air monitoring to evaluate potential exposure to residents, but it does not appear necessary. Visible airborne dust will be used as the action level for protection monitoring. Dust is generally considered visible at levels of roughly 2 to 10 milligrams per cubic meter of air (mg/m^3) (Pilat and Ensor 1969). Based on EPA's data from the most contaminated properties in Ruston, a dust level up to 10 mg/m^3 should not exceed Washington's residential exposure action levels for arsenic and lead.

Table 6-1: Ecology, Contractor, and Homeowner Responsibilities

	Ecology	Contractor	Homeowner
Before	■ Identify properties for cleanup. ■ Educate homeowners. ■ Develop cleanup plans. ■ Obtain signed cleanup plan agreement. ■ Retain a cleanup contractor.	■ Meet with homeowners to coordinate activities.	■ Decide whether or not to participate in the cleanup program. ■ Provide input on and approve the cleanup plan. ■ Sign the cleanup agreement. ■ Provide utility information, including irrigation and underground wiring. ■ Remove and reinstall physical obstructions within a cleanup area, such as boats, trailers, vehicles, play sets, wood piles, animal housing (e.g., doghouses or chicken coops), etc. ■ Remove stumps, diseased trees, or vegetation if the homeowner wants that area of unit addressed.
During	■ Conduct a pre-cleanup walk-through. ■ Oversee and document cleanup activities. ■ Abide by health and safety guidelines. ■ Conduct post-cleanup sampling and analysis. ■ Provide maintenance guidelines for replacement ground cover. ■ Provide warranty information for replacement ground cover.	■ Conduct a pre-cleanup walk-through, including photographic record. ■ Install and maintain temporary safety structures. ■ Provide visual barriers (e.g., caution tape and traffic cones) around work sites. ■ Conduct soil removal and property restoration activities. ■ Maintain reasonable access for the homeowner to the home and provide notice if access must be restricted. ■ Control noise, dust, air emissions, and surface water runoff to the extent practicable. ■ Abide by the Health and Safety Plan. ■ Maintain or replace fences and landscaping features. ■ Contact Ecology if an issue arises.	■ Abide by health and safety guidelines. ■ Secure pets. ■ Maintain reasonable property access for contractors. ■ Contact Ecology if an issue or concern arises.
After	■ Review status of property restoration. ■ Conduct a post-cleanup property walk-through, including photographic record. ■ Prepare Project Closeout Report for homeowner. ■ Maintain project documentation.	■ Conduct a post-cleanup property walk-through, including photographic record.	■ Conduct a post-cleanup property walk-through to identify concerns. ■ Maintain new landscaping (watering, replenishing mulch, etc.). ■ Contact Ecology if an issue or concern arises.

Pollutants could be moved off-property in stormwater runoff. Cleanup will be subject to a Construction Stormwater General Permit issued by Ecology's Water Quality Program. The permit requires preparation of a Stormwater Pollution Prevention Plan and monitoring of runoff from the property. The contractor will implement the controls and monitoring required under the permit.

Fencing is one of the safety features used during cleanup

The contractor will apply drainage and erosion control measures to minimize the discharge of soils or sediments to streets or storm sewers during excavation and backfilling. Best management practices that will be implemented and maintained will include silt fences, curbs, gutters, swales, and storm drain protection.

Ecology and the contractor will be responsible for performing visual inspections for potential runoff and of the adjacent storm system during rain events. The contractor will take preventive actions, such as covering bare soil with plastic, during severe weather. They will also sweep any soil that leaves the property. The best time of year for construction work is during drier months, however, construction may be year-round.

6.2.5 Health and safety considerations.

This section discusses potential health and safety concerns during cleanup and how Ecology will address those risks.

Soil cleanup may present short-term health and safety concerns for homeowners and residents as shown in **Table 6-2**. Ecology will require cleanup contractors to minimize these impacts.

Health and Safety Plan Elements

- ☐ General Yard Program overview
- ☐ A risk or hazard analysis for each site task
- ☐ Employee training
- ☐ Personal protective equipment requirements
- ☐ Monitoring procedures
- ☐ Site control measures
- ☐ Decontamination procedures
- ☐ Emergency response plan.

Table 6-2: Short-term Health and Safety Concerns

Concerns	Activities to Mitigate Concerns
■ Exposure to contaminated dust.	■ Implement dust control to meet a "no visible dust outside work area" standard.
■ Transport of contaminated runoff in stormwater.	■ Minimize runoff by implementing stormwater "Best Management Practices."
■ Physical hazards from construction equipment.	■ Minimize use of heavy equipment on property.
■ Physical hazards within excavations.	■ Use fences, construction tape, and/or other barriers to warn residents and prevent access.
■ Traffic hazards from construction equipment and haul vehicles.	■ Implement traffic controls.

Ecology, its consultants, and its construction contractors also can be affected by soil sampling and cleanup. Each organization will train its personnel. All work will follow health and safety procedures required under Occupational Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act (WISHA) requirements for workers on hazardous waste sites. Each organization participating in sampling and cleanup activities will be required to prepare and follow a site-specific Health and Safety Plan.

6.3 Post-Cleanup Activities

Figure 6-3 is a flowchart of post-cleanup activities. More details about these activities are provided in this section. Post-cleanup activities include a property walk-through, transferring warranty information, homeowner acceptance, and producing a Project Summary Report for the homeowner.

6.3.1 Cleanup completion property walk-through.

When cleanup is complete, Ecology and the contractor will do a thorough walk-through with the homeowner. The purpose of the walk-through is to evaluate and record post-cleanup conditions at the property. Ecology will note concerns and requests by the homeowner that are documented in the cleanup plan. Ecology will require the contractor to correct any items specified by the cleanup plan that have not be implemented. Ecology will provide the homeowner with maintenance guidelines, warranty information, and will review the responsibilities with the homeowner. The homeowner will need to acknowledge that they received these instructions.

When cleanup is complete, Ecology and the contractor will do a thorough walk-through with the homeowner.

6.3.2 Warranty information.

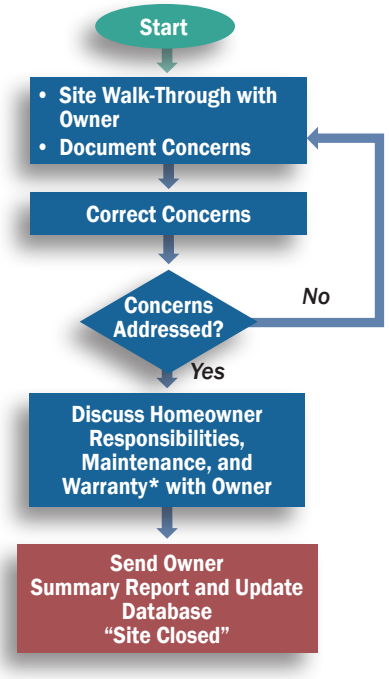
The homeowner will need to contact Ecology if they have warranty issues. Ecology will try to address any unresolved issues between the contractor and the homeowner.

In general, the homeowner will have one year to raise concerns about property damage or problems associated with cleanup work. Any issues with the settling of new soil, drainage, and establishment of vegetation usually appear within one year. Ecology will try to review each property between six months and at the end of one year after cleanup is complete. This review will verify and document if grass and other vegetation has survived.

The homeowner is responsible for watering and fertilizing grass and plants after the cleanup is completed. Assuming the homeowner performs proper maintenance, the contractor or Ecology will replace vegetation placed during cleanup if it does not survive during the warranty period.

Ecology may send surveys six to eight months after the completion of cleanup work. This may include a reminder that the warranty period is ending and the homeowner has limited time to notify Ecology of an issue.

Figure 6-3: Conduct Post-Cleanup Activities



Note:

****The homeowner will have one year to raise concerns regarding property damage or problems from cleanup activities.***

6.3.3 Project summary report.

Homeowners will receive a summary report (see **sidebar**) of the cleanup work completed on their property.

An example Project Summary Report is provided in **Appendix E**. Ecology will provide the summary report in hard copy to the homeowner. Sampling, analysis, and cleanup information will also be accessible through the public portal portion of the Area-wide Remediation Environmental Information System (AREIS) database.

Summary Report Items

This summary report will include the following main items:

- ☐ General Yard Program overview
- ☐ Property description
- ☐ Results of sampling and analysis before and after cleanup
- ☐ Summary of cleanup activities
- ☐ Warranty information.

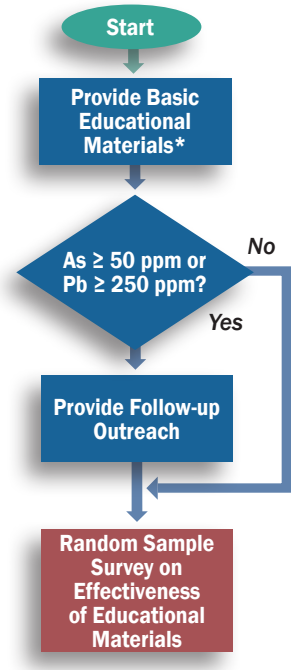
7. Outreach for Properties Below Threshold Levels

7.1 Properties with Soil Contamination Below the Threshold Levels will Qualify for Outreach

The Yard Program cleanup action levels are 100 ppm arsenic and 500 ppm lead. Ecology has set a threshold level of 90 ppm arsenic and 500 ppm lead in soil for offering cleanups under the Yard Program.

Ecology believes that most properties sampled will not qualify for cleanup. Instead, homeowners and residents will receive outreach about reducing contact with soils. The amount of outreach will depend on how high arsenic and lead levels are and whether children play in the yard (**Figure 7-1**).

Figure 7-1: **Outreach for Properties Below Threshold Levels**



Note:

****Families with children age six and younger will receive additional materials geared toward children.***

As = Arsenic
Pb = Lead

7.2 Basic Outreach and Sampling Results

Ecology will send each homeowner and resident a letter with their soil sampling results (**Appendix E**). The letter will explain that the property does not qualify for cleanup, but that contaminated soils still pose some risk. It will recommend reducing contact with soil by using healthy actions.

Ecology will enclose the following outreach materials to encourage healthy actions:

- Dirt Alert brochure
- Nail brush
- County-specific outreach materials.

Tacoma-Pierce County Health Department (TPCHD) will provide materials for Pierce County, including Ruston and Tacoma. Public Health - Seattle & King County (PHSKC) will do the same for Vashon-Maury Island. Examples of materials that may be sent include activity sheets for children, magnets, and door hangers reminding people to take shoes off at the door.

Healthy actions can greatly reduce exposure to soil contamination.

7.3 Follow-up Outreach for Near-Action-Level Properties

Some properties may have arsenic in soil just below the threshold level for cleanup (such as 80-89 ppm). Where arsenic is 50 ppm or higher, or lead is 250 ppm or higher, Ecology will attempt to provide additional outreach and strongly encourage residents to reduce contact with soil.

Healthy Actions to Reduce Exposure to Contaminated Soils

Healthy Actions Outside Your Home

- Cover bare patches of soil with sod, mulch, or other landscaping materials.
- Mix compost or clean soil into garden beds to dilute contamination.
- Wear gloves when working in the garden.
- Wash fruits and vegetables grown in the yard to remove dust and dirt.
- Peel root vegetables and toss the peelings in the garbage, not your compost.
- Grow vegetables in raised beds, especially leafy greens and root vegetables.

Healthy Actions in Your Home

- Wash hands after playing or working outside and before eating.
- Take off shoes before coming inside or use a doormat to wipe off dirt.
- Vacuum and damp dust regularly.
- Wash toys with soap and water.
- Wipe off pets' paws and brush off their fur before letting them inside.

Soil sampling results can help people focus on the more contaminated parts of their property first. Ecology recommends:

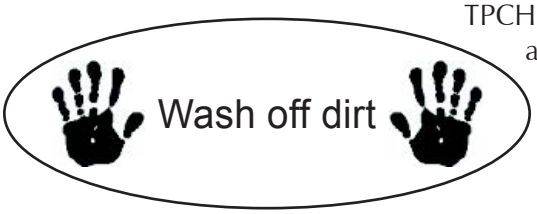
- Promptly taking healthy actions in the home
- Avoiding contact with bare soils in the more contaminated areas of the yard
- Planning future landscaping projects around healthy actions for the yard.

At this time, Ecology cannot offer funding to help with landscaping projects. Local health departments can offer advice to homeowners and help them determine the cost. Homeowners planning to remove soils from their yard should contact Ecology about proper disposal.

7.4 Outreach for Homes with Young Children

Children are more sensitive to arsenic and lead than adults. They are also more likely to be exposed because they play on the ground, breathe in dust as they are closer to the ground, and put dirty hands in their mouths. For homes with children age six or younger, Ecology will attempt to provide special outreach to the parents and children.

TPCHD and PHSKC have outreach programs for families. Music videos and activity sheets about soil safety are geared towards children. Brochures and health information advise parents on how to reduce soil contact in the home. The health departments can also help families find resources about other health issues.



Courtesy of Public Health - Seattle & King County

7.5 Use of Surveys to Gauge Outreach Effectiveness and Make Improvements

Each year, Ecology will send surveys to a random sample of both homeowners and residents with soil levels under the Yard Program threshold levels. The surveys will cover:

- Whether people understood their soil sampling results.
- Whether they took action based on those results.
- Which healthy actions they took to reduce soil exposure.
- If they did not take other actions because of difficulty, time, or cost.
- What resources could help people reduce contact with soil.

8. Data Management

Existing Data 8.1 | Yard Program Data 8.2 | Program Electronic Data Deliverables 8.3 | Data Access & Communication 8.4

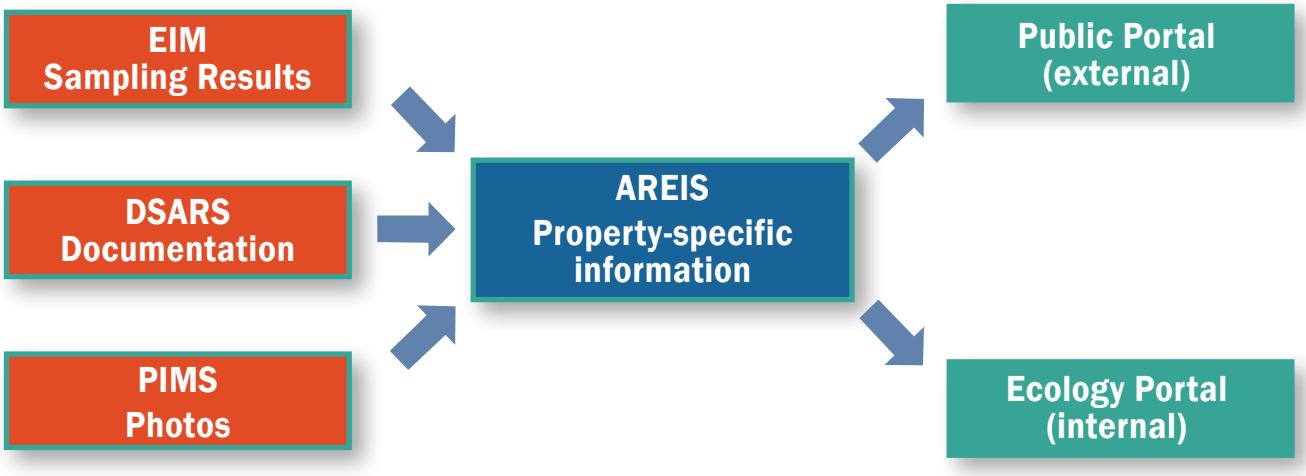
The Yard Program will produce a large amount of data over the lifetime of the program. It will be important to maintain quality control and standardization of this data. Four types of data collected during the Yard Program will be managed by Ecology with contributions from the local health department and Ecology contractors. The data are expected to be managed in four Ecology-managed databases:

1. Property, resident, and owner-specific information will be stored in the Area-wide Remediation Environmental Information System (AREIS).
2. Environmental data or sample results will be stored in the Environmental Information Management System (EIM).
3. Sampling agreements, maps, and cleanup documents will be stored in the Document Storage and Retrieval System (DSARS).
4. Property photos will be stored in the Photo and Image Management System (PIMS).

The following describes each of the Ecology-managed databases.

AREIS: AREIS is Ecology's database that will house the property, resident, and owner information and will be the keystone to link the four databases together for each property. The information gathered during the Yard Program will supplement data collected during previous sampling programs such as the EPA sampling and cleanup program and the Soil Safety Program.

AREIS has both internal and external web applications. The internal web application will be used by Ecology staff, local health departments, and Ecology contractors for storing property information and communications with homeowners and residents. The external web application (called the public portal) is where interested parties can input an address or parcel number and find sampling results and/or cleanup information for properties where Ecology has conducted sampling and/or cleanup. Ecology's AREIS Database Manual is provided in **Appendix H**.



EIM: EIM is Ecology's database for managing sampling results from environmental investigations. Analytical results from the laboratory will be uploaded into EIM. The EIM submittal will include at a minimum:

- Sample identification information
- Sample collection details
- Analytical methods
- Analytical results.

The data that is stored in EIM for each property will be imported into AREIS from EIM.

DSARS: DSARS is Ecology's database for storing documents related to cleanup sites. During the operation of the Yard Program, documents such as access agreements, field sampling maps, and property cleanup plans will be uploaded to DSARS. These documents will use a specific naming convention to facilitate document retrieval from DSARS such that they can be easily opened in either the AREIS internal or public portal.

PIMS: PIMS is Ecology's database for managing photographs and images. This database houses non-transitory photos and images for Ecology. During the operation of the Yard Program, photos will be taken of the property before, during, and after cleanup. These photos will use a specific naming convention to facilitate linking and retrieval to AREIS.

8.1. Existing Data

As described in Chapter 3, the EPA sampling and cleanup program focused on properties closest to the former Asarco smelter. In addition, EPA's sample collection targeted depth intervals of 0- to 1-, 1- to 6-, 6- to 12-, 12- to 18-, and 18- to 24-inches below ground surface, with a cleanup action level for arsenic of 230 ppm.

EPA data from the EPA Study Area has been incorporated into the Yard Program for comparison and management purposes. EPA data are available to the public via the AREIS public portal.

EPA data from the EPA Study Area has been incorporated into the Yard Program for comparison and management purposes. In order to compare EPA data with the data that will be generated during the Yard Program, the data need to be similar. For example, sample data from EPA Study Area database covering the 0- to 1-inch and 1- to 6-inch sample depth intervals must be compared with sample data that will be generated from the Yard Program covering the 0- to 6-inch sample depth interval. In order to correlate the 0- to 6-inch sample data, Ecology computed the weighted averages of the EPA 0- to 1-inch and 1- to 6-inch data by each unit and combined the averages to represent the combined 0- to 6-inch depth interval (**Chapter 3.3.6**).

The existing EPA data and property information has been entered into EIM, AREIS, and DSARS. EPA data are available to the public via the AREIS public portal.

8.2 Yard Program Data

Yard Program data will consist of:

- Property-specific information from the access agreement or phone interview, photographs, and site-specific cleanup plans
- Soil sampling to characterize units
- Post-cleanup soil sampling documentation.

Examples of property-specific information, as well as soil sampling methods, sampling depths, and analytical methods, are described in the SAP (**Appendix C**). Examples of the type of field data collection forms that may be used are included as attachments to the SAP. For each property, the interview forms, sampling plan, cleanup plan, and final property report will be uploaded into the DSARS, the site photographs into the PIMS, and the analytical results into the EIM database. These sets of data are linked together by the site code for each property in AREIS.

The QA/QC protocols for managing Yard Program data are outlined in the QAPP (**Appendix D**).

8.2.1 Property evaluation data.

Field teams will document property conditions, including the unit and the unit type, sample depth, date and time of collection, and requested sample test method. If property interviews have not yet been completed, field personnel will also interview homeowners and residents for information regarding property conditions and land use areas and activities.

Field teams will document property conditions. Property maps will be created to document permanent structures and landscaped areas.

Property maps will be created to document permanent structures, landscaped areas, and high-use soil areas such as play areas and gardens. Field personnel may also photograph property conditions, sampling practices, property structures, high-use areas, and other relevant details that could affect data collection.

Information obtained from the interview and property use evaluation will be recorded by hand onto forms or directly entered into the AREIS database using a field laptop/tablet. If forms are used, they may be scanned and uploaded into the DSARS database for access from AREIS. Hard copies of the document will be maintained in Ecology files.

Information obtained from the interview and property use evaluation will be recorded by hand onto forms or directly entered into the AREIS database using a field laptop/tablet.

Units at each property will be assigned unique identifiers that will be used to track each unit. The unique identifier may be assigned prior to field mobilization (if possible) or in the field, and will be recorded on the field forms. Naming conventions are discussed in the SAP, and flexibility will be necessary to allow field crews to adjust to site-specific conditions as needed. The unique identifier will allow linking of uploaded data forms within DSARS to a particular property. An example property use evaluation and interview form is provided in the SAP.

8.2.2 Sampling data and chain of custody.

Soil sampling data for laboratory analysis will consist of sample location, depth, sample name, date and time collected, and sampling personnel. In addition, XRF field measurements may be obtained during cleanup to inform and document cleanup decisions. XRF sample information and results will be recorded on the field forms.

The electronic data deliverable (EDD) submittals will report location and sample-specific data, including the property identifier, sample identifier, sample date and time, sample depth, sample type (i.e., discrete or composite sample), sample matrix (i.e., soil), sample analysis, and data qualifiers, if any. The submittals will also identify duplicate and matrix spike samples to ensure that data quality requirements are satisfied. Procedures for managing chain-of-custody forms, XRF sample information and results, EDDs, and laboratory reports are provided in the QAPP.

8.2.3 Cleanup field documentation.

For those properties with soil sampling results above threshold levels for arsenic or lead, cleanup activities will follow the procedures described in **Chapter 6**. During the cleanup process, field data will be collected to document cleanup activities. Field data will include:

During the cleanup process, field data will be collected to document cleanup activities.

- Signed cleanup plan agreement
- Start and end dates of cleanup
- Photos of property before, during, and after cleanup work
- Location, areas, and depth of soil removal will be provided on a property map along with areas of the property not addressed by the program.

Field data will be collected on data sheet templates, entered into electronic files, and uploaded regularly to the AREIS database or directly entered into the AREIS database using a field laptop/tablet. Data reports will be reviewed for accuracy before final entry into the database. Data will be summarized and provided to homeowners as part of the final property report documenting activities at each property. Examples of a cleanup plan and a property report are provided in the SAP.

Data will be summarized and provided to homeowners as part of the final property report documenting activities at each property.

8.2.4 Post-excavation sample data.

Field and analytical data from the post-excavation sampling program will be documented and submitted using the same procedure as the pre-excavation sampling effort described previously. In addition, post-excavation data will document the results of field-screening samples if an XRF analyzer is used. Any XRF field-screening will follow procedures in the SAP and QAPP. Some split soil samples will also be sent to an analytical laboratory for testing and will be managed as described in **Chapter 8.2.2**. Data collected during the post-excavation sampling will be included within the EIM and AREIS databases.

8.2.5 Data input standardization.

Data generated during the Yard Program will be prepared as an EDD submittal to be uploaded into the EIM and AREIS databases. These databases standardize the study information and facilitate research and review of field and analytical results.

8.3 Program Electronic Data Deliverables

Analytical results will be reported in EDDs by the analytical laboratory, in addition to Adobe® PDF format. Ecology's EIM format will be used for laboratory EDDs. The QAPP provides the procedures for managing EDDs.

8.4 Data Access and Communication

Final property reports will be provided to homeowners and residents. The reports will be stored and accessible through the AREIS database. Access to the Ecology AREIS database is available for both the public through a public portal, and to agency personnel through an internal portal. Expanded access to AREIS, EIM, DSARS, and PIMS databases will be provided to other personnel on an as needed basis.

Final property reports will be provided to homeowners and residents, and will also be stored and accessible through the AREIS database.

Public access to AREIS is available at https://fortress.wa.gov/ecy/areispublic/. Access to the EIM databases is also available to the public at the following online address: http://www.ecy.wa.gov/eim/. Results of the Yard Program can be viewed by searching under the project Study Names: **TSPPCRES** (Tacoma Smelter Plume Pierce County Residential Yard Program) and **TSPKCRES** (Tacoma Smelter Plume King County Residential Yard Program).

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Appendix A

Appendix A

Glossary, Acronyms, and Abbreviations

Program Design and Implementation Plan

Appendix A: Glossary, Acronyms, and Abbreviations

Tacoma Smelter Plume
Residential Yard Sampling and Cleanup Program

June 2013

Toxics Cleanup Program
Washington State Department of Ecology
Olympia, Washington

Appendix A. Glossary, Acronyms, and Abbreviations

A.1 Glossary

Access Agreement– Formal agreement between Ecology and homeowner to grant Ecology permission to conduct work on the property.

Access Group – Groups of approximately 100 parcels to be utilized by sampling teams to track number of parcels for access, sampling, and cleanup.

Action Level - The arsenic or lead level at which Ecology or EPA will conduct soil cleanup.

Arsenic - A metal found naturally in soil, and also as a result of pollution (like from the Asarco smelter). Scientists have linked long-term exposure to arsenic to heart disease, diabetes, and cancer of the bladder, lung, skin, kidney, liver, and prostate.

Block Group – Defined geographical areas of the Service Area based on census defined areas, containing approximately 300 to 800 properties per block group.

Charrette – Is a meeting that uses a creative method of organizing thoughts in a structured format that integrates the ideas of a diverse group of people.

Cleanup - A broad term that covers the whole cleanup process. This includes finding and studying contamination, looking at cleanup options, writing a cleanup plan, doing the cleanup, and checking to make sure the cleanup worked.

Cleanup Level - The level of a hazardous substance that Ecology believes will not harm human health or the environment. Any given substance has cleanup levels for soil, water, air, and sediment.

Cleanup Plan – The plan Ecology will develop for cleanup activities including a drawing displaying planned cleanup activities and a list of vegetation, structures, and materials to be protected, left in place, removed, or removed and replaced during cleanup activities.

Contaminant - Any hazardous substance that does not occur naturally or occurs at greater than natural background levels.

Educational Unit – Areas on properties that are not eligible for cleanup although may be sampled upon the request of the homeowner or resident. These educational units will likely be wooded or contain permanent landscaping, such as hedges, perennials, or other dense vegetation.

Footprint Study – Study that examines how far contamination goes and how high the levels are. Tacoma Smelter Plume footprint studies focused on less disturbed forest soils, looking mainly for arsenic and lead.

Home Visit – Ecology will coordinate planning with homeowners and residents for sampling and cleanup through a home visit.

Interim Action - Partial cleanup that addresses only part of the contamination on a site.

Interim Action Plan (IAP) - A document that outlines partial cleanup actions for a site. The plan also considers public comments and community concerns.

Lead – A toxic metal. In children, lead can cause behavioral problems, permanent learning difficulties, and reduced growth. In adults, it can increase blood pressure, affect memory, and contribute to other health problems.

Model Toxics Control Act (MTCA) - Legislation passed by citizens of the State of Washington through an initiative in 1988 and later amended by the legislature. It regulates the identification, investigation, and cleanup of facilities where hazardous substances have been released into the environment. It also provides for public involvement in the decision-making process. The Model Toxics Control Act is Chapter 70.105D of the Revised Code of Washington (RCW).

Model Toxics Control Act Cleanup Regulation - The regulation which provides specific details of how the Model Toxics Control Act is to be implemented. Chapter 173-340 of the Washington Administrative Code (WAC).

Model Toxics Control Act Method A Cleanup Level - The Model Toxics Control Act regulation gives a table of cleanup levels for 25 to 30 of the most common hazardous substances in soil and groundwater. The cleanup levels are protective of human health when cleanups are straightforward or involve only a few substances.

Multifamily Housing – Properties with multiple housing units, such as apartments, condominiums, duplexes, townhouses, etc. that have shared outdoor living space. Multifamily housing also includes common play areas, garden areas (where residents regularly contact the soil), and gathering areas that are part of single-family residential developments. For any individually-owned residence within the multifamily property that has a unique street address/parcel number, and that has a separate yard (for example, fenced and only accessible to the homeowner), the separate yard will be considered an individual property under Ecology's program. For multifamily housing with numerous, yet very small individual yards, Ecology may sample only a few yards to evaluate whether cleanup may be needed.

Parts per Million – A measure of concentration. One part per million is about a half a drop of water in a bathtub. One part per million is equal to one milligram per kilogram.

Program Design – The abbreviation for the Program Design and Implementation Plan. This is the document that explains how and why Ecology will do yard sampling and cleanup work for the Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program.

Qualitative Assessment – Assessment to be conducted by sampling teams to identify areas of high use and those areas to exclude from the sampling program.

Quality Assurance (QA) - A set of activities designed to establish and document the reliability and usability of measurement data.

Quality Assurance Project Plan (QAPP) - A document that describes the objectives of a project and the processes and activities necessary to develop data that will support those objectives.

Quality Control (QC) - The routine application of measurement and statistical procedures to assess the accuracy of measurement data.

Service Area – The area of the Tacoma Smelter Plume where arsenic levels are most likely to exceed 100 ppm. This area encompasses southern Vashon-Maury Island, Ruston, and areas of northwest Tacoma to Highway 16. This is the area that Ecology plans to systematically sample and cleanup.

Smelter - A facility that heats ores to very high temperatures to extract metals.

Soil Safety Program - Ecology's program that offers free soil sampling and cleanup for play areas at schools, licensed child care centers, parks, camps, and multi-family public housing.

Standard Operating Procedure (SOP) – A document that describes in detail a reproducible and repeatable organized activity.

State Environmental Policy Act (SEPA) - A State law that directs State and local agencies to consider environmental values along with technical and economic considerations when making decisions on proposals for actions. This law is Chapter 43.21C of the Revised Code of Washington (RCW).

Unit – Areas of a property sampled or cleaned up separately because they may have different patterns of soil contamination. For example, a recently developed area may have less arsenic and lead than a forested area. Sampling them separately may help narrow down the area that needs cleanup.

Superfund Program - EPA's program for cleaning up contaminated sites. It funds EPA-led cleanup and allows EPA to compel responsible parties to do or pay for cleanup. See http://www.epa.gov/superfund/.

Tacoma Smelter Plume - An area, encompassing more than 1,000 square miles within parts of Pierce, King, Thurston, Snohomish, and Kitsap counties in the state of Washington that contains soil contamination as a result of air emissions from the former Asarco smelter in Ruston, Washington.

Threshold Level – Level of arsenic and lead in soil for Ecology to compare sampling results to in order to decide whether to do cleanup.

Warranty – The agreement through which the homeowner will have one year to raise concerns about property damage or problems associated with cleanup work.

A.2 Acronyms and Abbreviations

Acronym	Definition
A&CR	Archeological and Cultural Resources
AREIS	Area-wide Remediation Environmental Information System
ARARs	applicable or relevant and appropriate requirements
As	arsenic
bgs	below ground surface
BMP	best management practice
CAA	Cleanup Access Agreement
CAO	Critical Areas Ordinance
CESCL	Certified Erosion and Sediment Control Lead
COC	chain of custody
Corps	U.S. Army Corps of Engineers
CRQL	contract required quantitation limits
DAHP	Washington Department of Archaeology and Historic Preservation
DOT	U.S. Department of Transportation
DQO	Decision Quality Objective
DSARS	Document Storage and Retrieval System
Ecology	Washington State Department of Ecology
EDD	electronic data deliverable
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
GIS	geographic information system
GPS	global positioning system
IAR	Inorganic Arsenic Rule, Department of Labor and Industries
IATA	International Air Transport Association
ICP	Inductively coupled plasma

Acronym	Definition
ICP-MS	Inductively coupled plasma mass spectrometry
ISM	incremental sampling methodology
LID	Low Impact Development
LOCAL	Local regulations for Shoreline Management Act, Critical Areas Ordinance, Growth Management Act and grading and stormwater management
LR	lead rule
MDL	method detection limit
MDNS	mitigated determination of non-significance
mg/m^3	milligrams per cubic meter
mm	millimeter
MQO	measurement quality objective
MRL	method reporting limit
MS/MSD	matrix spike and matrix spike duplicate sample
MTCA	Model Toxics Control Act
MUTCD	Manual of Uniform Traffic Control Devices
NPDES	National Pollutant Discharge Elimination System
OHSA	Occupational Safety and Health Administration
Pb	lead
PIMS	Photo and Image Management System
Plan	Program Design and Implementation Plan
ppm	parts per million
QA	quality assurance
QC	quality control
QAPP	Quality Assurance Project Plan
R	recovery
RCW	Revised Code of Washington
ROD	Record of Decision
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SEPA	State Environmental Policy Act
Service Area	area within the Tacoma Smelter Plume most likely to contain average arsenic levels above 100 ppm
SMA	Shoreline Management Act
SOP	standard operating procedure
SSP	Soil Safety Program
SWMRR	Solid Waste Management, Reduction, and Recycling
SWPPP	Stormwater Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
TMDL	Total Maximum Daily Load
TPCHD	Tacoma-Pierce County Health Department
TSP	Tacoma Smelter Plume
TSPPCRES	Tacoma Smelter Plume Pierce County Residential Yard Program
TSPKCRES	Tacoma Smelter Plume King County Residential Yard Program

Acronym	Definition
WAC	Washington Administrative Code
WCAA	Washington Clean Air Act
WISHA	Washington Industrial Safety and Health Act (Washington Division of Occupational Safety and Health regulations)
WISSARD	Washington Information System for Architectural and Archeological Records Data
WPC	Water Pollution Control
WSU	Washington State University
UF	urban trees/forestry
XRF	X-ray fluorescence

Appendix B

Appendix B

Service Area Map Development

Appendix B. Service Area Map Development

This appendix contains three documents:

1. Appendix B Main Body – This provides the details of how Ecology used outputs of the geostatistical mapping methodology to develop the service area map and the sequencing of the yard program.
2. Attachment 1 – Data Acquisition and Processing by Ian Mooser, GIS Manager Toxics Cleanup Program Washington State Department of Ecology February 2013. This attachment is the description of the data collection and data processing that was provided to Dr Pierre Goovaerts
3. Attachment 2 –TSP Mapping Project – Development of a geostatistical mapping methodology by Dr. Pierre Goovaerts PGeostat, LLC November 2012. This attachment provides the details of the geostatistical mapping methodology.

Appendix B. Service Area Map Development

This appendix describes Ecology's process for defining the service area under the Yard Program. It covers the development of the 2011 draft service area and the updated 2013 service area.

1.0 Draft Service Area Map (2011)

In 2011, Ecology provided a draft service area map to the public, and planned to do a more thorough study in 2012 to refine the map. We published this map as part of the Interim Action Plan—the overall cleanup plan for the Tacoma Smelter Plume. It showed a rough estimate of areas expected to have arsenic over the action level of 100 parts per million (ppm). We mapped arsenic because it exceeds state cleanup and action levels more often than lead does.

The draft service area map reflects conservative estimates of arsenic levels using the best available information at the time. Ecology used arsenic sampling data and their distance and direction from the former smelter along with contamination trends. Contamination tends to follow wind patterns and decrease with distance. At the time of the Interim Action Plan Ecology needed an estimate of the areas that could have yards with arsenic over 100 ppm. Therefore, we used a simple method of dividing existing data into "bins" to estimate arsenic levels for areas of the plume.

1.1 Soil Sampling Datasets

We gathered data from the agency's Environmental Information Management System (EIM) and from hard copy reports. All the data sources met the following criteria:

- Were from within the Tacoma Smelter Plume.
- Had soil arsenic data.
- Had results from the 0-6 inch depth.

We used datasets from the following sources:

- **Ecology studies of the Tacoma Smelter Plume.** Ecology used a series of footprint studies to determine the extent of contamination. We also sampled play areas to understand risks to children. For the footprint studies, we took three discrete samples. For the play areas, we took eight discrete samples.
- **Soil Safety Program sampling.** Through this program, Ecology has taken thousands of samples at school, childcare, and park play areas. We take about eight discrete samples per play area.
- **Home soil testing.** The Tacoma-Pierce County Health Department had sampled around 2,000 yards as part of an outreach program. Public Health—Seattle & King County had sampled a few yards on Vashon-Maury Island and on mainland King County. Samples are four-point composites and come mainly from high-use areas like garden beds, lawns, and play areas.
- **Other studies.** We looked at data from other cleanup projects within the Tacoma Smelter Plume.

- University Place Water Tank
- Junett Street Condos
- 19th and Proctor
- Former Holiday Resort Underground Fuel Storage Tank Removal Investigation
- Rongve Group Property, Kirkland, Contaminated Soil Cleanup

See Mooser, 2013 in **Attachment 1** for a more detailed list of the studies compiled.

1.2 Preparing the Data for Analysis

We first separated all of the 0-6" depth data from the rest of the data. Some studies sampled the top 0-2" and 2-6" depths. In these cases, we calculated a weighted average of the two depths.

We then divided the data into disturbed and undisturbed samples. Disturbed samples are from developed properties like homes or businesses. Undisturbed samples are from forests or forest fringes. Forest samples tend to have higher arsenic levels than disturbed areas, and are good for showing the "worst case." However, for predicting areas where arsenic is over 100 ppm in *yards*, it is important to also look at disturbed areas.

1.3 Contamination Patterns and the "Bin" Concept

Arsenic levels in the plume are strongly linked to distance and direction away from the former smelter. Levels are highest closer to the smelter. They are also higher along the primary wind directions, north-northeast and south-southwest. Therefore, certain areas of the plume are more likely to have arsenic levels over 100 ppm.

We divided our map into "bins" for holding all the sampling data. This would be our unit of analysis. We created the bins by first drawing concentric circles a mile apart, centered on the former smelter (see **Figure 1**). Sixteen radii then cut the map into bins. These radii are the basic compass directions of a wind rose.

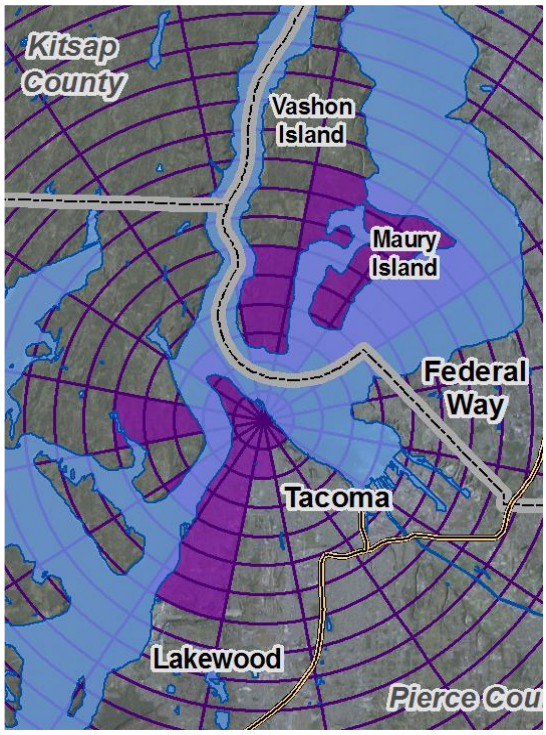


Figure 1. Draft Service Area "Bin" Map (2011)

1.4 Map Analysis

We overlaid our data with the bin outlines on a map. We then highlighted all bins meeting any of the following criteria:

- At least 5% of total disturbed samples were over 100 ppm.
- At least 30% of undisturbed samples were over 100 ppm.
- If the bin had no samples or did not meet the above criteria but was expected to based on distance and direction due to further bins meeting the criteria.

Figure 1 shows the highlighted bins in purple. We removed the Gig Harbor bins from the final 2011 "high zone" map. High forest results from a few unofficial reports led to their initial inclusion, but the data in EIM and from Pierce county showed these areas were not likely to be above 100 ppm, as all concentrations were below 90 ppm. The 2013 map analysis further supports the choice to remove the Gig Harbor bins (see section 2.6).

Figure 2 shows the "high zone" map used in the Interim Action Plan. It covers over 17,000 parcels in Tacoma, Ruston, University Place, and on Vashon-Maury Island.

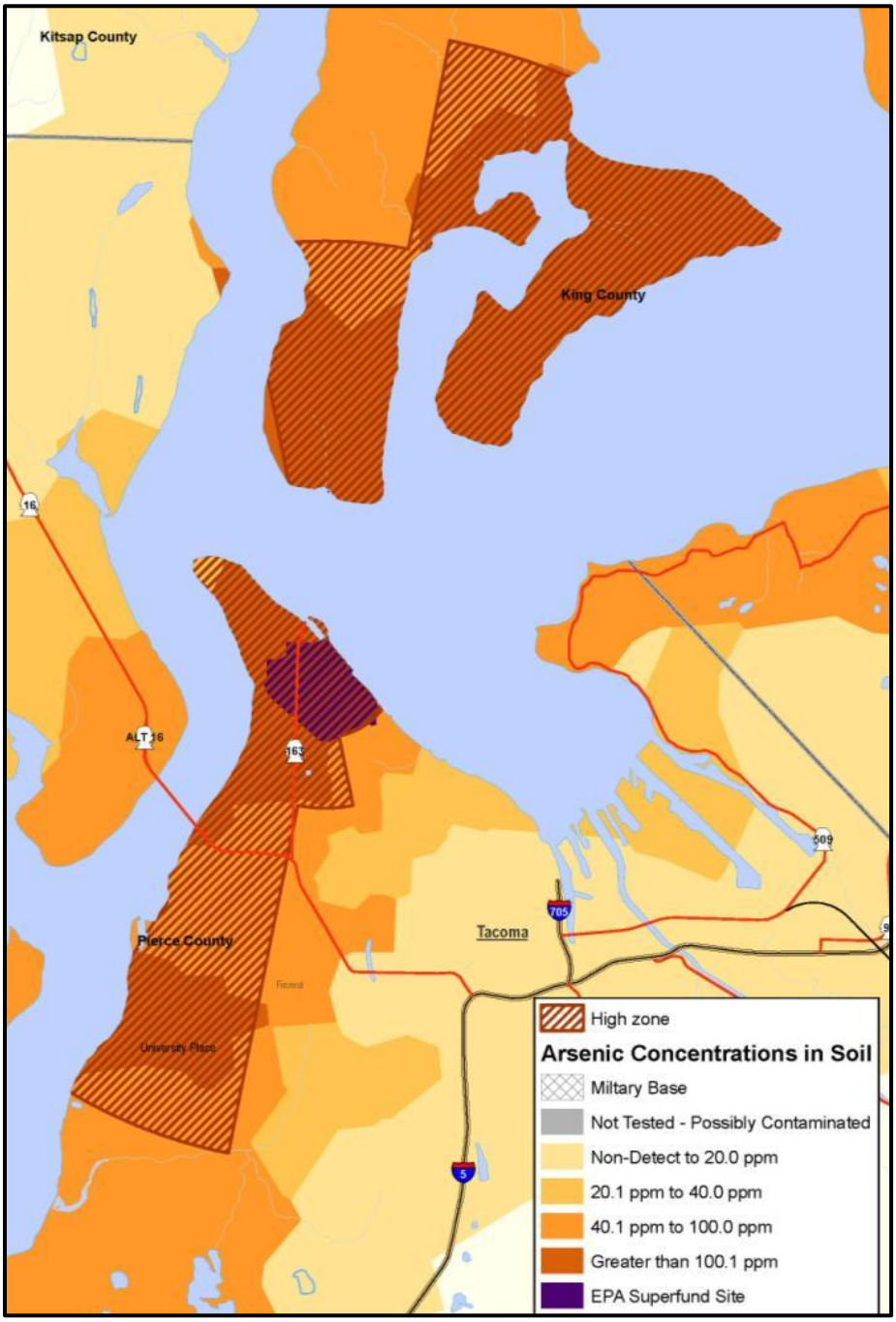


Figure 2. Draft Service Area "High Zone" Map (2011)

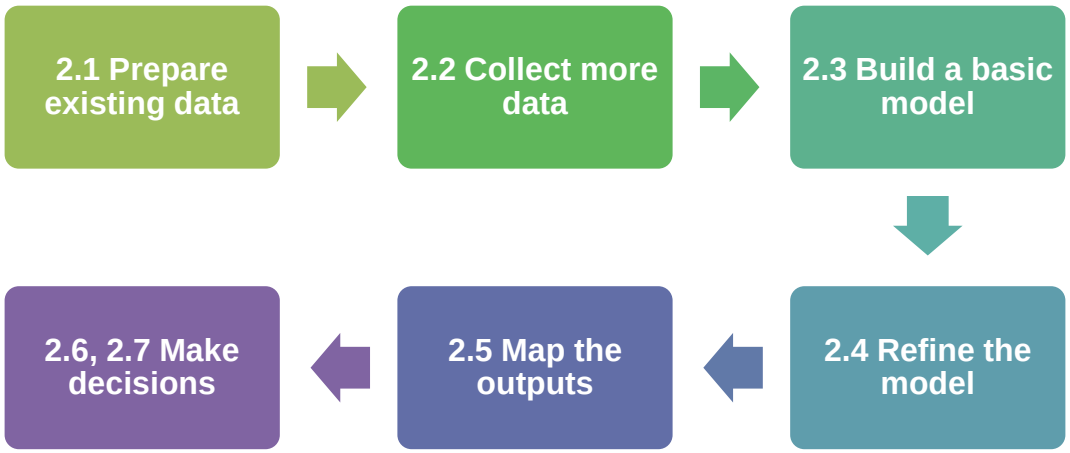
2.0 Service Area Map (2013)

In 2012, Ecology began working with a team of consultants and internal GIS staff to refine the service area map. The goals of this project were to:

1. Estimate areas where yards are most likely to have arsenic over 100 ppm.
2. Draw a more refined yard program service area boundary.
3. Rank neighborhoods based on the probability of having arsenic over 100 ppm.

Ecology worked with Dr. Pierre Goovaerts, Greg Glass, and Ian Mooser to build a statistical model to predict arsenic levels throughout the plume. We then used the outputs from the model to make decisions about the service area boundary and program sequencing.

The following subsections explain the major steps in creating the service area map:



2.1 Preparing Existing Data

Ecology used much of same data from the draft service area map (Section 1.1), but excluded a few of the studies due to unknown sampling depths or data location information. We also added the following datasets (for a complete list see **Table 1** in **Attachment 1** of this appendix):

- **Ruston/North Tacoma Study Area.** Over 20 years, Asarco and the U.S. Environmental Protection Agency (EPA) collected thousands of soil samples within the Ruston/North Tacoma Study Area portion of the Superfund site. We did not include data from the smelter property.
- **Voluntary Cleanup Program sites.** Several sites have arsenic and lead only from the Tacoma Smelter Plume. The sites were Vassault Overlook, and Maury Island Open Space (formerly the Glacier Northwest gravel mine).
- **Additional Home Soil Testing Data**: More recent data collected from Public-Health Seattle & King County and Tacoma-Pierce County Health Department.

- **Ecological Soil Screening Levels for Arsenic and Lead in the Tacoma Smelter Plume Footprint and Hanford Site Old Orchards (Sloan, 2011)**. This Ecology study collected data from 25 forested locations within the plume.

In preparation for modeling, Ecology added the following information to the datasets:

- **Arsenic level.** Average arsenic for the parcel, in parts per million (ppm). We used a parcel average because the number of samples taken per site varied from study to study. We used all sample results because we did not find a reason to remove outliers.
- **Azimuth**. The direction away from the smelter in degrees, where 0=South, 90= West, 180= North, and 270= East.
- **Coordinates.** X, Y in WA State South NAD 83 HARN.
- **Distance.** Euclidean distance from the smelter in feet, based on WA State South NAD 83 HARN.
- **Distance over land.** Distance traveled over land with major water bodies like Puget Sound, Lake Washington, and American Lake omitted.
- **Land use.** We divided samples into the following categories:
    - Disturbed samples. Samples taken on residential parcels. These samples have a higher probability of soil disturbance from building a home, landscaping, gardening and other working of the land.
    - Undisturbed samples. Samples taken on land that was mostly forested or land that due to plant cover appeared to have little soil disturbance during smelter operation.

For further discussion of the datasets see Mooser, 2013, **Attachment 1**. See Goovaerts, 2012, **Attachment 2**, for more about data transforms.

2.2 Collecting More Data on Vashon-Maury Island

While evaluating the data, we found that Vashon-Maury Island had very few disturbed samples. The lack of data could weaken the model, so we decided to do more sampling. Dr. Goovaerts highlighted 200 residential parcels in areas we most needed data. In the fall of 2012, Ecology did a small study on the southern end of Vashon-Maury Island.

We contacted owners of the 200 parcels and gained access to and sampled 63. We focused on disturbed areas of the parcel, such as lawns, garden beds, and play areas. All of the data results were added to the dataset. Of the 63 parcels, only five had units with arsenic over 90 ppm.

2.3 Building the Model

There are a number of variables that affect the levels of arsenic in soil. As discussed in Section 1.3, arsenic levels vary with distance and direction away from the former smelter. We also know that levels vary based on elevation and slope aspect. Levels tend to be higher on land that slopes towards the smelter, than on land sloping away. In general, the higher the elevation the higher the arsenic level. Soil disturbance and land cover also affect arsenic levels in soil.

In developing a model, we had co-located information for only four of these variables. Dr. Goovaerts developed a non-spatial regression model using the following four variables:

- Distance from the smelter
- Direction from the smelter
- Slope aspect
- Elevation

The relationship between these variables and arsenic levels differs depending on the geographical zones of the plume. Wind direction and topography influence these variables. Near the former smelter stack, the wind moves primarily to the north-northeast and then switches directions in the summer to the south-southwest. Plumes also move differently over land than over water due to temperature changes.

The plume was divided into three zones based on the different seasonal wind directions and topography: Pierce County portion, mainland King County portion, and Vashon-Maury Island.

The model predicts average arsenic for a given parcel. We chose parcels because we had parcel-level data and because they can be easily aggregated into larger units like census block groups. The maps (**Figures 3** and **5**) display the aggregated data in block groups.

2.4 Refining the Model

Dr. Goovaerts used the non-spatial regression model to predict arsenic values for all the parcels where we have sampling data. He then mapped the residuals, which are the differences between the predicted and actual values. The residuals appeared to have a spatial pattern. This meant that the model predicted arsenic values better in some areas than in others.

To account for this, a spatial trend regression model was developed:

$$Trend = Intercept + b1 \times Cos(Azimuth-\theta_1) + b2 \times Log(Distance\ to\ smelter) \times |Cos(Azimuth-\theta_2)| + b3 \times Log(Distance\ to\ smelter) + b4 \times Elevation$$

This model predicts arsenic levels better than the non-spatial model.

Limitations: The main limitations of the model are a lack of data in certain areas and data for other variables that affect arsenic levels, like history of soil disturbance. Some areas, such as Vashon-Maury Island, have limited data, while the EPA Study Area has thousands of samples. History of soil disturbance can be measured by age of home. Home building disturbs surface soils and can greatly reduce arsenic levels. Arsenic levels tend to be higher on parcels with older homes, when the smelter was still operating. Adding age of home to the model could improve its fit. In the future we will collect the data on age of home and it may be used to improve the model.

2.5 Mapping the Spatial Model Outputs

Next, Dr. Goovaerts ran 999 “simulations” using the spatial trend model. Each simulation gives a predicted arsenic value for each of the hundreds of thousands of parcels in the plume. After 999 runs, each parcel has 999 possible arsenic values. These values form a “distribution,”

where certain values appear more often than others. Using this distribution, we can tell the probability of that parcel being over or under a certain arsenic value.

Dr. Goovaerts used a program he developed to process the millions of arsenic values from the 999 simulations. He aggregated the parcel-level data by census block group. Block groups consist of around 300-800 households. Our program decisions and sequencing are based around block groups.

We mapped the outputs from the processing program to inform decisions about the service area boundary. The program's output has three main parameters:

- Arsenic threshold
- Percent of parcels over the arsenic threshold
- Probability that a given percent of parcels will be over the arsenic threshold

The program allows the user to set two of the parameters constant and see how the third varies by block group. The user must always set a constant arsenic threshold. This leaves two possible options for maps:

- Set the percent of parcels over the threshold and see how the probability varies.
- Set the probability constant and see how the percent of parcels over the threshold varies.

General approach: In making decisions about service area boundary and sequencing, Ecology looked to balance sampling and cleanup costs. We want to sample to find the parcels that need cleanup and still have sufficient funds remaining to do the cleanup. In some block groups further from the smelter we will spend more money sampling to find the few parcels needing cleanup. We used the program to create several maps with different probabilities and different percents of parcels over the arsenic threshold.

Map parameters when the probability is set and percentage of parcels varies: We set the arsenic threshold level to 90 ppm. We then set three different probabilities—80%, 50%, and 20%. The percent probability is the likelihood of a given event occurring. The 20% map is the likelihood that 20% of the time a parcel is over 90 ppm. This is expressed as a ratio of the number of actual occurrences to the number of possible occurrences.

Next, we looked at what percent of parcels exceeded 90 ppm in each block group. We call this the exceedance rate. In each of our maps (**Figure 3A**), we used the same color coding for the percent of parcels expected to be over 90 ppm:

- **At 80% probability,** three block groups in the EPA Study Area have at least a 60% exceedance rate. Five block groups have an exceedance rate of between 20 and 40%. A few block groups from Vashon Island to Highway 16 have at least 10 to 20% exceedance rate.

- **At 50% probability,** more block groups have at least a 10% exceedance rate. They are in the general area from Vashon Island to Highway 16.

- **At 20% probability,** even more block groups have at least a 10% exceedance rate from Vashon Island to Highway 16. Four block groups south of Highway 16 also have a 10 to

20% exceedance rate. The lower the probability, the more block groups may have some parcels over the 90 ppm arsenic threshold. At 20%, we can be more sure that we are catching the areas where yards could have over 90 ppm arsenic.

Map parameters when the exceedance rate is set and probability varies: We set the arsenic threshold level to 90 ppm. We then set three different percents for exceedance rates—20%, 15%, and 10%. The program then provided the probability of exceedance. In each of our maps (**Figure 3B**), we used the same color coding for the probability of exceedance expected for the percent of parcels over 90 ppm:

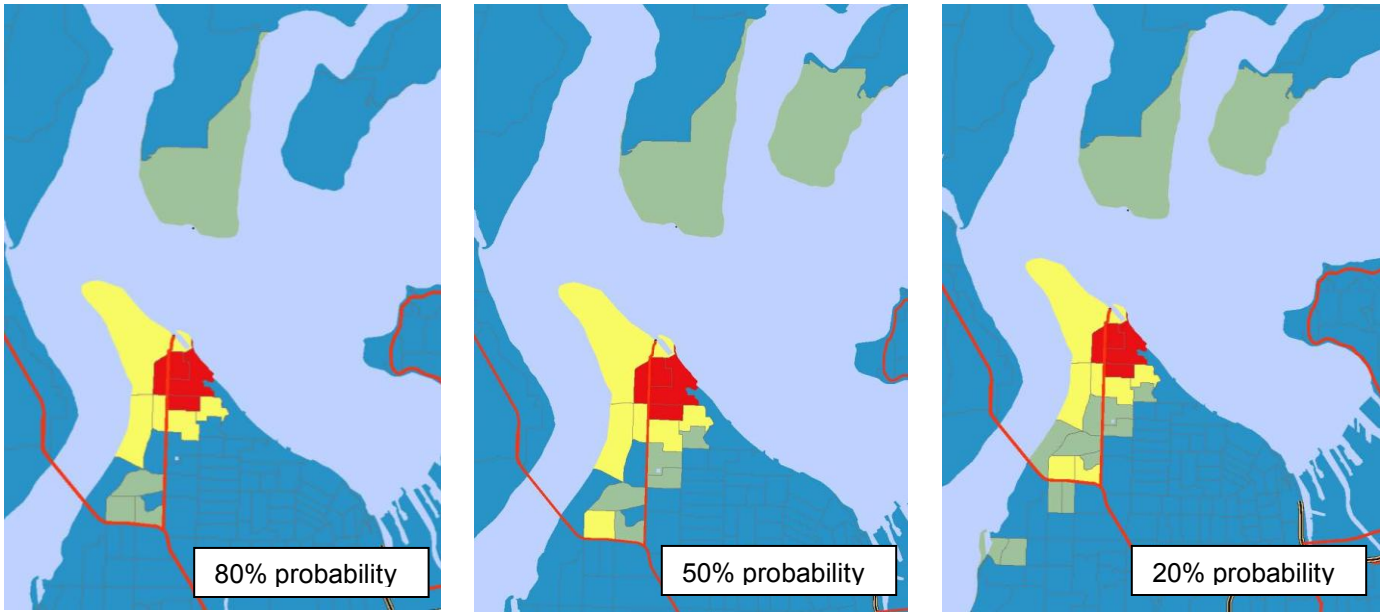
- **At 20% exceedance rate**, there are block groups from Highway 16 to the northern tip of Tacoma that have between 60% and 100% probability of finding at least a 20% exceedance rate of the 90 ppm threshold.

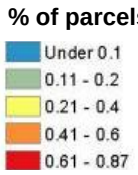
- **At 15% exceedance rate**, the area expands to include some of Vashon-Maury Island with a 20% to 40% probability of finding at least a 15% exceedance rate of the 90 ppm threshold.

- **At 10% exceedance rate**, the probabilities from Vashon-Maury Island to Highway 16 increase to 80% to 100% of finding at least 10% exceedance.

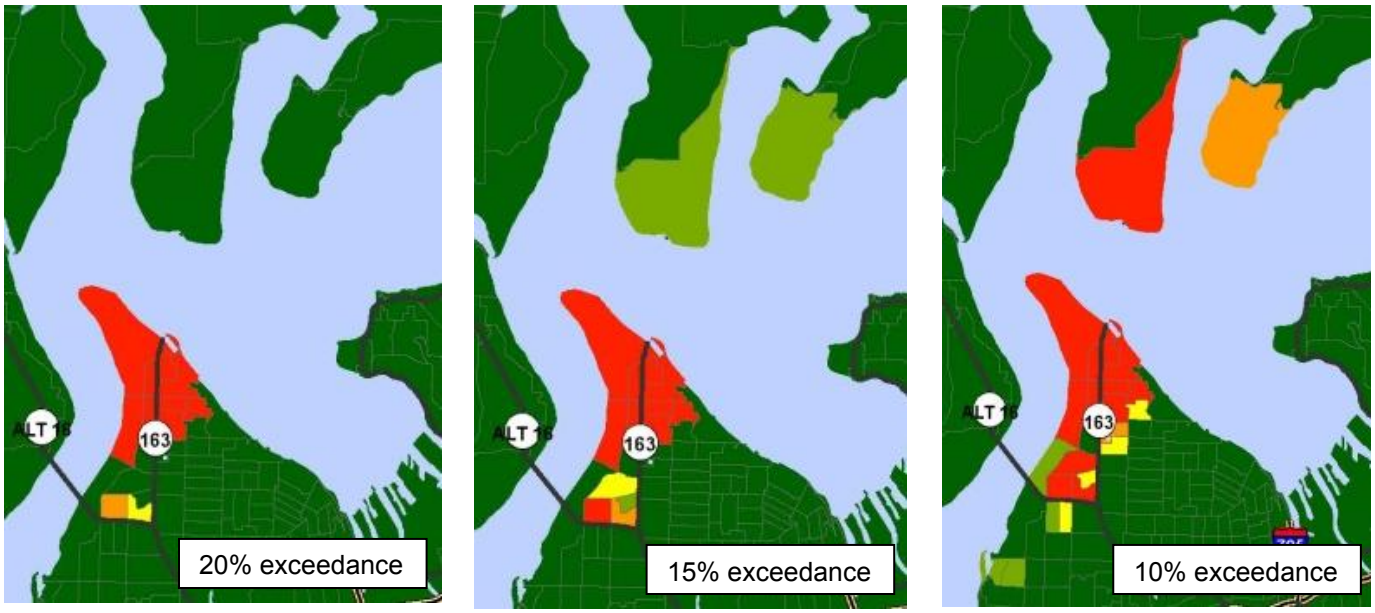
Figure 3. Probability and percentage of parcels over 90 ppm by block group

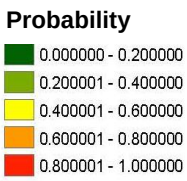
A. Set the probability and vary % of parcels





B. Set the % of parcels and vary probability





2.6 Service Area Boundary Decisions

To create the service area boundary (**Figure 4**), we used the map where we set the probability to 20% (**Figure 3A**). We included all block groups with at least a 10% exceedance rate, except four block groups. . The four block groups are south of Highway 16, in the West End neighborhood and University Place. The exceedance rate and the probability of exceedance is generally lower in these four block groups. The 50% probability map (**Figure 3A**) shows these four block groups as having a less than 10% exceedance rate. These four block groups are also shown to have a lower probability of exceedance when comparing the 10% and 15% exceedance (**Figure 3B**).

More Data Required: The four block groups south of Highway 16 have a 10 to 15% exceedance rate. In this area, we plan to take more samples to better understand the likelihood of yards having arsenic levels over 90 ppm. The hash marks on Vashon Maury Island and south of Highway 16 (**Figure 4**) show areas where we will collect more samples before including or excluding these block groups from the program.

General approach: We chose a conservative approach to developing the service area boundary. We want to err on the side of including more parcels, using future data to refine the boundary further. This service area is smaller than the 2011 draft service area, covering around 7,300 parcels instead of 17,000. This is due, in part, to having far more data and a more scientific approach to analysis. Around 2,700 of the parcels included in the service area are located within the EPA Study Area and have existing sampling data. This leaves about 4,600 parcels to be sampled under the Yard Program (see **Table 1**).

Having a smaller service area balances soil sampling and cleanup costs better than a large service area. We expect around one in six parcels to exceed 90 ppm arsenic, based on the model. If we had gone with the “high zone” map service area (**Figure 2**) we would have a lower overall rate of parcels qualifying for cleanup. This would have meant spending more money on sampling and less on cleanup. See **Table 1** for the estimated number of parcels expected to exceed 90 ppm.

Table 1 provides the estimated number of parcels needing sampling and likely to require cleanup. It also provides the cost estimate for sampling and cleanup based on a per parcel sampling cost of $1500, and cleanup cost of $50,000. The overall cost is approximately $67 million. This assumes a 100% sampling and cleanup participation rate. Of the $95 million settlement, we planned for approximately $64 million for the Yard Program, so the Service Area boundary supports this budget.

This map is a starting point for the program. We plan to rerun the model in the future using more data collected during the program.

Table 1 Estimated number of parcels to sample and cleanup by area

Location	# Parcels to sample	Estimated sampling cost[a]	# Parcels to clean up	Estimated cleanup cost[b]
Ruston/North Tacoma	2700	$0	695	$ 34,750,000
Vashon-Maury Island	731	$ 1,096,500	100	$ 5,000,000
Pierce County	3922	$ 5,883,000	400	$ 20,000,000
Total	7353	$ 6,979,500	1195	$ 59,750,000

a – $1500 per parcel
b - $50,000 per parcel

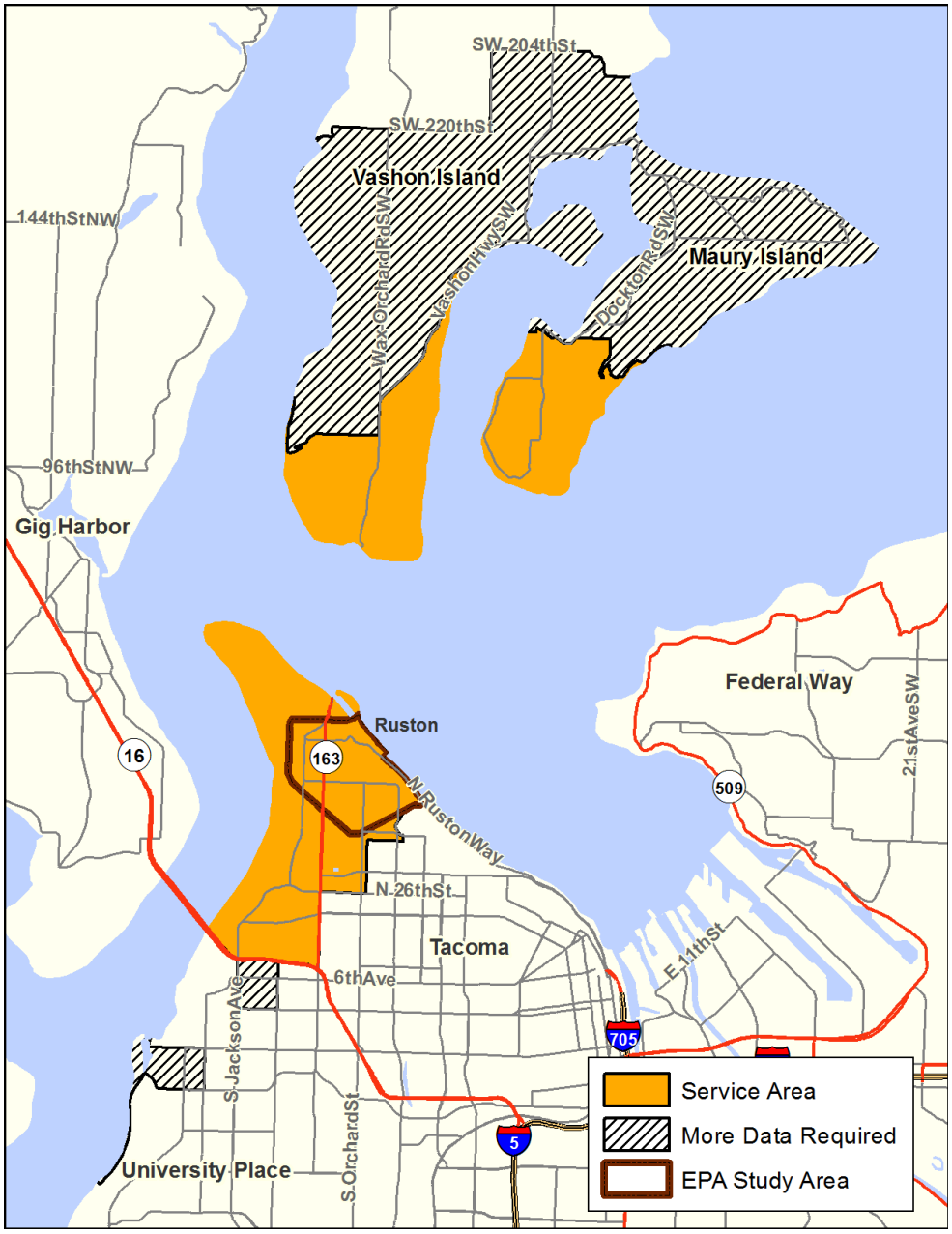


Figure 4. Program Service Area Boundary

2.7 Program Sequencing Decisions

The Yard Program Service Area has three subareas (**Figure 5**)—the EPA Study Area, Vashon-Maury Island, and Pierce County outside of the EPA Study Area. Each area will have its own sequencing order and Ecology will have separate work crews for each. The EPA Study Area already has sampling data, so Ecology will begin cleanup work there sooner than in the other areas. Vashon-Maury Island needs a special approach because it is isolated, has larger parcels, and has a large area requiring more data (**Figure 4**).

The subareas are further broken down into block groups. The model output for each block group will be used to sequence the sampling of the block groups for each county. The sequencing letters were assigned starting with the letter A in the block group with the highest exceedance rate for each county. **Figure 5** shows the block groups on Vashon-Maury Island and Pierce County outside of the EPA Study Area labeled with sequencing letters.

Sampling will start with the letter A in each county and then proceed to the next letter in alphabetical order. We may change the sequence to avoid jumping from one area to another across town. This could be inefficient for Ecology and frustrating to homeowners who have to wait much longer than their neighbors. Ecology will also update the model every two years, as new data are collected, which could change the sampling order.

The block groups are divided into access groups. The block groups contain around 300 to 800 residential parcels. We will divide each block group into access groups when we upload them to the database--groups of about 100 parcels that will be contacted for sampling at the same time. This will provide the sampling teams a manageable number of parcels to track for access and sampling. We will evaluate and may change the size of access groups as sampling progresses.

Cleanup Prioritization: Cleanup will start inside the EPA Study Area since sampling data for these properties are already available to Ecology. The EPA Study Area will have its own prioritization for cleanup that is not based on the model outputs, but on EPA cleanup work, actual results, and program efficiency. **Figure 6** shows the cleanup sequence that will be used inside the EPA Study Area.

To determine the sequence, we used the EPA sampling data to determine how many homes met our criteria. We used EPA's existing letter coding as a way to group the data. We looked at three statistics for each letter group:

- Total residential parcels.
- Total residential parcels meeting Ecology's criteria, with no action taken by EPA.
- Total residential parcels meeting Ecology's criteria, where EPA had performed cleanup work.

We then prioritized the letter groups using the following criteria:

- Areas with the highest number of parcels over 90 ppm arsenic, with no EPA action.
- Areas with the highest percentage of parcels over 90 ppm arsenic.

- Areas with the highest percentage of parcels over 125 ppm arsenic in the top six inches of soil, where EPA took no action.
- Areas with the highest percentage of parcels over 125 ppm arsenic in the top six inches of soil.

To move more systematically and efficiently through the Study Area, we may address some letter groups at an earlier time than the ranking indicates. **Table 2** shows the overall cleanup sequence, the ranking for each EPA letter code group, and the percentages used to sequence the cleanup.

Outside the EPA Study Area, the sequence of cleanup will generally follow the same pattern as for sampling. Those block groups sampled first will most likely have cleanup performed before the groups sampled later. Ecology may adjust this sequence for efficiency, to manage construction access, or to address unexpectedly high sampling results that pose a higher risk to homeowners.

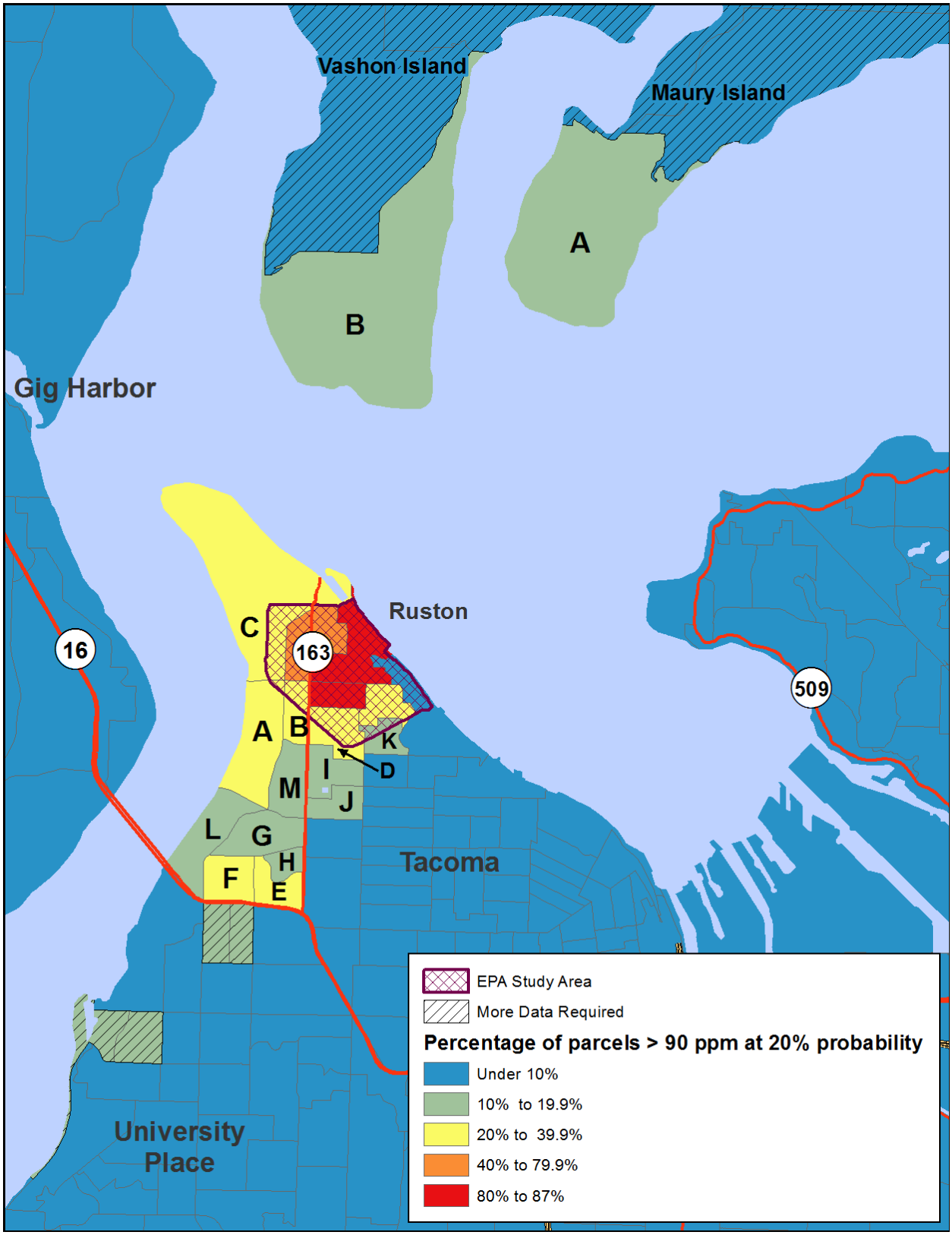


Figure 5. Program Sequence Map for the areas outside of the EPA Study Area.

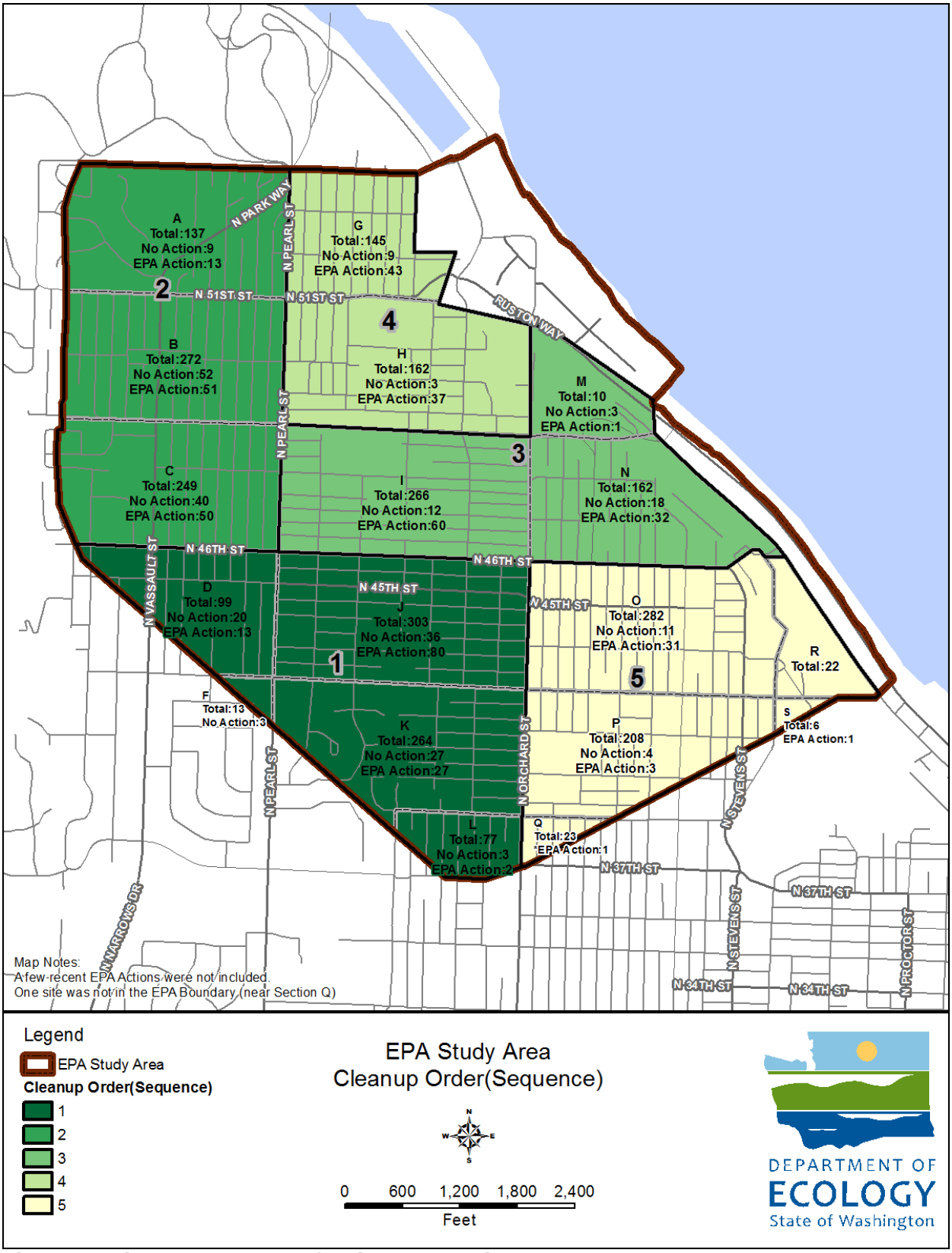


Figure 6. Cleanup Sequence for the EPA Study Area

Table 2 Cleanup Sequence Table for Inside the EPA Study Area.

Cleanup Sequence	EPA Letter Code	% No Action	% Sites> 90	% sites no EPA action > 125 avg 0-6	% all sites over 125 ppm avg 0-6	Rank by Letter
	D	61%	33%	24%	30%	**1**
	F	100%	23%	0%	0%	**12**
	J	31%	38%	12%	25%	**2**
	K	50%	20%	11%	17%	**7**
	L	60%	6%	20%	20%	**3**
1	**Total**	**42%**	**28%**	**14%**	**23%**	
	B	50%	38%	8%	13%	**4**
	C	44%	36%	7%	11%	**8**
	A	41%	16%	9%	14%	**11**
2	**Total**	**47%**	**33%**	**7%**	**12%**	
	M	75%	40%	0%	0%	**5**
	N	36%	31%	8%	18%	**6**
	I	17%	27%	8%	15%	**10**
3	**Total**	**26%**	**29%**	**8%**	**16%**	
	G	17%	36%	0%	17%	**9**
	H	8%	25%	0%	15%	**13**
4	**Total**	**13%**	**30%**	**0%**	**16%**	
	O	26%	15%	2%	10%	**14**
	R	0%	0%	0%	0%	**18**
	P	57%	3%	0%	0%	**15**
	S	0%	17%	0%	0%	**16**
	Q	0%	4%	0%	0%	**17**
5	**Total**	**29%**	**9%**	**2%**	**8%**	

Attachment 1

Data Acquisition and Processing

For

The Tacoma Smelter Plume Mapping Project

Purpose:

This is an overview of the data sources, the study/sampling review process and the data processing techniques used to provide Dr. Goovaerts with the data for the Tacoma Smelter Plume geostatistical analysis. This work was completed at the Washington Department of Ecology with a large contribution from our consultant Greg Glass.

Date: 2/19/2013 Author: Ian Mooser, GIS Manager, Toxics Cleanup Program - Washington Department of Ecology

This attachment consists of ***3 parts describing the data acquisition and processing.*** This data was used for the geostatistical model and the mapping for the residential yard program.

Table of contents:

Part 1 - Data Sources/Credits:

1. Sampling data - Various environmental studies that represented samples from residential yards and forested/undisturbed areas (generally the footprint studies).
    a. Washington Department of Ecology
    b. Tacoma-Pierce County Health Department
    c. Environmental Protection Agency and United States Army Corps
    d. Public Health Seattle & King County
    e. Greg Glass , literature review, and the 2003 credible evidence report
2. US Census Block groups - United States Census Bureau
3. Parcels - Pierce, King, Thurston, Snohomish, & Kitsap Counties
4. Elevation data - United States Geological Survey(DEM)
    a. Used to derive slope and aspect

Part 2 - Study/Sample Data Review:

Summary: The following is a brief summary of the study/sampling data review that the Washington Department of Ecology and Greg Glass used to find applicable studies/samples for Dr. Goovaerts.

Mr. Glass's extensive experience studying the smelter in Ruston allowed the Washington Department of Ecology to collect hundreds of reports, studies and dissertations related to the Tacoma Smelter Plume. Much of this information was used in the credible evidence report. The Washington Department of Ecology and Mr. Glass thoroughly analyzed the material in a literature review and subsequently analyzed more recent studies for this project.

We have not included samples from the 1970s, 1980s or the early 1990s even though some examples, such as Crecelius's research, found much higher concentrations in certain areas. Mr. Glass and the Washington Department of Ecology decided instead to focus on more recent studies/samples for a variety of reasons. Some of the reasons are that the older studies did not include location information (i.e. no latitude, longitude), no sample depths were given, the field collection methods were not documented (i.e. grab vs. composite samples), the lab methods were not documented, the sampling and analysis plan (SAP) was not included, etc.

Brief Timeline:

In 1974 – In Eric Crecelius's University of Washington dissertation "The Geochemistry of Arsenic and Antimony in Puget Sound and Lake Washington, Washington," we saw the first published maps of widespread arsenic contamination attributed to ASARCO. However, most of Crecelius's early work was conducted on sediment samples, not soil samples. However, by the 1980's, his work expanded to soil samples.

In 2003 - The credible evidence report was produced, which has led to extended footprint studies and future mapping efforts. "The ASARCO Tacoma Smelter and Regional Soil Contamination in Puget Sound"
http://www.ecy.wa.gov/programs/tcp/sites_brochure/tacoma_smelter/Sources/Credible_Evidence/web%20pieces/X_cred%20entire%20report.pdf

In 2011 – The Washington Department of Ecology and Mr. Glass reviewed the studies to find applicable arsenic samples.

1. Literature review to find applicable studies
    a. Reviewed known studies and credible evidence report
    b. Contacted other potential data sources within the study area
        i. Washington Department of Ecology cleanup site managers (i.e. find reports or studies "in progress")
        ii. Public Health Seattle & King County
        iii. Joint Base Lewis-McChord
        iv. Environmental Protection Agency
        v. US Army Corps and various environmental consultants
2. Acquired data from other sources (not in the credible evidence report)
    a. Electronic Data and/or reports
        i. Washington Department of Ecology
        ii. Environmental Protection Agency
        iii. Tacoma-Pierce County Health Department
        iv. Public Health Seattle & King County
        v. Joint Base Lewis-McChord
        vi. Environmental consultants
    b. Hard Copy data
        i. Water Tank Study
        ii. Vassault

In 2012 – The results of the literature review and study analysis identified 112 studies of interest. Next, we reviewed these studies.

Study Review Process:

Objective: To create a dataset for arsenic in the study area that had similar study characteristics in the field and lab.

Brief outline of the study review process:

The environmental studies we examined were not all designed in the same way. Because of the size of the study area we needed to look at multiple studies.

- Studies were reviewed with Mr. Glass and several Washington Department of Ecology staff. (Amy Hargrove, Marian Abbett, Hannah Aoyagi and Ian Mooser)
    - Did we have access to study documents like the Quality Assurance Project Plan (QAPP), study design document and the study results?
    - Did we have good sample location information?
    - Did we have access to digital data or would we need to manually enter it?
        - Note: two studies were manually entered.
    - Documented the methods used in the field
        - Grab vs. composite
        - Sampling depths
        - Miscellaneous - other important methods
    - Documented the analytical methods used in the lab
    - After this was documented – we removed studies and samples that did not meet the criteria:
        - Removed studies in which the source of arsenic was most likely a source other than the smelter.
        - Removed studies in which some basic sample data elements were not included: soil sample depth, lab analysis method, or no location information.
        - Removed EPA residential superfund samples within a quarter of mile of the smelter stack, looking for air deposition samples, and removed nearby samples that had the potential to be from a source like stack fires or fugitive emissions.
    - Reviewed data outliers with study contact.

Results of the Study Review:

Table 1: 22 applicable studies identified by the team for Dr. Goovaerts's analysis.

Study Name:	Study Date:
Environmental Protection Agency – Ruston/North Tacoma residential Yard Samples – Pre-Remediation	1997 to 2007
Evaluating Toxicity of As and Pb in different soil types, Tacoma Smelter Plume/Hanford Old Orchards	2010
King County -Residential Samples	2010
Maury Island – Gravel	2003 to 2010
Tacoma Pierce County Heath	Ongoing
Tacoma Smelter Plume (TSP) King County Child Use Study	10/2002-6/2003
Tacoma Smelter Plume (TSP) King County Child Use Study 2	12/2004-5/2005
Tacoma Smelter Plume (TSP) King County Extended Footprint	7/2003-6/2005
Tacoma Smelter Plume (TSP) King County Soil Safety Program	Ongoing
Tacoma Smelter Plume (TSP) Kitsap County Footprint	2/2004
Tacoma Smelter Plume (TSP) Phase II Mainland Footprint Study	2/2001-6-2001
Tacoma Smelter Plume (TSP) Pierce County - Extended Footprint	9/2001
Tacoma Smelter Plume (TSP) Pierce County Child Use Study	2/2003-9/2005
Tacoma Smelter Plume (TSP) Pierce County Footprint Study	9/2001-12/2002
Tacoma Smelter Plume (TSP) Pierce County Soil Safety Program	Ongoing
Tacoma Smelter Plume (TSP) Thurston County Extended Footprint	8/2004-12/2004
Tacoma Smelter Plume (TSP) Thurston County Soil Safety Program	Ongoing
Tacoma Smelter Plume (TSP) Vashon-Maury Island Child Use Study	8/2000-11/2000
Tacoma Smelter Plume (TSP) Vashon-Maury Island Footprint Study	9/1999-12/1999
University Place - Tank study – Background	2003
Vassault Overlook Property VCP (Narrows Overlook Undeveloped Church Property), Tacoma, WA	2005
**Residential Study - Vashon Maury Island - Study done after initial review because of residential data gap*	*2012*

Part 3 - Data Processing:

Sampling Data: Data calculated or added for Dr. Goovaerts. Software used included ArcGIS, SQL Server and Excel.

Added sampled location types:

1. Disturbed samples (*See Figure 1*): Since the cleanup is of residential yards, we compiled a dataset representative of residential yard sampling programs. Residential yard samples have a much higher probability for some amount of soil disturbance (building a house, landscaping, gardens, irrigation systems, etc.)
    a. Note: After a "cleanup," samples were removed, i.e. post-remediation or confirmational samples.
    b. It was determined some samples were not representative of a residential yard, e.g., those of areas such as forest fringe and some partial samples were not included in the "disturbed" data.
2. Undisturbed samples (*See Figure 2*): (generally Tacoma Smelter Plume footprint studies) also includes Vassault, the Water Tank Study and a study on Vashon Maury Island.
    a. Some samples in the footprint study were from "residential" areas or disturbed areas. These were not included in the undisturbed data set.

Average and Maximum Site Arsenic Calculations: *The average and maximum value for all the samples at a "site." A site for a disturbed dataset is a residential property that almost always is a residential parcel. Depending on the study design this could range from 1 sample to over a dozen samples at a single site. This was done because most studies only documented one location (same location for all samples) on the property even if the property had multiple decision units.*

1. Note: Ecology compiled approximately 20,000 residential samples from 4300 sites.
2. This same method was used for undisturbed samples.

Sample Depth Calculations: **Objective - to calculate a 0 to 6 inch result for all studies.** Some studies had sample depths of 0 to 2 inches and 2 to 6 inches, or 0 to 1 inch and 1 to 6 inches.

1. ((0 to 2 inches * 50 ppm(parts per million))/.33) + ((2 to 6 inches * 6 ppm)/.67)
    a. If the results had a data qualifier such as 'u,' results (6 ppm = 3 ppm) were divided in half and then placed in the equation.
2. Note: All but two studies included soil sample depths of 0 to 6 inches. These two included studies had a depth of 0 to 2 inches.

Figure 1: Undisturbed (Residential) Sample Map - Mapped by Site Average

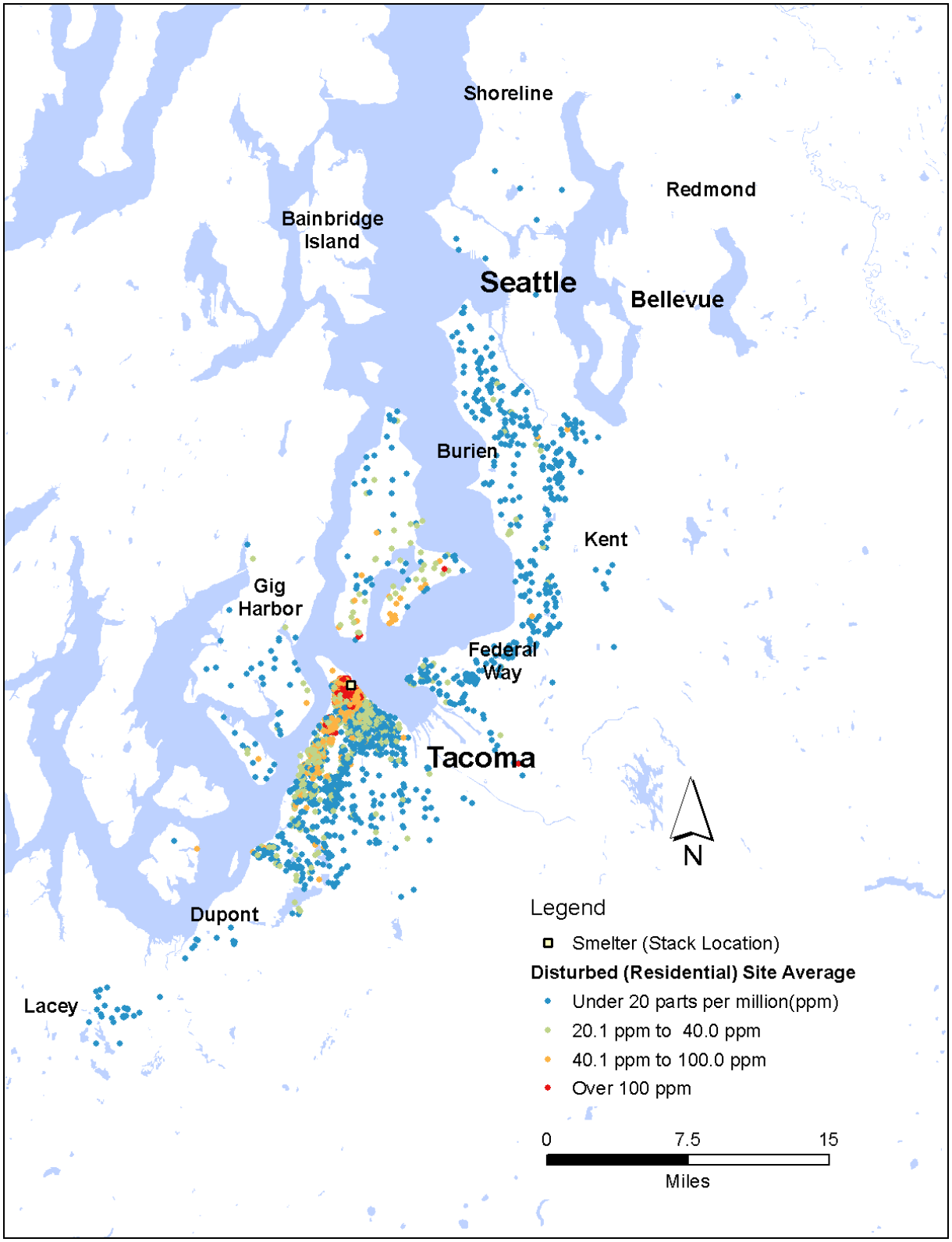
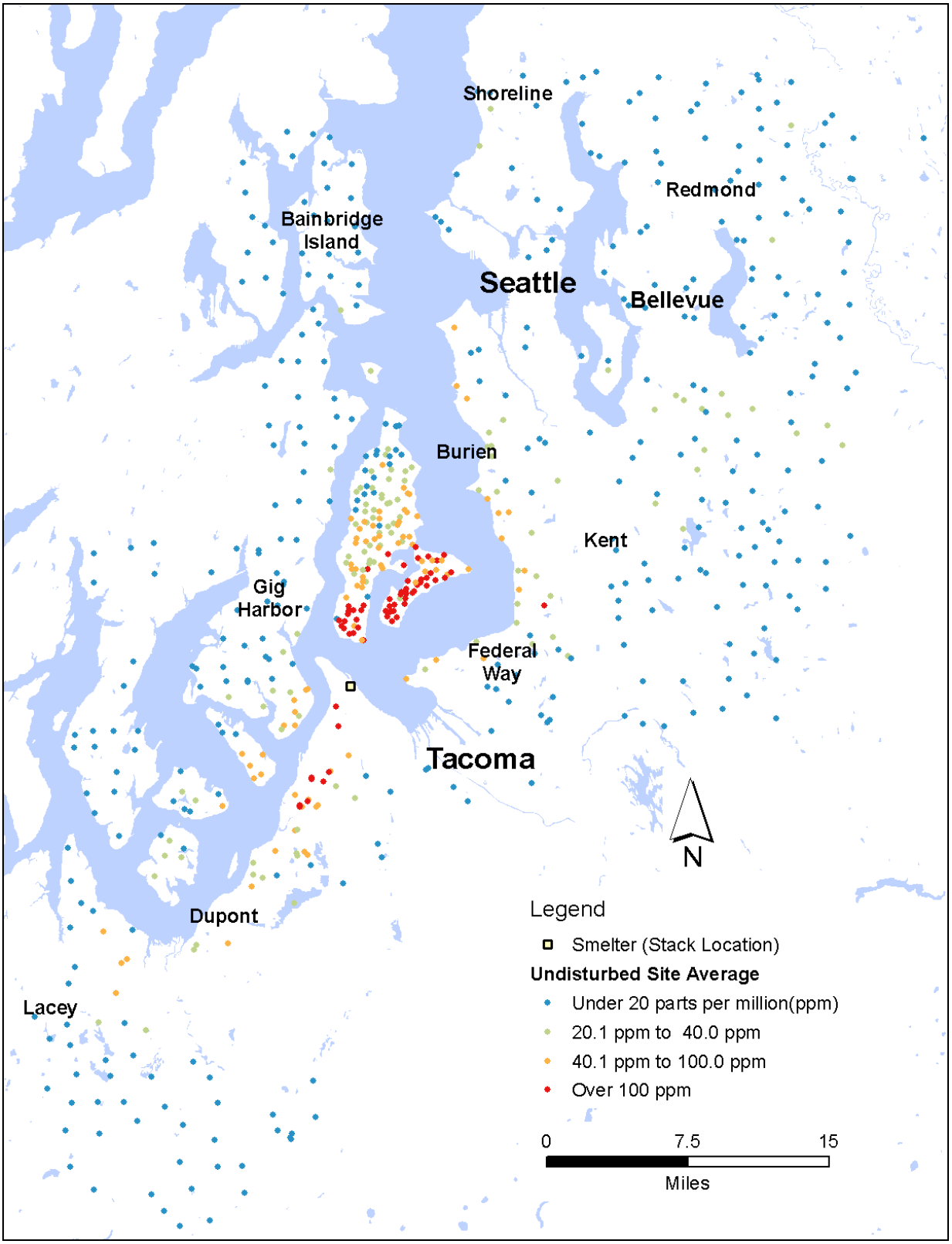


Figure 2: Undisturbed Sample Map **-** Mapped by Site Average

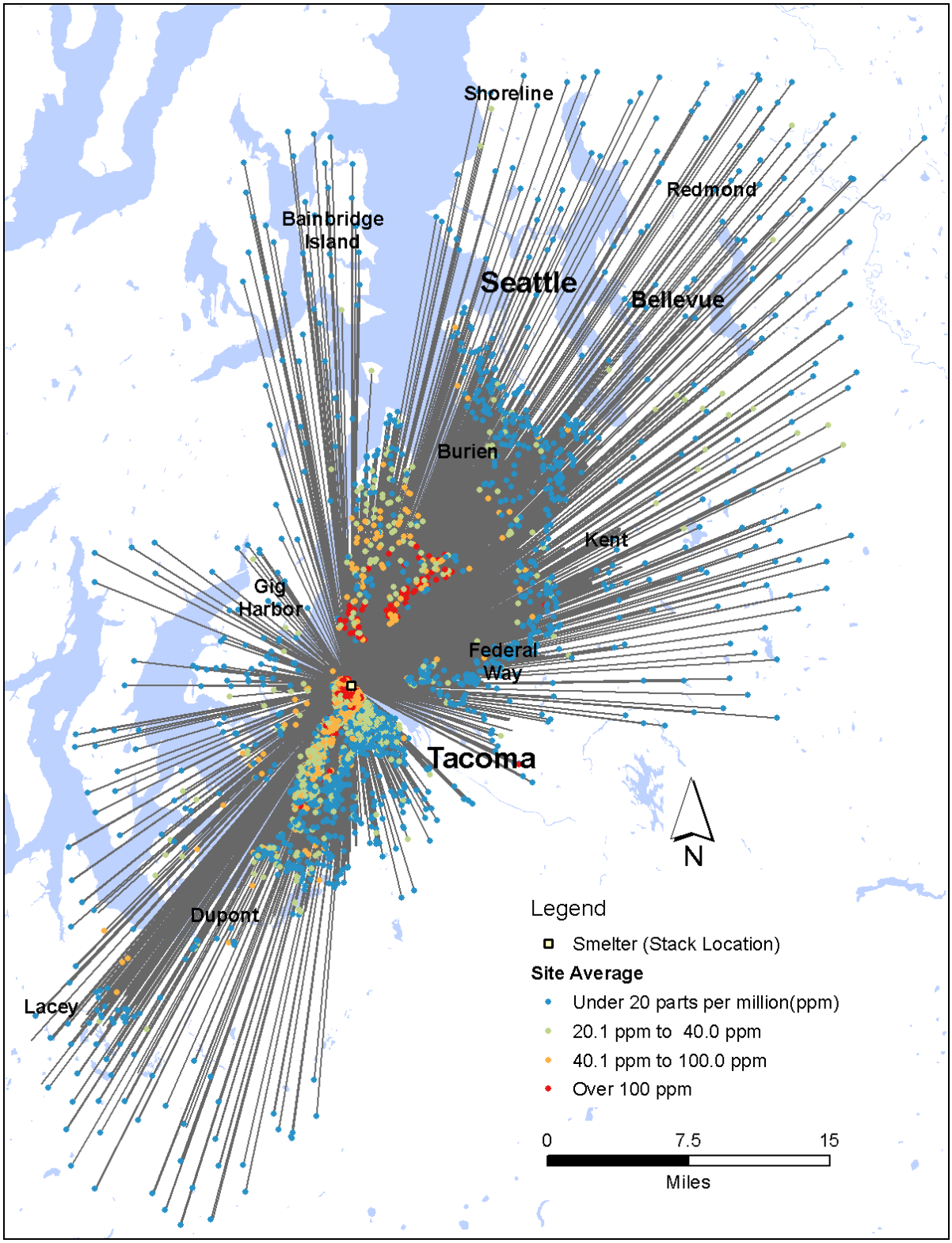


Derived location elements for sampling data

1. Distance to smelter stack (in feet) - (*See Figure 3*)
    a. Total distance(units feet - to the stack/source)
    b. "As the crow flies" distance - calculated by a spider diagram from sample location to the stack

2. Azimuth to Smelter (*See Figure 3*)
    a. Azimuth (units degrees - data type integer)
    b. Calculated from spider diagram
3. Slope - calculated from USGS DEM
4. Elevation - calculated from USGS DEM
5. Aspect - calculated from USGS DEM
    a. Note: Not used - distance over primary water body (would have preferred an air deposition model). Hypothesis: seen in sampling data is that arsenic particles in the air were deposited near shorelines due to cold air over water hitting warmer air over the land and being deposited near the shoreline and bluffs.
    b. Distance over primary water body (units: feet - distance over land from the stack (as the crow flies) & water bodies < 10 acres were omitted.

Figure 3: Spider Diagram Map to sample/site locations - used to calculate azimuth (to the smelter) and distance (as the crow flies)



US Census Block Groups Data: Software used included ArcGIS, SQL Server and Excel.

1. US Census Block Groups - A statistical subdivision of a census tract generally defined to contain between 600 and 3,000 people, and are the smallest geographic unit for which the Census Bureau tabulates sample data.
   Source: http://factfinder2.census.gov/help/en/glossary/b/block_group_bg.htm
2. The numbers of residential and undeveloped parcels were added to the block group from the parcels for Dr. Goovaerts.
3. Note: Two block groups on southern Vashon Maury Island were split in half for analysis. Census block groups are based on population and the block groups on Vashon Maury Island covered a larger expanse of land than the block groups in Pierce County since the area has less population. The impact of higher arsenic levels located further south in the block groups were diluted by the lower levels further north. The overall rate of exceedance was lower when we looked at the intact block groups than when they were split.

Parcel Data: Software used was ArcGIS.

1. Combined GIS parcel data from counties in study area (Pierce, King, Thurston, Snohomish and Kitsap Counties).

2. Goal to determine what constitutes "residential" (*See Figure 4*) and "undeveloped" (*See Figure 5*) areas in the study area.

    a. Generalized land uses (*See Table 2*): They land use codes are for the most part standardized between counties, but even in this study area they varied and codes were rolled up.
        i. Land use is defined on the parcel level
            1. General land use definition and why land use exists in parcel data: the present highest and best use of the property for appraisal purposes.
            2. They are numbered from 01 to 99 (sometimes up to 4 digits in Pierce County) in the parcel data.
            3. For example, "11" or "1101" = single family residential
            4. The following URL provides examples of several hundred land use values in Pierce County.
               http://www.co.pierce.wa.us/xml/abtus/ourorg/at/PC_ATR_Use_Codes.pdf

b. ***Table 2:*** Details for all 4 counties in the study area (parcels count and rollup landuse values)

LANDUSE	**Parcel Count**
Agriculture	5766
Commercial\Industrial	37940
Fishing or Mining or Water, etc.	1568
Government or Educational Services	3995
Hotels & Institutional Lodging	1286
Mobile Home Parks	8461
Park	3451
Recreational\Cultural	12440
Residential Multifamily or Condos	56954
Residential Other	16762
Residential Single to 4	***1062355***
Timber	9935
Transportation Facility\ROW\Parking\Utilities	12639
Undeveloped - Vacant	***156781***
Undeveloped - Other	***14067***

There was also an interesting area near the military base (JBLM). Pierce County does not map the military base, whereas Thurston County maps and classifies their part of the military base as undeveloped.

Definition of "land use": The "present" ***highest*** and ***best use*** of the property for appraisal purposes. Some of the older and larger rural lots (5 acres or more) on Vashon and Maury, while classified as single family, have more forested characteristics throughout.

3. Calculated slope, aspect, and elevation for the parcel centroid
    a. Slope: derived and calculated from USGS DEM
    b. Elevation: calculated from USGS DEM
    c. Aspect : derived and calculated from USGS DEM
4. Add year built for the structure (not used)

Figure 4: Residential Parcels (Single Family to Fourplex) in the Study Area

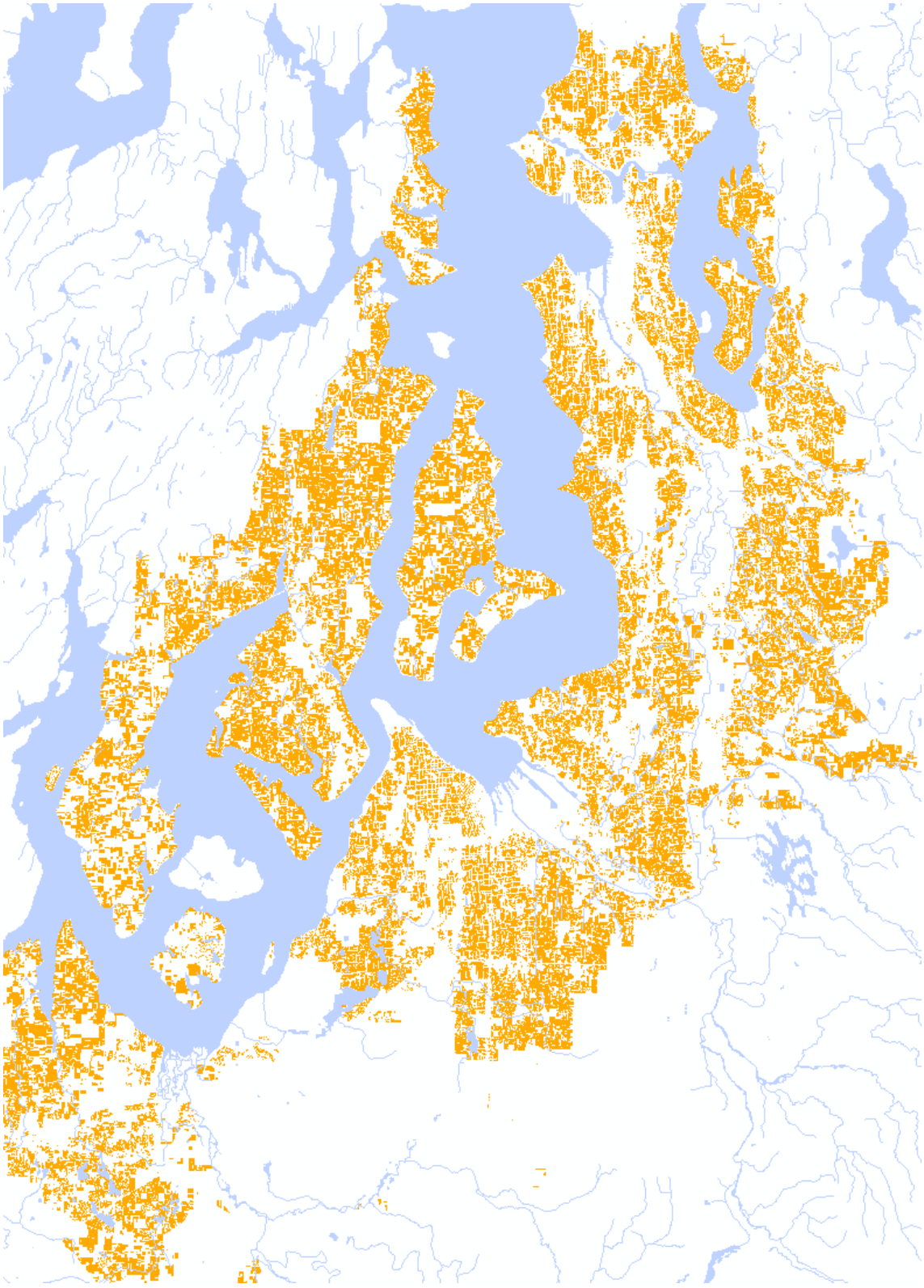
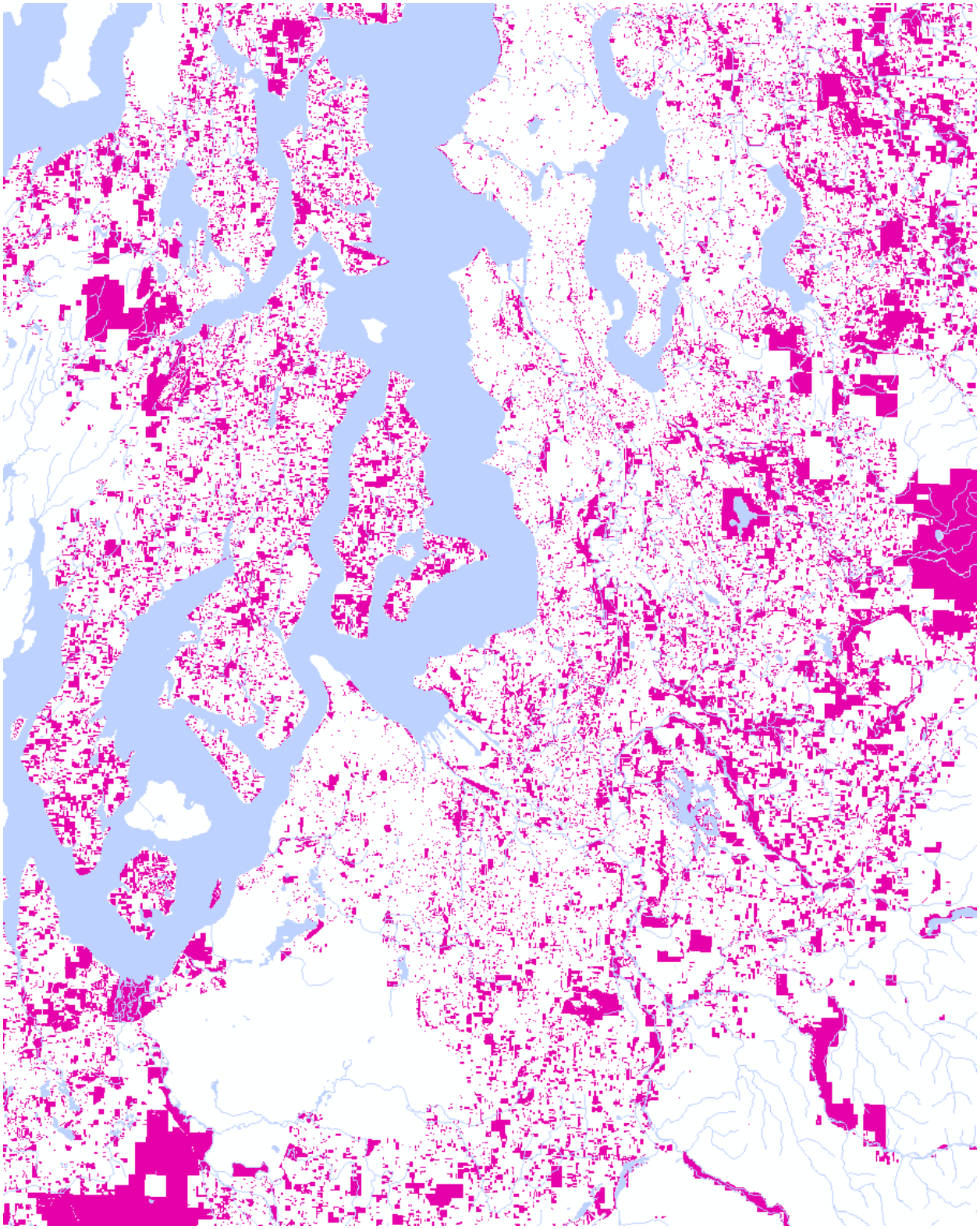


Figure 5: Undeveloped Parcels



ATTACHMENT 2

TACOMA SMELTER PLUME

MAPPING PROJECT

Development of a geostatistical mapping methodology

Prepared for:

Department of Ecology
State of Washington
Olympia, WA 98504-7600

Prepared by:

Dr. Pierre Goovaerts
PGeostat, LLC
11487 Highland Hills Drive
Jerome, MI 49249-9588

Date issued: December 12, 2012

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List of Figures

Section 1.0 Objectives

The objectives of this project were:

1) to revise the mapping methodology-protocol for the Tacoma Smelter Plume (TSP) Boundary Map,
2) to model geostatistically the spatial distribution of soil arsenic in parcels in TSP area and to provide Ecology with a computer code to post-process these results and compute statistics at the block-group level, such as expected fraction of parcels exceeding a given arsenic threshold or the probability that a given fraction of parcels exceeds a given arsenic threshold.
3) to design a sampling scheme that accommodates the resources available (i.e. number of samples) and criteria set by Ecology (e.g. target areas of largest uncertainty about arsenic concentrations or the probability of exceeding specific arsenic levels), and
4) to compare the power of different composite sampling design options when deciding whether the average arsenic concentration within a residential parcel exceeds or not a threshold of 90 or 100 ppm.

The third objective was accomplished for Vashon Maury Island (VMI) and results were shared with Ecology in July 2012, leading to the collection of 63 additional residential samples. The fourth objective was accomplished in October 2012 and resulted in the memorandum listed in Appendix A. The present report will focus on the first two objectives.

A geostatistical approach was developed and implemented to: 1) incorporate wind rose information, elevation and field measurements in the geostatistical mapping of arsenic concentration estimates at the parcel level, and 2) compute the probability of exceeding specific arsenic levels at the parcel and block-group levels. A computer program documented in Appendix B was also written to allow Ecology to compute for each block-group within the modeled area:

- the mean arsenic concentration,
- the average (expected) number of parcels that exceeds a given Threshold **T'**,
- the probability that a fraction **X'** of the parcels exceeds a given Threshold **T'**, and
- the fraction **X** of the parcels for which the threshold **T** is exceeded with a given probability **P**.

Both parameters **X'** and **T'** are specified by the user who can choose multiple fractions and thresholds per run. The parameters **T** and **P** can also be specified by the user but only one value is allowed by run.

The models and resulting maps for soil arsenic concentrations over the Tacoma Smelter Plume study area will be used by Ecology to support program planning, yard cleanup, community education, and permitting components of the agency's overall program to address the Tacoma Smelter Plume site. As Ecology conducts its yard cleanup program, a large number of additional sampling results in selected block group areas will become available. Periodic updates to the models to incorporate this new information are planned by Ecology. The maps of soil arsenic concentrations may change to some degree with new data (Goovaerts *et al*., 2008b).

Section 2.0 Caveats and limitation

It is noteworthy that the model is known to be incomplete in some respects. For example, since age of residence was not available for many sampled properties it is not included in the model, but it is very likely to be an important variable affecting soil arsenic concentration. Thus, a meta-analysis of model outputs may be beneficial for program implementation. A block group where a large fraction of residential parcels are for homes built well after smelter operations ended (1986), with few or no sampling results for those residences in the modeling data set, may be overestimated by model outputs.

The model is also based on the data sets as provided by Ecology, and thus there is no consideration of any non-representative factors such as "selection bias" among volunteers for sampling. For example, some interview comments for the 2012 VMI sampling suggested that a larger fraction of those volunteering to be sampled could have greater concerns over arsenic contamination and have engaged in "self-remediation" efforts.

Some larger parcels characterized as residential are known to have relatively small cleared and developed areas within a largely forested or undeveloped area (e.g., VMI). The models for undeveloped parcels can provide information useful for characterizing the undeveloped portions of such properties, which are likely to have higher soil arsenic concentrations than shown by the residential models for the small developed portions of the parcels.

Section 3.0 Data available

All the data were prepared by Ecology and provided to the consultant in electronic format. The data consisted of:

1. Average arsenic concentrations measured in a series of residential and undeveloped/forested parcels located in the study area displayed in Figure 1. Most samples were located in Pierce and King Counties, with the remaining samples found in Thurston, Kitsap and Snohomish Counties. All measurements were standardized to a 0 to six inches depth for uniformity.

   All data as provided by Ecology were used for modeling. There was no outlier screening on the data as received. Ecology did do some outlier screening and removed a small number of results before providing the modeling data set. Ecology will prepare a separate memorandum on the process for compiling the modeling data set.
2. Geographical coordinates of each sample projected using Lambert_Conformal_Conic and NAD_1983_HARN_StatePlane_Washington_South_FIPS_4602_Feet.
3. Projected shape file for all 1,452 block groups and 583,291 residential and undeveloped parcels located within the study area. Note that in a few cases on VMI where a block group was spatially larger Ecology subdivided into two smaller areas used as block groups for modeling.
4. Separation distance and azimuth with respect to the location of the smelter for all field samples and parcels. The reference point for the smelter was the tall stack. This modeling effort did not attempt to make any distinctions based on different locations for low-level fugitive emissions (e.g., at the converter building) versus tall stack emissions.
5. DEM attributes (elevation, slope and aspect) computed for all field samples and block-groups.

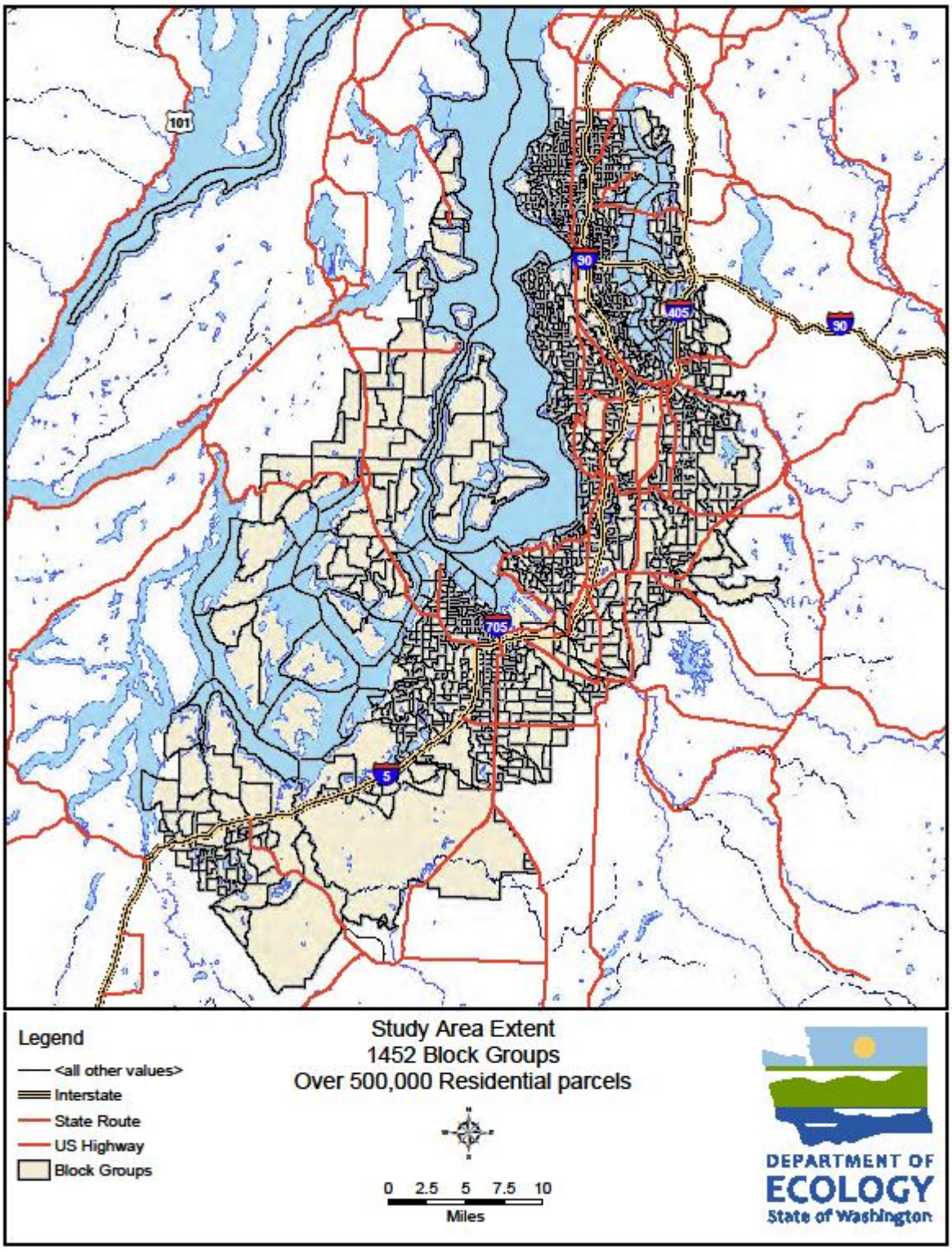

Figure 1: Extent of the study area with the location of 1,452 block groups that will be modeled using geostatistics.

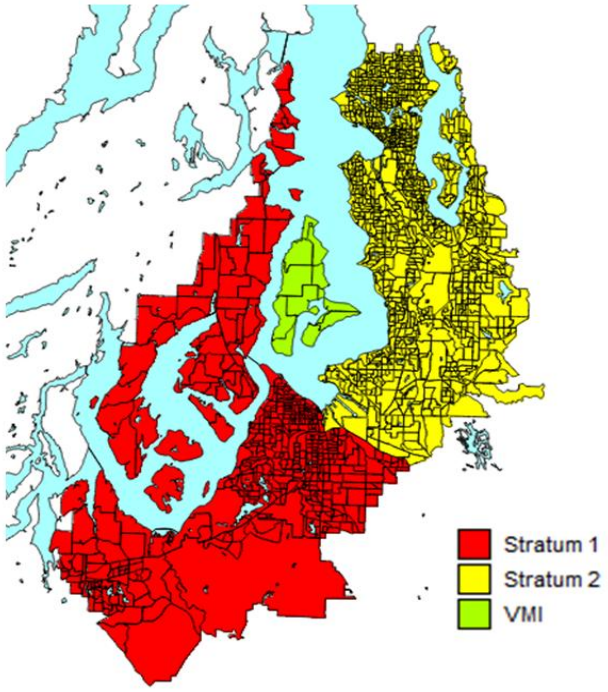

Figure 2: Stratification of the study area into three zones that were modeled separately using geostatistics. The polygons correspond to block-groups within each stratum.

The study area was stratified into three zones (Figure 2) that were deemed more homogeneous than the entire study area for modeling purposes: Stratum 1, Stratum 2, and VMI. The wind rose for the Tacoma Smelter has two dominant (seasonal) downwind directions. The division of the study area into zones is consistent with a separation of primary downwind areas according to the wind rose. Table 1 lists for each zone the number of block-groups, as well as the number of samples and parcels for residential and/or undeveloped land use. Additional parcel types, such as commercial, industrial, or agricultural, are not included in either the residential or undeveloped parcel counts.

Table 1: Number and type of data for each stratum. Duplicate parcels or parcels that coincide with sampled locations were discarded.

Object number	**Stratum 1**	**Stratum 2**	**VMI**
Block groups	454	987	11
Residential parcels	173,621	322,912	4,972
All parcels	200,932	374,614	7,745
Residential samples	4,133	422	99
Forest samples	234	239	157

The sample locations in each zone are displayed in Figure 3 with a color code to distinguish residential samples from forest samples. These maps highlight the very different spatial patterns for sampling results for the two types of properties, based on land use and development patterns over the study area. Forest samples cover a much larger area than residential samples that are confined to the nearshore and the vicinity of the smelter for Stratum 1 and 2. The majority of samples on VMI were collected on undeveloped parcels. In addition, some larger parcels characterized as residential are known to have relatively small cleared and developed areas within a largely forested or undeveloped area.

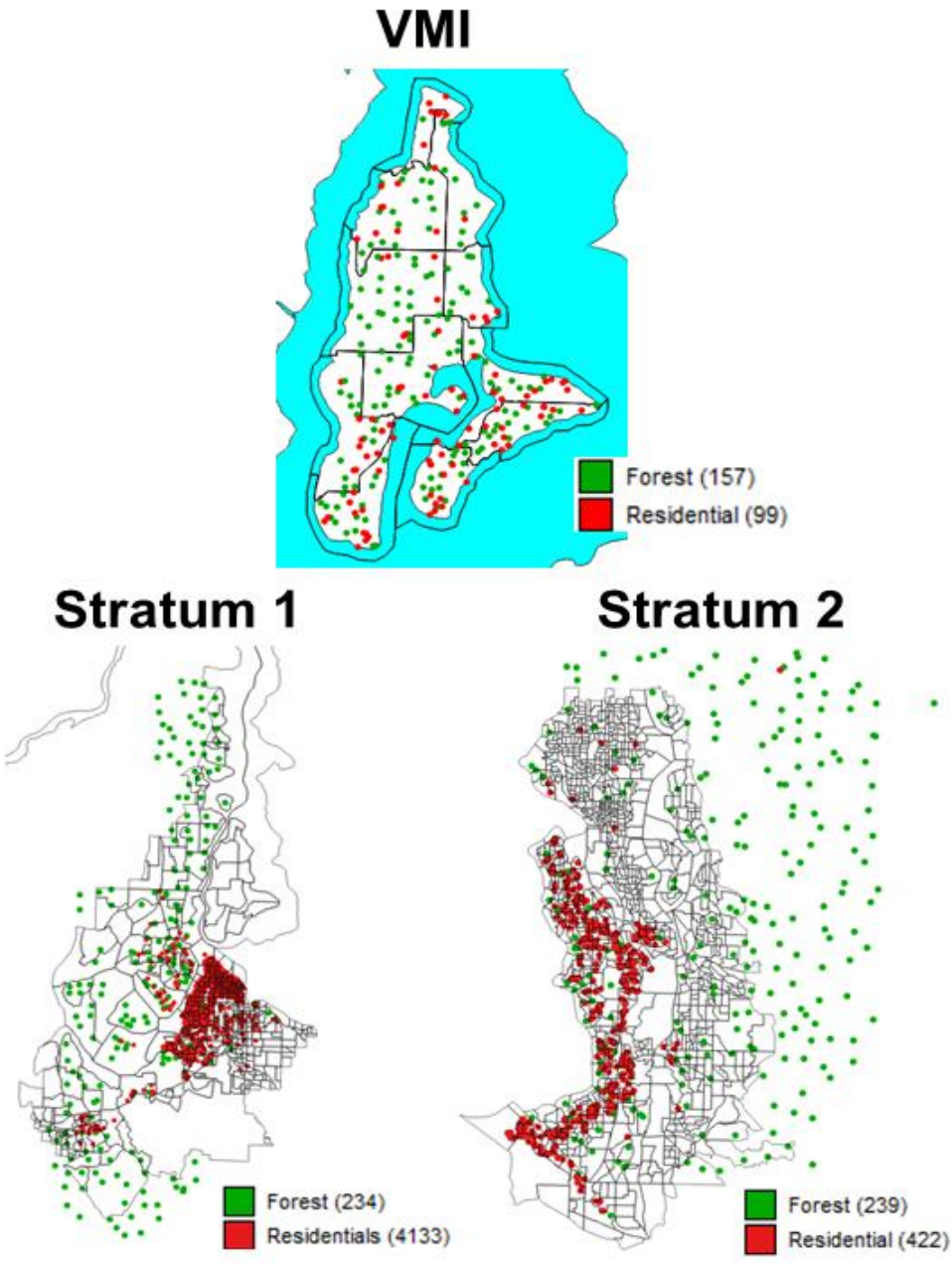

Figure 3: Location of residential and forest samples within the three modeling zones. The polygons correspond to block-groups within each stratum.

Section 4.0 Methodology

The methodology was based on the approach published in Goovaerts *et al.* (2008a). The general approach is described first, followed by implementation details for each of the three zones.

The following methodology was implemented for each of the three modeling zones and the residential versus residential&undeveloped parcels (i.e. 6 scenarios in total):

1. All arsenic concentrations (forest and residential values) were first normal score transformed to correct for the strongly positively skewed sample histogram.
2. The transformed arsenic values were regressed against covariates (explanatory variables) that were based on separation distance and azimuth with respect to the location of the smelter, as well as DEM-related attributes (elevation, slope and aspect); see Section 4.1 for details. This regression model was used to predict the arsenic concentration and standard error at each sampled location and at the geographical centroid of each parcel.
3. The spatial variability of regression residuals (i.e. field data minus trend model) was modeled using the semivariogram.
4. To assess the accuracy of the geostatistical model created using the parameters derived in Steps 2 and 3, a cross-validation was conducted that involved removing one observation at a time and re-estimating it by multiGaussian kriging (Goovaerts, 1997) using the remaining observations. The prediction error and correlation between predicted and observed values were computed to detect any bias in the predictions. Cross-validation results were also used to compare alternative kriging techniques; in particular the type of trend model for each zone was selected such as to minimize the magnitude of prediction errors (see Section 4.1).
5. Sequential Gaussian simulation (Goovaerts, 1997) was used to simulate the spatial distribution of arsenic values conditionally to the sampled data, the trend model inferred in step 2 and the pattern of correlation modeled in step 3. 999 realizations were generated over all 583,291 parcels located in the study area (Table 1). To assess the consistency of the geostatistical model, the field data were overlaid over the average of all 999 simulated maps. No visual inconsistencies were noticed and the models were deemed adequate and not in need of revision
6. Parcel-level simulated values were post-processed using the program *SIMU-postprocessing .exe* described in Appendix B to compute for each of the 1,452 block-groups: 1) the mean arsenic concentration, 2) the average (expected) number of parcels that exceeds a given Threshold **T'**, 3) the probability that a fraction **X'** of the parcels exceeds a given Threshold **T'**, and 4) the fraction **X** of the parcels for which the threshold **T** is exceeded with a given probability **P**. Both parameters **X'** and **T'** are specified by the user who can choose multiple fractions and thresholds per run. The parameters **T** and **P** can also be specified by the user but only one value is allowed by run.

Steps 1 through 5 were accomplished by the commercial GIS Software *SpaceStat* (BioMedware, 2011). The last step was executed using the program *SIMU-postprocessing.exe* developed by Dr. Goovaerts and provided to Ecology as part of this report.

Section 4.1 Spatial trend modeling

A key step in the approach was the creation of a spatial trend model by regression (Step 2). The information provided by Ecology, such as azimuth and DEM-related attributes, needed to be processed before being used as explanatory variables in a regression model. For example, the geographical proximity of the directions of azimuth 1° and 360° is not captured by the raw azimuth values and requires a trigonometric transform (Figure 4). The following new variables were thus created:

- Cos(Azimuth-θ_1)
- Log(Distance to smelter)× |Cos(Azimuth-θ_2)|
- Log(Distance to smelter)
- Cos(Aspect-θ_3)

Where the offset angles θ_1, θ_2 and θ_3 were selected through a sensitivity analysis that aimed at maximizing the linear correlation between the covariate and the transformed arsenic values. These four variables were combined with the slope and elevation attributes to form a set of six potential covariates. Stepwise linear regression indicated that for all three zones and two types of land use two variables consistently did not contribute significantly to the regression model: slope and Cos(Aspect-θ_3). Thus, the spatial trend model took the form:

$$Trend = Intercept + b1 \times Cos(Azimuth-\theta_1) + b2 \times Log(Distance\ to\ smelter) \times |Cos(Azimuth-\theta_2)| + b3 \times Log(Distance\ to\ smelter) + b4 \times Elevation$$

For VMI, the trend model for both residential and undeveloped parcels was fitted using the forest data because they were more numerous, covered the island uniformly (Figure 3) and reflect the undisturbed impact of the smelter on the soil in the island. For the two other zones, the trend model for residential parcels was fitted using the residential data, although for Stratum 1 the offset angles θ_1, θ_2 and θ_3 were selected using the forest data that provides a better coverage in terms of azimuth. Forest data were used to build the trend for the undeveloped parcels.

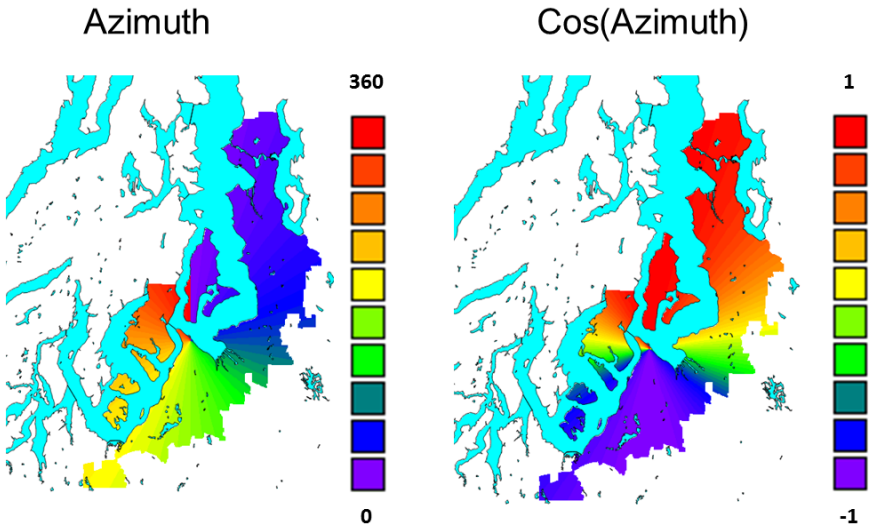

Figure 4: Map of the azimuth value with respect to the location of the smelter before and after trigonometric transform.

Section 5.0 Main results

The end-result of the simulation procedure is a set of 999 maps of simulated parcel-level concentrations for each of the six combinations of modeling zone and land use. The most straightforward way to summarize this information is to simply average the simulated arsenic values within each block-group and across all 999 simulations. These average block-group concentrations are mapped in Figures 5 and 6 for the three zones combined and the residential and undeveloped scenarios, respectively. These maps illustrate the higher arsenic concentrations observed on undeveloped parcels, closer to the smelter and along the prevailing wind directions.

Each simulated map was also analyzed to compute for each block-group the fraction of parcels where a given arsenic concentration threshold **T** is exceeded. The distribution of 999 fractions (one for each simulation) can then be used to compute empirically for each block-group:

- The average number of parcels that exceeds a given threshold **T**; see Figure 7 for an example with **T**=50ppm for residential parcels.
- The probability that the fraction of parcels above a given threshold **T** exceeds a given percentage **X**; e.g. simply by counting the proportion of fractions above a given percentage **X**. Figures 8 and 9 show an example for **T**=80 ppm and **X**=25% for the residential and undeveloped scenarios, respectively.
- The fraction of parcels that exceeds a given threshold **T** with a probability **P**; see Figure 10 for an example with **T**=50ppm and **P**=0.8 for residential parcels.

Other values for parameters **T**, **X** and **P** can be easily considered using the program *SIMU-postprocessing .exe* described in Appendix B.

Section 6.0 References

1. BioMedware, 2011. SpaceStat User Manual version 2.2., BioMedware, Inc., New York, 311 pp.
2. Goovaerts, P. 1997. *Geostatistics for Natural Resources Evaluation*. Oxford Univ. Press, New-York, 483 p.
3. Goovaerts, P., Trinh, H.T., Demond, A.H., Franzblau, A., Garabrant, D., Gillespie, B., Lepkowski, J., and P. Adriaens. 2008a. Geostatistical modeling of the spatial distribution of soil dioxin in the vicinity of an incinerator. 1. Theory and Application to Midland, Michigan. *Environmental Science & Technology*, **42**(10), 3648–3654.
4. Goovaerts, P., Trinh, H.T., Demond, A.H., Towey, T., Chang S.-C., Gwinn, D., Hong, B., Garabrant, D., and P. Adriaens. 2008. Geostatistical modeling of the spatial distribution of soil dioxin in the vicinity of an incinerator. 2. Verification and calibration study. *Environmental Science & Technology*, **42**(10), 3655-3661.

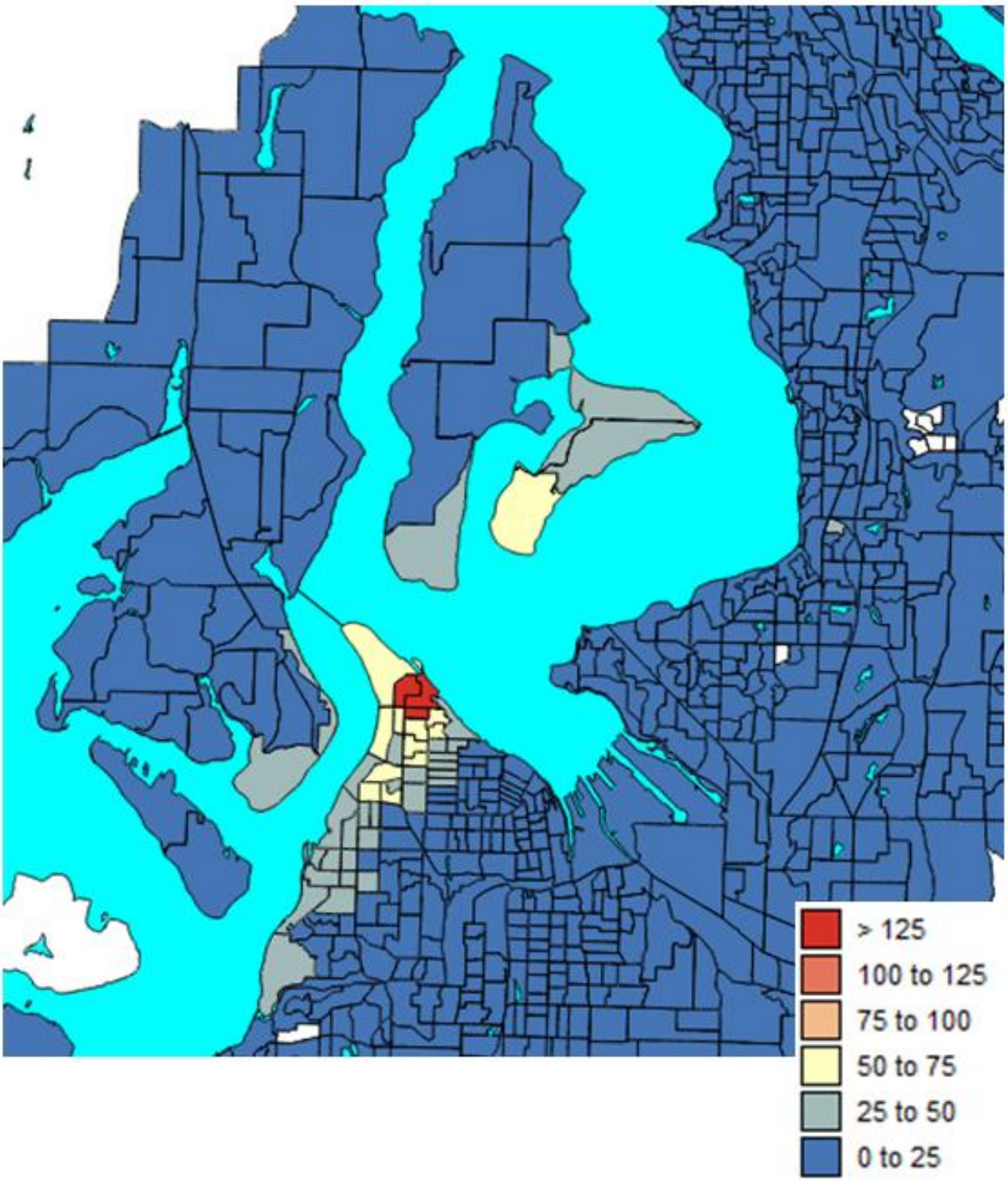

Figure 5: Map of average block-group arsenic concentration estimated using residential data within the three modeling zones.

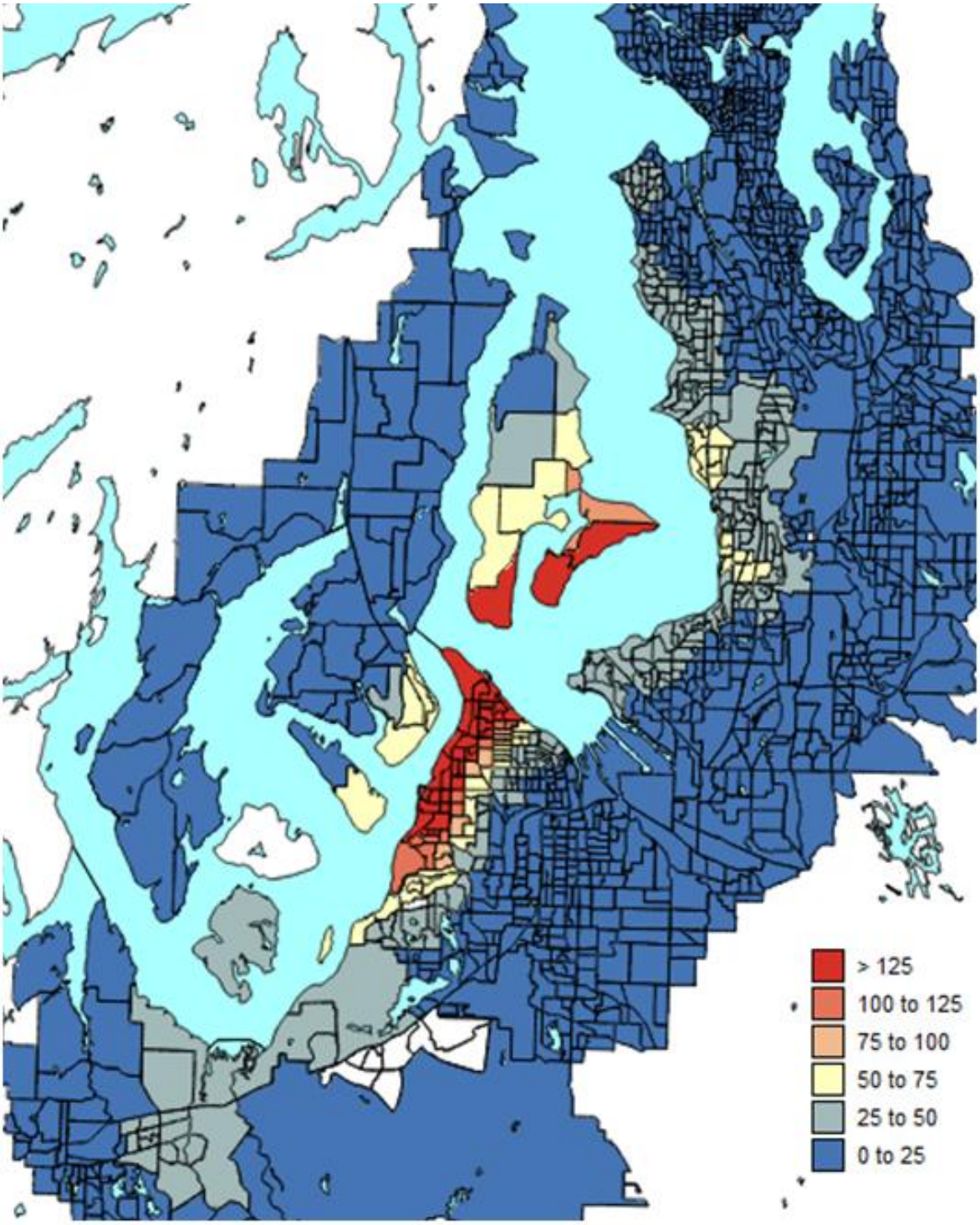

Figure 6: Map of average block-group arsenic concentration estimated using forest data within the three modeling zones.

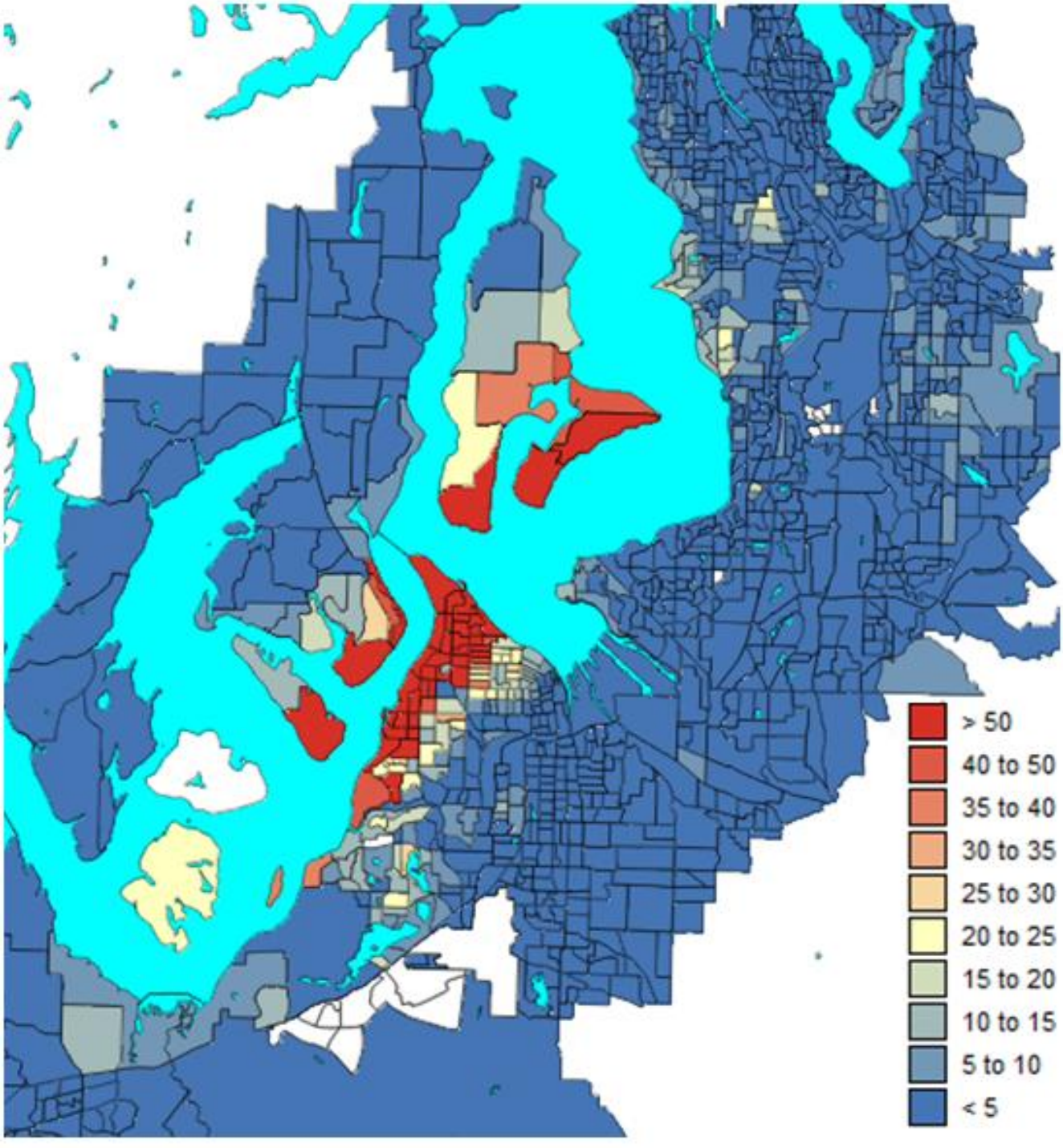

Figure 7: Map of the average number (expected value) of residential parcels per block group that exceed an arsenic concentration of 50 ppm.

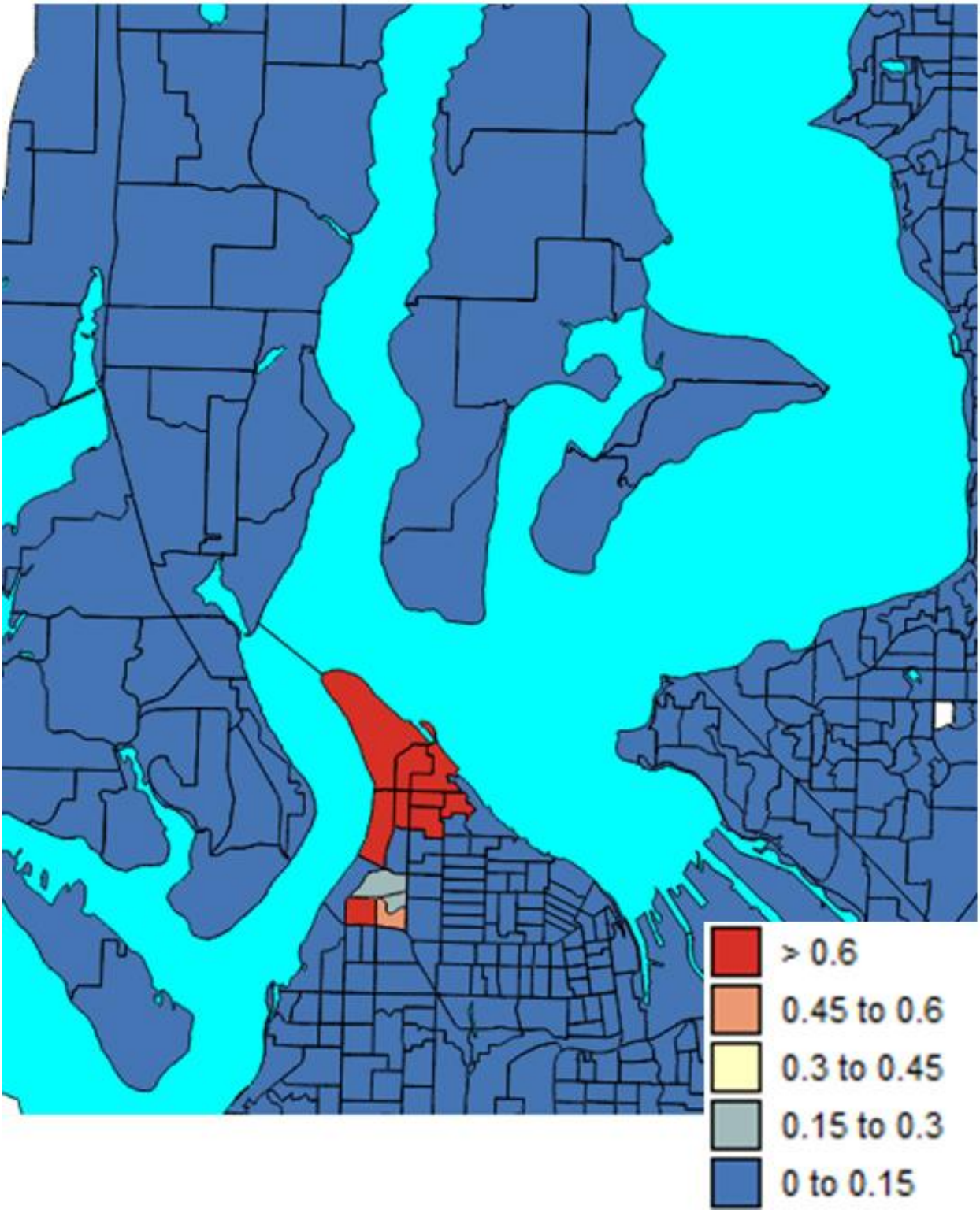

Figure 8: Map of the probability that at least 25% of the parcel within a block-group exceeds an arsenic concentration of 80 ppm estimated using residential data.

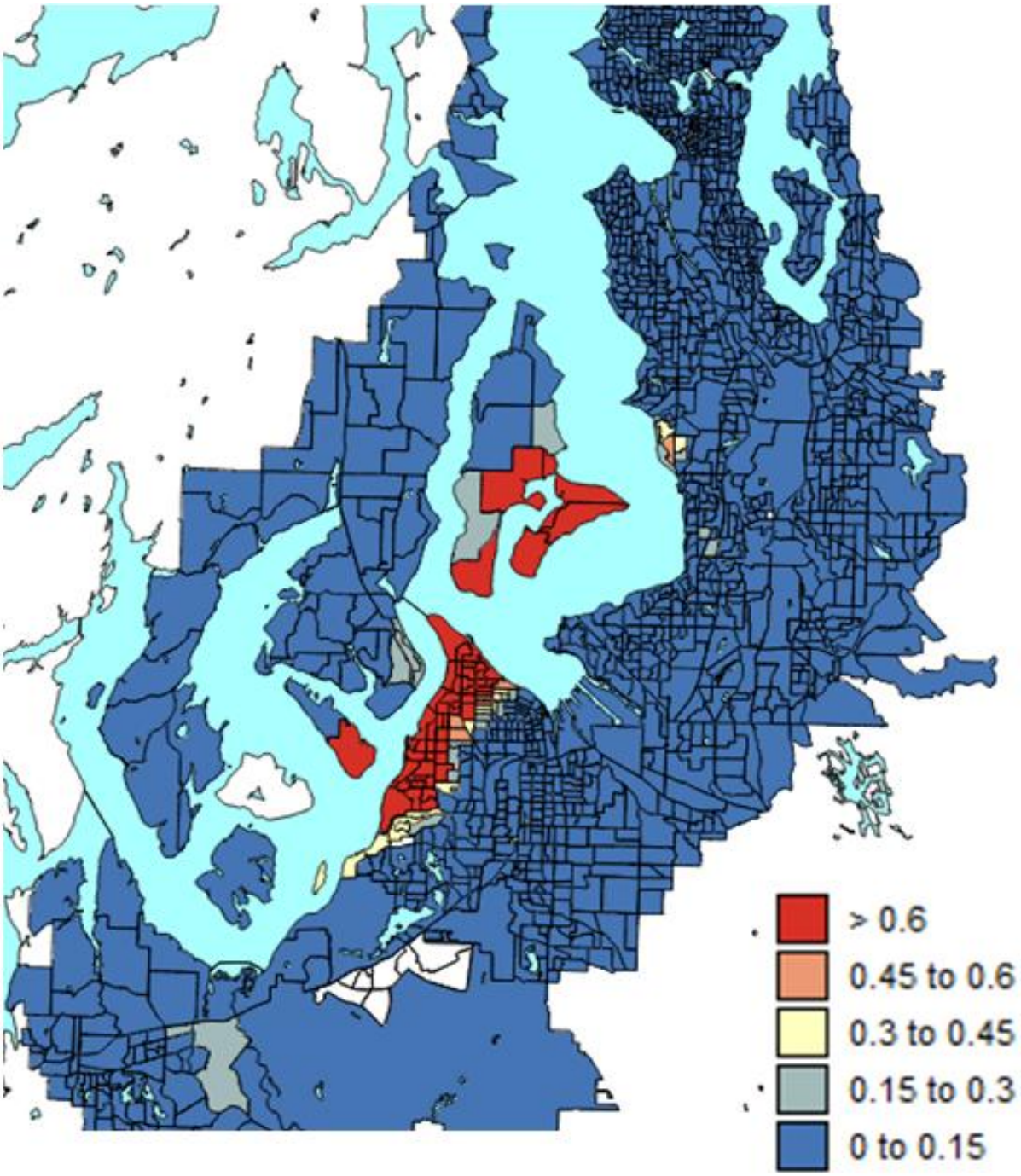

Figure 9: Map of the probability that at least 25% of the parcel within a block-group exceeds an arsenic concentration of 80 ppm estimated using forest data.

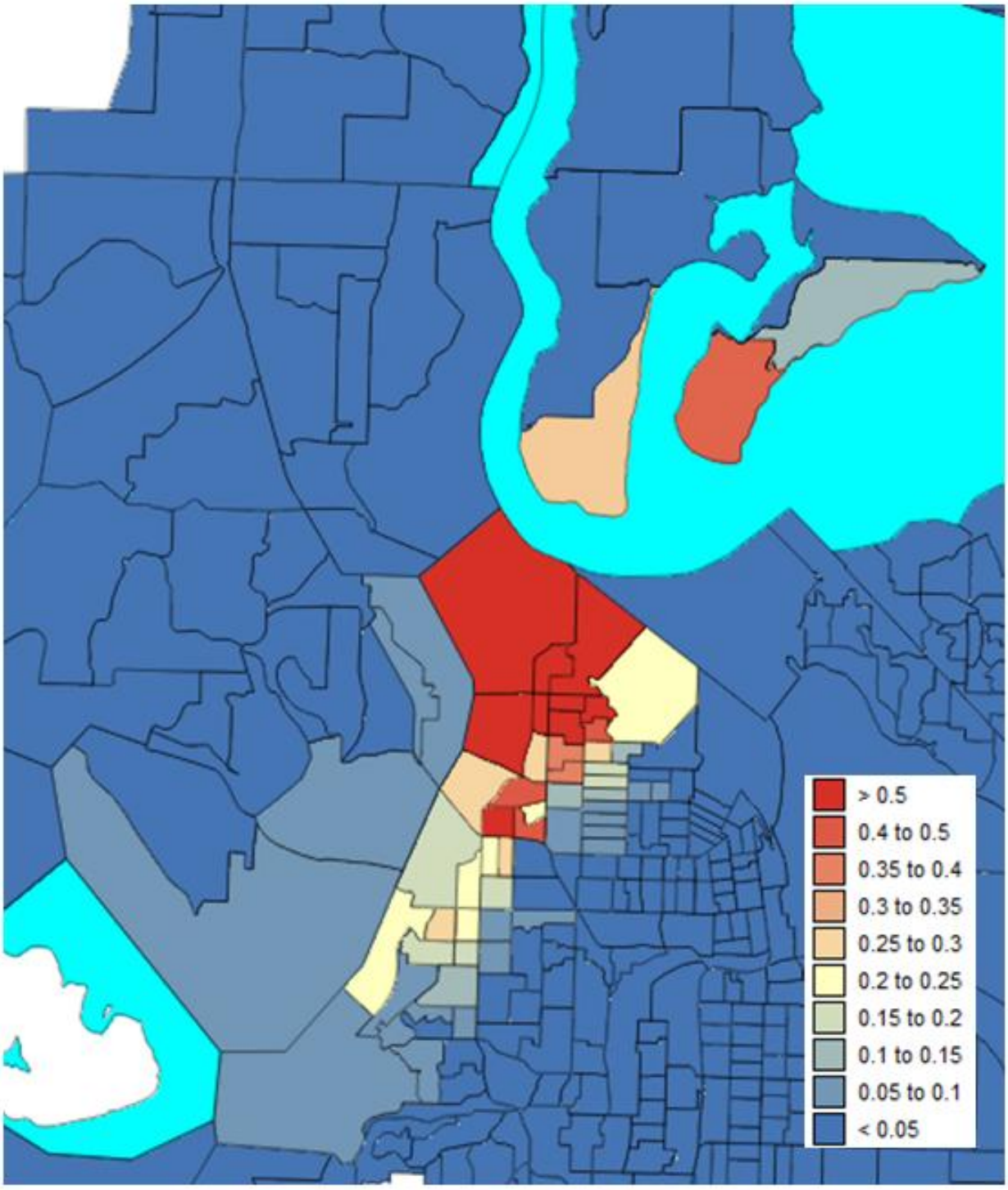

Figure 10: Map of the estimated fraction of residential parcels per block group that exceed an arsenic concentration of 50 ppm with probability above 0.80.

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Appendix A: Memorandum on the design simulation study

The objective of this design simulation study is to estimate the rates of false positives and false negatives expected when deciding whether the average arsenic concentration within a residential parcel exceeds or not a threshold of 100 ppm. This simulation study was conducted under the following conditions:

1. Six different sampling design options that included: composite samples at 4:1, 6:1, 8:1, 10:1, and 12:1, as well as an MIS design at 30:1 for comparison purposes.
2. A range of true arsenic concentrations covering 0 to 220 ppm
3. Two decision criteria: 90 and 100 ppm

The computation of the rates of false positives and false negatives requires knowledge of the distribution (i.e. histogram) of arsenic concentrations within a residential parcel. To avoid making assumptions regarding the shape of this distribution, e.g. arbitrary choice of a normal or lognormal distribution, this distribution was derived empirically from a set of 3,531 observations collected over 539 residential parcels. The number of soil samples per parcel varies between 4 and 25, with a median of 6.

The simulation approach proceeds as follows:

- Define 40 overlapping classes of arsenic level with a width of 25 ppm and covering the range 0-220 ppm; i.e. [0, 25], [5,30], [10,35], …, [190, 215], [195, 220].
- For each class,
    1. Group the observations from all residential parcels whose mean value falls within that class. The number of observations per class ranges from 2,213 for the class [0, 25 ppm] to 32 for the class [195 ppm, 220 ppm] with a median of 108. This step thus generates 40 histograms or empirical distributions of arsenic concentrations.
    2. Draw randomly 30 values from the empirical distribution corresponding to that class. This is accomplished by drawing a random number uniformly distributed between 0 and 1 and selecting the corresponding quantile in the distribution (e.g. a random number of 0.5 would lead to the selection of the median of the distribution). The resolution of each distribution was increased by conducting a linear interpolation between values.
    3. Compute the mean of the first 4, 6, 8, 10, and 12 drawn values to mimic each composite sampling design option. The MIS design corresponds to the mean of all 30 values.
    4. Compare the simulated “sampled mean” to each of the two decision criteria and classify the parcel as clean (sampled mean < decision criterion) or contaminated (sampled mean ≥ decision criterion) with respect to the target threshold concentration of 100 ppm arsenic identifying yards for active soil cleanup.
    5. Decide whether the classification based on the sampled mean is correct or not by comparing the active cleanup threshold of 100 ppm to the “true mean” which is identified with the mean of the empirical distribution. If the classification is incorrect, flag it as a false

positive (sampled mean ≥ criterion and true mean < criterion) or false negative (sampled mean < criterion and true mean ≥ criterion).

6. Repeat steps 1 through 5 many times (i.e. 9,999 simulations in this case) to compute the percentage of false positives and false negatives. Compute also the percentage of simulations where the "sampled mean" exceeds the decision criterion in order to estimate the probability of detection.

Power curves are created by plotting the probability of detection (vertical axis) versus the "true mean" (horizontal axis); see Figures A1 and A2. The percentage of false positives (case where "true mean" < 100 ppm) and false negatives (case where "true mean" ≥ 100 ppm) are tabulated for 12 [out of 40] classes of arsenic concentrations centered around 100 ppm (Tables A1 and A2).

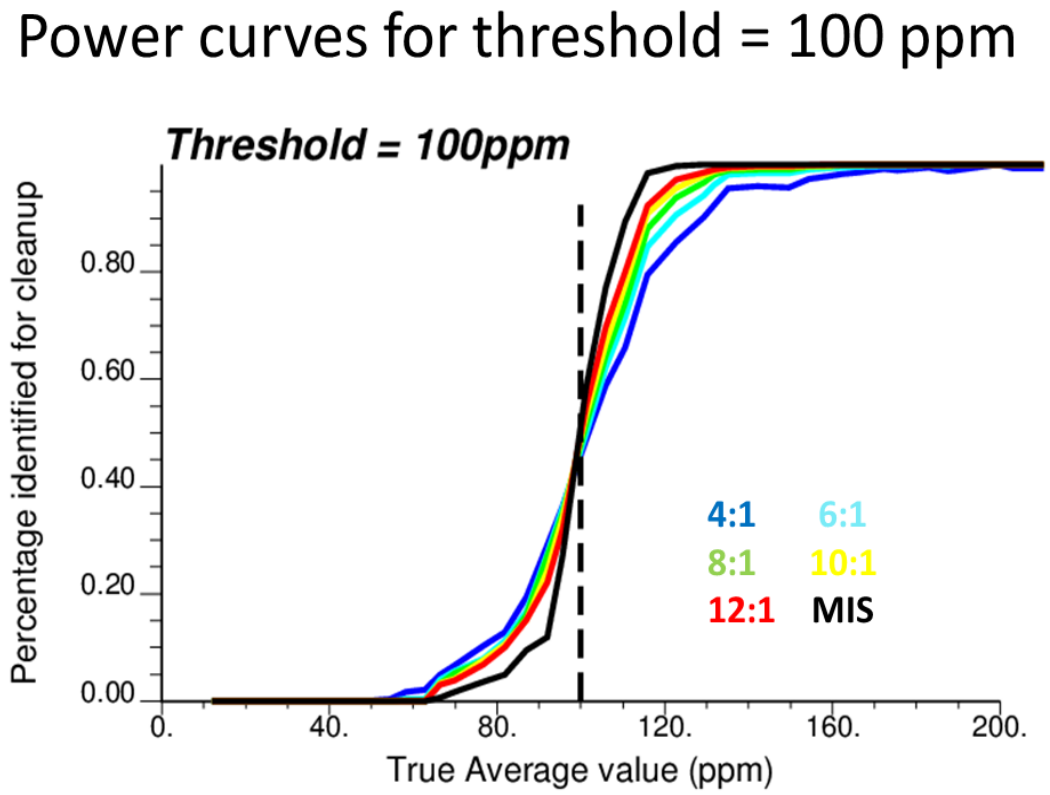


Figure A1: Power curves that illustrate the probability of detecting parcels as being above 100 ppm obtained using six different composite sampling designs for a series of underlying true arsenic concentrations (threshold for decision rule = 100 ppm).

Table A1. Percentages of parcels wrongly classified as being above or below 100 ppm obtained using six different composite sampling designs for a series of underlying true arsenic concentrations (threshold for decision rule = 100 ppm). These percentages were derived from the power curves in Figure A1.

	Composite design	4:1	6:1	8:1	10:1	12:1	30:1
True values	Type of error						
69.9 ppm	False+	6.7	5.6	5.2	4.2	3.9	1.7
76.7 ppm	False+	10.3	7.9	7.5	7.6	6.8	3.6
81.9 ppm	False+	12.9	11.3	10.2	10.6	10.1	5.0
87.0 ppm	False+	19.5	16.7	16.1	15.1	15.1	9.5
92.0 ppm	False+	29.1	27.5	27.0	24.3	22.1	11.9
95.6 ppm	False+	36.3	36.0	35.0	34.2	32.0	27.1
101.3 ppm	False-	51.2	50.0	48.2	46.5	44.9	41.3
105.9 ppm	False-	41.2	37.8	35.6	33.3	30.3	22.9
110.5 ppm	False-	34.0	28.4	25.7	22.5	19.9	10.7
115.9 ppm	False-	20.5	15.3	11.9	9.1	7.6	1.6
122.7 ppm	False-	14.5	9.3	6.1	4.4	2.8	0.3
129.3 ppm	False-	9.9	5.7	3.3	2.0	1.4	0.0

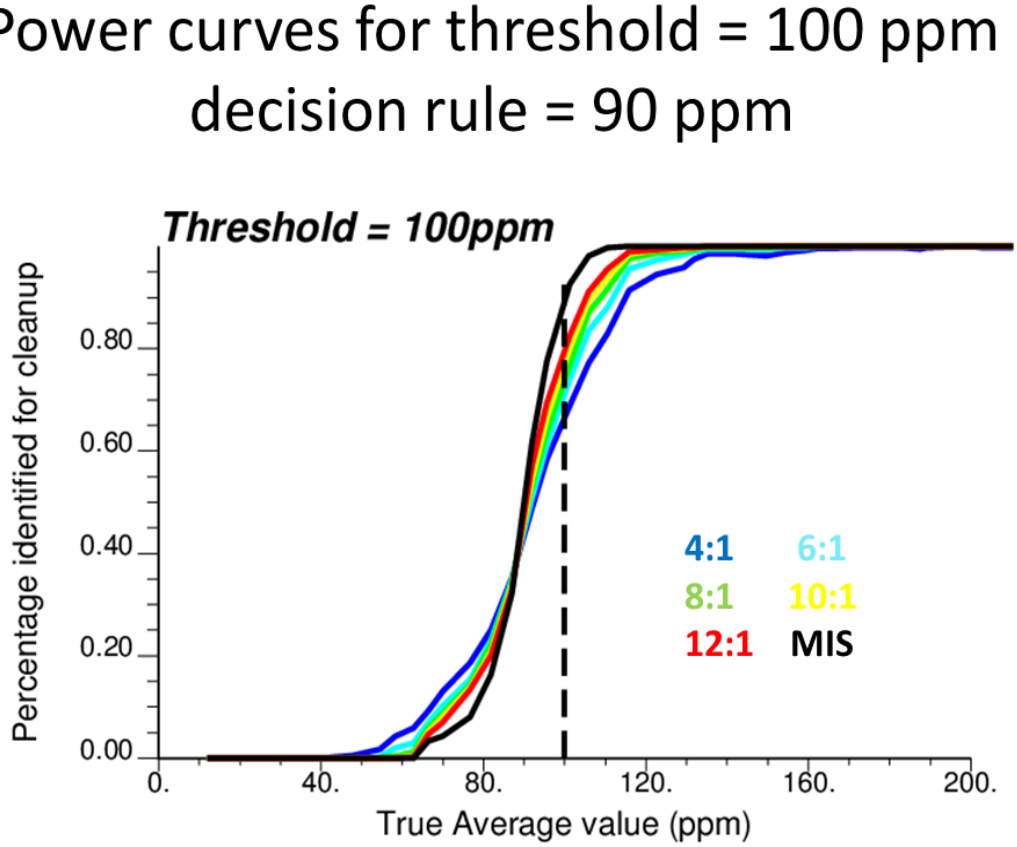


Figure A2: Power curves that illustrate the probability of detecting parcels as being above 100 ppm obtained using six different composite sampling designs for a series of underlying true arsenic concentrations (threshold for decision rule = 90 ppm).

Table A2. Percentages of parcels wrongly classified as being above or below 100 ppm obtained using six different composite sampling designs for a series of underlying true arsenic concentrations (threshold for decision rule = 90 ppm). These percentages were derived from the power curves in Figure A2.

	Composite design	4:1	6:1	8:1	10:1	12:1	30:1
True values	Type of error						
69.9 ppm	False+	13.0	10.2	8.7	8.0	6.9	4.3
76.7 ppm	False+	18.6	15.4	14.3	13.8	13.4	8.0
81.9 ppm	False+	25.1	22.9	22.2	20.8	20.1	16.3
87.0 ppm	False+	35.2	34.8	34.3	33.7	32.8	32.2
92.0 ppm	False+	48.9	50.9	53.2	54.7	57.3	61.8
95.6 ppm	False+	58.5	61.3	63.8	66.6	69.5	77.7
101.3 ppm	False-	31.1	26.0	23.0	19.8	17.4	7.4
105.9 ppm	False-	22.8	16.5	12.8	10.5	8.8	1.9
110.5 ppm	False-	17.0	11.9	8.3	6.2	4.4	0.3
115.9 ppm	False-	8.5	4.4	2.5	1.5	1.0	0.0
122.7 ppm	False-	5.5	2.7	1.3	0.7	0.6	0.0
129.3 ppm	False-	4.1	1.6	0.9	0.5	0.2	0.0

Appendix B: Software for post-processing simulation results

The executable *SIMU-postprocessing.exe* is a compiled FORTRAN code that executes the following tasks:

1. Read the arsenic values simulated at the parcel level for one of the three modeled areas (Stratum 1 & 2, VMI, see Figure B1) and one type of land use (developed or undeveloped). These values are stored in two text files: *Simu1-500.txt* (simulations 1 through 500) and *Simu501-999.txt* (simulations 501 through 999) located in a folder named according to the area and type of land use (Figure B2). Each text file includes as many rows as parcels and each column corresponds to a different simulation. The first column in both files lists the parcel ID in the original shape file.
2. Compute for each block-group within the modeled area: 1) the mean arsenic concentration, 2) the average (expected) number of parcels that exceeds a given Threshold **T'**, 3) the probability that a fraction **X'** of the parcels exceeds a given Threshold **T'**, and 4) the fraction **X** of the parcels for which the threshold **T** is exceeded with a given probability **P**. Both parameters **X'** and **T'** are specified by the user who can choose multiple fractions and thresholds per run. The parameters **T** and **P** can also be specified by the user but only one value is allowed by run.
3. Create a Comma Separated Values file (.csv extension) with the results which can then be opened with Excel, merged with the corresponding block-group shape file using the *Target_FID* attribute, and mapped in ARCGIS available at Ecology.

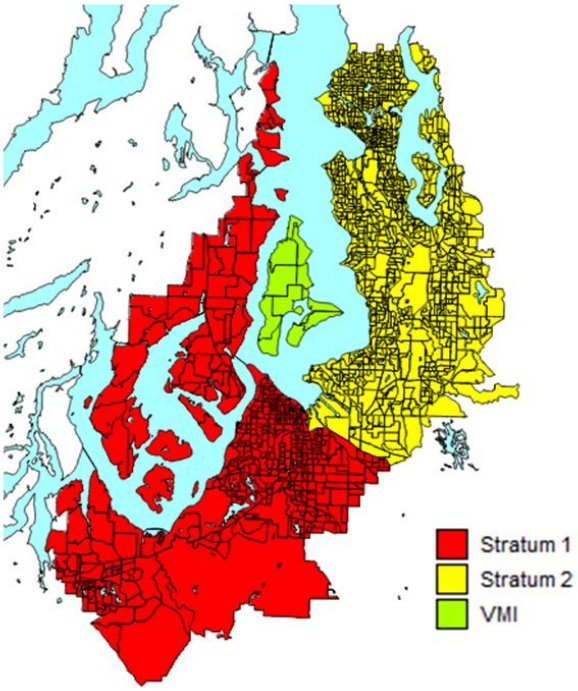


Figure B1: Stratification of the study area into three zones that were modeled separately using geostatistics. The polygons correspond to block-groups within each stratum.

Figure B2 shows a screenshot of the main folder *WA Simulation post-processor* that includes:

- The executable *SIMU-postprocessing.exe*
- One output file *Results_VMI-undeveloped.csv* with results for undeveloped parcels on VMI (Figure B3)
- Six folders that include: 1) text files with the arsenic values simulated at the parcel level for one of the three modeled areas (Stratum 1 & 2, VMI, see Figure B1) and one type of land use (developed or undeveloped), 2) a text file "*block-groupID.dat*" that lists for each parcel the ID of the corresponding block-group, and 3) a text file "*Target_FID.txt*" that lists for each block-group the *Target_FID* attribute.
- One folder with the block-group shape file for each of the three modeled areas.

In order to run, the executable needs to remain located in a folder that includes the six data folders.

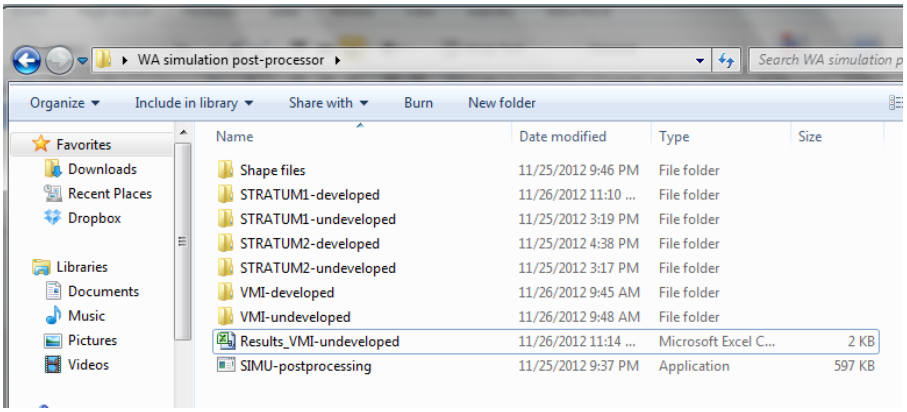
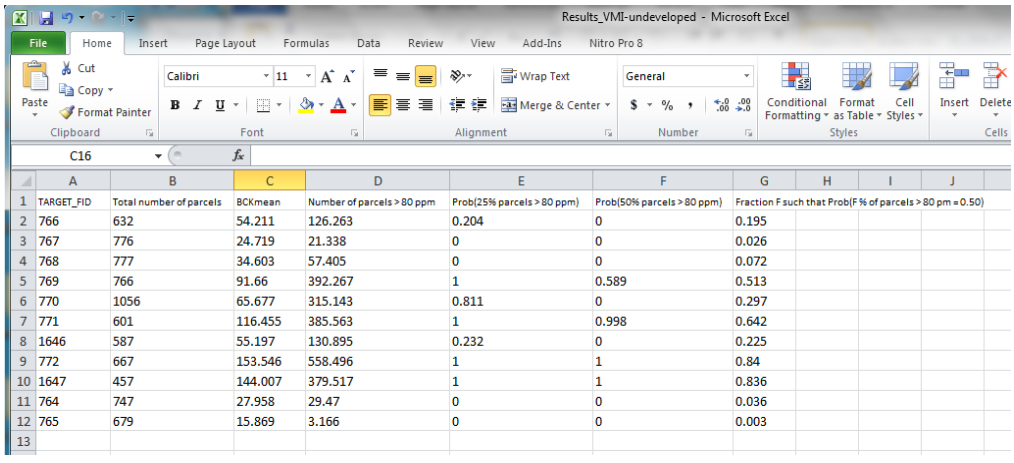


Figure B2: Screen shot of the folder that includes the executable *SIMU-postprocessing.exe*, six folders with simulated parcel values, a folder with the block-group shape files, and one results file.



	A	B	C	D	E	F	G
1	TARGET_FID	Total number of parcels	BCKmean	Number of parcels > 80 ppm	Prob(25% parcels > 80 ppm)	Prob(50% parcels > 80 ppm)	Fraction F such that Prob(F % of parcels > 80 ppm = 0.50)
2	766	632	54.211	126.263	0.204	0	0.195
3	767	776	24.719	21.338	0	0	0.026
4	768	777	34.603	57.405	0	0	0.072
5	769	766	91.66	392.267	1	0.589	0.513
6	770	1056	65.677	315.143	0.811	0	0.297
7	771	601	116.455	385.563	1	0.998	0.642
8	1646	587	55.197	130.895	0.232	0	0.225
9	772	667	153.546	558.496	1	1	0.84
10	1647	457	144.007	379.517	1	1	0.836
11	764	747	27.958	29.47	0	0	0.036
12	765	679	15.869	3.166	0	0	0.003
13							

Figure B3: Screen shot of the output file "*Results_VMI-undeveloped.csv*" that includes results for undeveloped parcels on VMI: Target_FID and total number of parcels for each block-group, mean arsenic concentrations (BCKmean), the expected number of parcels that exceed 80 ppm, the probability that 25% or 50% of the parcels exceed 80 ppm, and the fraction of parcels for which a threshold of 80 ppm is exceeded with a 0.5 probability.

To execute the program, the user will proceed as follows:

1. Click on the executable to open a *Command Prompt Window* similar to the one shown in Figure B4.
2. Select the region to be analyzed by entering a number between 1 and 3: 1=Stratum1, 2=Stratum2, 3=VMI.
3. Select the type of land use to be considered by entering the number 1 or 2: 1=Developed parcels, 2=undeveloped parcels.
4. Enter the number of soil arsenic thresholds you want to consider (maximum = 10)
5. Enter the value for each of the arsenic thresholds (ppm)
6. Enter the number of fraction values you want to consider (maximum = 5)
7. Enter the value for each of the fractions (percentage)
8. Decide whether you want to compute the fraction of the parcels for which the threshold **T** is exceeded with a given probability **P**.
9. If you answered yes at Step #8, enter the value of the probability **P**, then the value of the threshold **T**.
10. Wait until the *Command Prompt Window* closes, which indicates that the program has run without problem. Errors during the execution will stop the program and generate warning messages in the prompt window.
11. Once the program has run, open the Comma Separated Values output file with Excel.
12. Import the results and the shape files provided with this program into any mapping software using the *Target_FID* attribute as merging key.

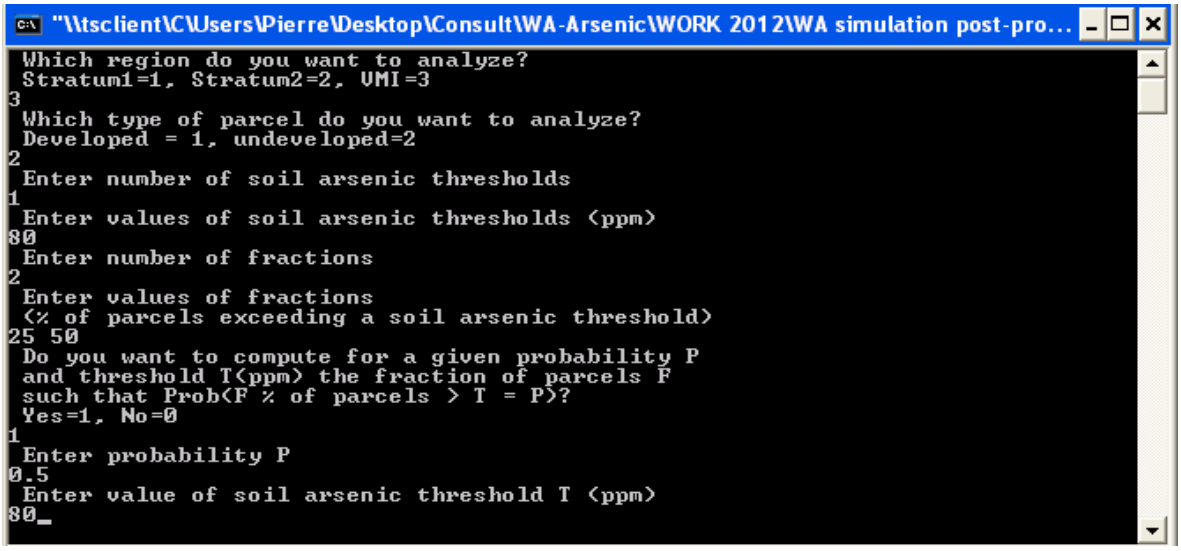


Figure B4: Screen shot of the *Command Prompt Window* opened by clicking on the executable *SIMU-postprocessing.exe*. The parameters entered by the user generated the output file "*Results_VMI-undeveloped.csv*" displayed in Figure B3.

Appendix C

Appendix C

Sampling and Analysis Plan

Program Design and Implementation Plan

Appendix C - Sampling and Analysis Plan

Tacoma Smelter Plume
Residential Yard Sampling and Cleanup Program

June 2013

Toxics Cleanup Program
Washington State Department of Ecology
Olympia, Washington

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Abstract

The Washington State Department of Ecology (Ecology) developed this Sampling and Analysis Plan (SAP) to describe the objectives and procedures for the soil sampling and analysis that will be carried out under the Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program (Yard Program). Ecology will fund the Yard Program using funding from the State of Washington's 2009 settlement with Asarco for the future costs of cleaning up the Tacoma Smelter Plume (TSP). Currently, Ecology has scheduled implementation of the Yard Program through 2021.

The TSP is primarily contaminated by arsenic and lead in soil. The Yard Program includes residential properties within the most highly contaminated areas of the TSP defined as the Service Area. The Service Area is the area where average arsenic may be over 100 parts per million. The Yard Program will provide resources for soil sampling at single family residential and multi-family residential properties within the Service Area.

This SAP supports the collection of sampling and laboratory analytical data regarding arsenic and lead levels at residential properties. This information will be used to help guide the cleanup decision process and to support community outreach and education portions of the Yard Program. The SAP also provides guidance on sampling and laboratory analytical procedures for post-cleanup soil sampling.

Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program Overview

This Sampling and Analysis Plan (SAP) has been prepared as part of the Washington Department of Ecology's (Ecology's) Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program (Yard Program) for the Tacoma Smelter Plume (Figure C-1). This SAP has been prepared as guidance to field personnel to direct sampling and analysis of soil under the Yard Program. Decision-making for which properties to include in Yard Program sampling program is discussed in the Program Design and Implementation Plan (Program Design) for the Yard Program.

The SAP includes guidelines for:

- **Sampling**: conducting property use surveys, determining where on a property to sample, collecting shallow soil samples, and transferring samples to a laboratory for analytical testing of arsenic and lead.
- **Post-cleanup sampling**: collecting soil samples from the base of excavations, conducting XRF field screening for arsenic and lead, and transferring samples to a laboratory for analytical testing of arsenic and lead.

Data collected through implementation of this SAP are to meet project-specific Decision Quality Objectives (DQOs) and Measurement Quality Objectives (MQOs), as described in the Quality Assurance Project Plan (QAPP).

Data Quality Objectives

The DQOs for the Yard Program are 1) to provide sufficient field and chemical analytical data to base decisions for property cleanups; 2) provide data to support risk reduction strategies such as use of geotextiles, and education and outreach materials; and 3) document cleanups.

Objectives of the soil sampling program are to:

- Identify where people have the most direct contact with soil on their property (i.e., high use areas).
- Sample shallow soils (i.e., top six-inches) to document the levels of arsenic and lead in these high use areas.
- Document post-cleanup arsenic and lead levels.

Soil Action Levels

The Ecology Model Toxics Control Act (MTCA) Method A cleanup levels for unrestricted land use for arsenic and lead are included in Table C-1. For the Yard Program, Ecology developed action levels to guide cleanup activities that are higher than the MTCA Method A cleanup levels. The site-specific action levels were specifically developed to provide a reasonable threshold to guide cleanup activities and reduce the risk from high arsenic and lead levels in shallow soil.

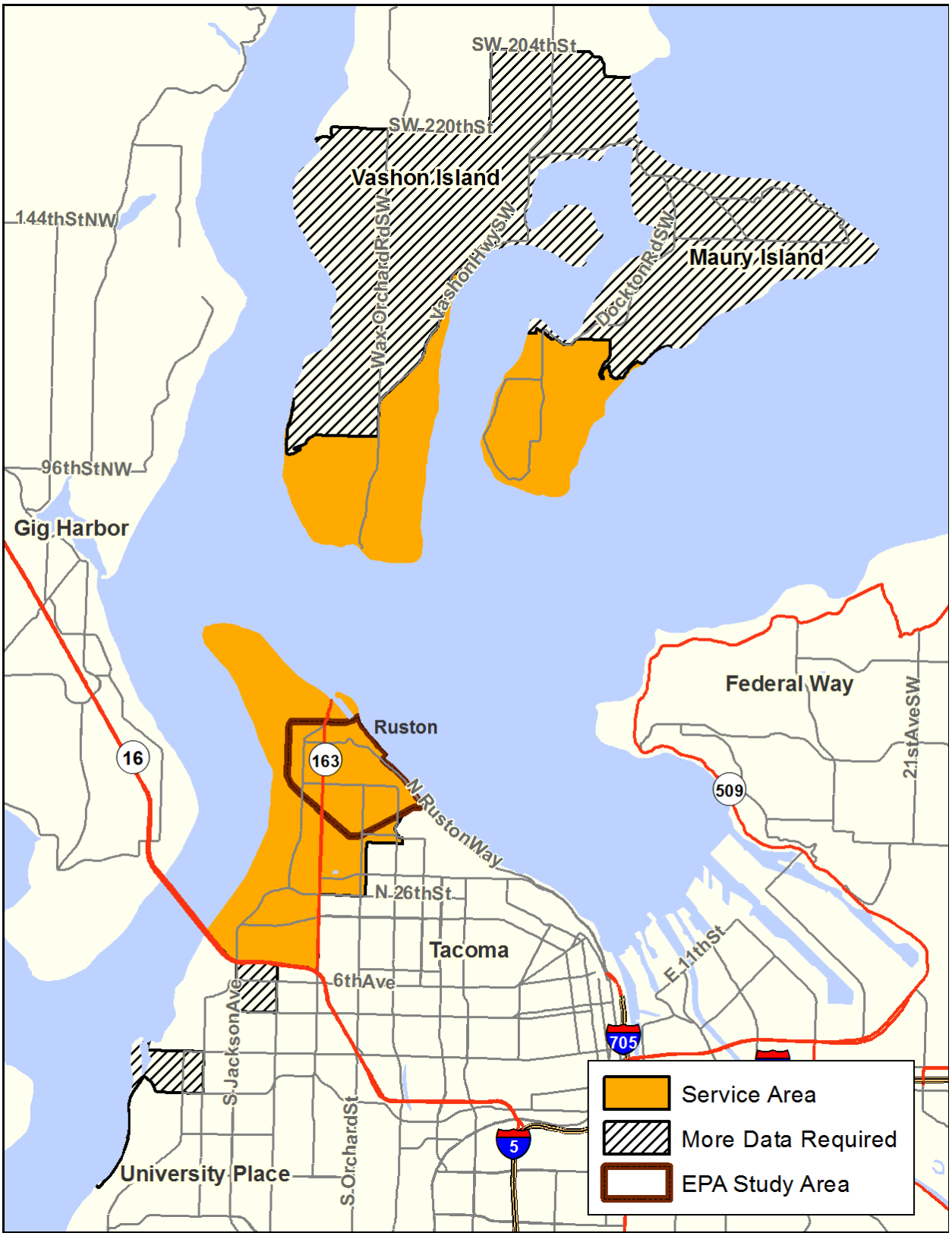


Figure C-1. Program Service Area Boundary

Table C-1: Constituents of Concern and Action Levels

Constituent of Concern	Yard Program Action Levels (parts per million [ppm])	State Cleanup Levels (ppm)
Arsenic	100 (90-threshold level)	20
Lead	500	250

Results from soil sampling to be conducted during the Yard Program will be compared with cleanup and action levels. Based on available funding, Ecology may offer soil sampling and cleanup of residential properties when contaminant levels exceed the action levels. Because of uncertainty associated with analytical results, Ecology will actually target units with average soil sampling results of 90 ppm arsenic and above for cleanup. Lead action levels remain as summarized in Table C-1. For properties where arsenic levels are less than 90 ppm and lead levels are less than 500 ppm, but are between the cleanup and threshold levels (20-90 ppm arsenic or 250-500 ppm lead), education and outreach materials, and technical assistance will be provided regarding healthy actions and potential cleanup alternatives.

Property Use Evaluations

As the initial step in sampling activities, property use will be evaluated to determine where sample locations will be best placed on a given property.

Property-Specific Evaluations and Development of Sampling Plans

Small Lots – up to 0.25-acre

Properties up to 0.25 acres will be divided into two units, usually the front and back yards. Side yards will be incorporated in one of the two units using natural dividing lines such as fences, planters, or the corners of buildings.

Large Lots – greater than 0.25-acre

For properties greater than 0.25 acres, sample locations will be located on each property based on where people tend to spend the majority of time potentially in contact with soil. In other words, locations where the property is used the most and where residents would potentially have regular contact with soil at greater frequencies, such as play areas. These types of high use areas are defined in the following sections.

Multifamily Properties and Playgrounds

For multifamily properties, sample locations will be located on each property based on where people tend to spend the majority of time potentially in contact with soil. In other words, locations where the property is used the most and where residents would potentially have regular contact with soil at greater frequencies, such as play areas, gathering areas and gardens where residents regularly work in the soil.

Sample locations will take property owner and resident concerns and priorities into consideration. Site specific features to be field checked and inventoried during the qualitative assessment will include identification of the locations of buildings, outbuildings, driveways, walkways, paths or other pavements, landscaped beds, steep slopes, wooded areas, wetlands, livestock areas, and/or other areas excluded from the sampling program.

High Use Areas

High use areas for each property will be evaluated during initial visits and interviews with the property owner/residents. High use areas are defined as areas on the property where residents report to spend the majority of their time and come into contact with soil. High use areas could include one or more of the following:

- Lawns
- Play areas
- Seating areas
- Picnic areas
- Unpaved walking paths
- Annual and vegetable gardens where residents work in the soil
- Paths, trails, or other bare dirt areas that are frequently used/accessed

In general, samples will be obtained from a pre-determined area not greater than approximately 0.25 acres in total size generally located near the home. For multifamily housing, the total area sampled may be larger than 0.25 acres.

In addition, up to two educational samples may be obtained from small and large properties, if requested by the property owner or resident. The educational samples, or units, would incorporate areas of special interest that otherwise would have been excluded from sampling under the Yard Program.

Exclusions from Sampling for Cleanup Eligibility

Areas of properties that will be excluded from the Yard Program include the following areas and considerations. Some of these areas may be sampled as educational units if requested by the property owner.

- **Inaccessible areas,** such as lawn or gardens enclosed by brick or stone walls that cannot be easily moved or temporarily relocated.
- **Permanently landscaped beds**, including landscaping at property boundaries, and large tracts of invasive species such as English ivy. In some instances Ecology may consider removal of large, permanently landscaped beds, but will not replace in kind. For example, a permanently landscaped bed could include: 1) greater than 50% perennial woody plants (excluding nonnative invasive species) that are at least 2 feet in height; 2) recurring areas with bark mulch or other permanent cover, and/or 3) greater than 75% native groundcover (e.g. kinnick kinnick, salal, etc.) and/or perennials.
- **Special plants** will not be replaced in kind. Ecology can avoid damage to some plants and/or avoid working in areas if requested by the Property owner.
- **Raised beds with imported soil.** If determined during the property interview that raised beds were constructed using local soil, the raised beds will be sampled as part of the Yard Program.
- **Steep slopes** and areas approximately 10 feet from the toe or head of a steep slope. Steep slopes greater than approximately 30% grade (about 16.7 degrees inclination, or 3.3 Horizontal:1 Vertical) and greater than 10 feet tall. Potential for erosion problems and land sliding on steep slopes are defined as in the Pierce and King County Development Standards.
- **Retaining walls** and other structural features

- **Water structures**, creek banks, wetlands
- **Forested areas**, or other unimproved/undeveloped areas
- **Livestock areas,** barns, dog runs
- Areas under **permanent/semi-permanent structures** (pavement, decks, concrete pads); sheds, and/or wood piles. If the property owner desires to have sampling completed beneath these features, they can remove the items prior to sampling.

Other areas not listed here may be excluded from the Yard Program at Ecology's discretion. These areas deemed excluded for cleanup eligibility may be sampled as educational units.

Property Specific Sampling Plans

The property use evaluations will be used to create a property-specific sampling plan. In general, the sampling plan will be comprised of an interview form to determine site specific features, an aerial photograph with site layout, and a sample collection form. The interview form will initially be mailed to the property owners/occupant along with the Access Agreement and educational/outreach materials. Examples of these documents are included in Appendix E of the Program Design.

Units

The following provides the protocols for delineating units for the purposes of sampling activities.

Unit Designation

Residential properties will be divided into units based on property size. A unit is an area that is a subdivision of a larger site/property/parcel and can be isolated for targeted characterization or cleanup. Units may vary in size and in usage, and therefore risk exposure. Accurate characterization of units is fundamental to the success of the residential yard cleanup design for a target property. Ecology will determine average arsenic and lead soil levels within a unit based on results of the composite samples.

Small Properties

Properties up to 0.25-acres in size shall be classified as small properties. Small properties shall have no more than two units per property. Units will be central to and expand outward from the property primary residence, generally the front and back yards of an average city lot. One composite sample will be collected and submitted for laboratory analysis for each unit designated for a residential property, for a maximum of two composite samples collected for a small parcel.

Large Properties

Residential properties over 0.25-acres in size will be classified as large properties. Large properties shall be divided into no more than four units based on property land use. Units and acreage will be central to and expand outward from the property primary residence. The units will be placed where residents are likely to have the highest percentage of direct contact time with shallow soil. One composite sample will be collected and submitted for laboratory analysis for each unit designated for a residential property, with a maximum of 4 composite samples collected for a large parcel.

Multifamily Housing

Multifamily housing properties may be divided into multiple units, up to the number of households living on the property. The units will be defined as high use areas, where residents are likely to have the highest percentage of direct contact time with shallow soil. Each unit will be no more than 0.25 acres in size. One composite sample will be collected and submitted for laboratory analysis for each unit.

Educational Units

Educational units will be additionally assessed if requested by property owners or residents. These educational units may include areas described under exclusions from sampling for cleanup eligibility (e.g., permanently landscaped beds or raised gardens). A maximum of two educational samples will be sampled per property. Therefore including both regular yard samples and educational samples, a total of up to four units could be sampled per small property and up to six units total per large property. Educational samples will be obtained using the same sampling and compositing methods as used for yard and cleanup samples. Sample results will be provided in the report to the property owners. However, results from educational samples will not be included in the geo-statistical model updates for the Yard Program, nor will be used to determine cleanup for a property.

Unit Types

Properties will also have the type of units defined with letters. This will enable Ecology to know what type of unit was sampled.

- Y will be a regular yard sample.
- E will be an educational sample for a homeowner with no cleanup associated with this unit area.
- C will be a cleanup sample taken during the cleanup process.

Sampling Procedures

One composite soil sample will be collected from each unit and submitted for analytical testing. Sampling procedures are described in more detail in the following subsections.

Sampling Depths

Sampling Depths: During the sampling phase, composite soil samples will be collected generally from a depth interval of 0-6 inches below ground surface. In some cases, a composite soil sample may also be collected from a depth interval of 6-12 inches below ground surface (bgs). Up to two inches of grass/sod, bark, mulch, matted roots, or other top cover will be removed prior to sampling. Composite soil samples will consist of eight equal-volume soil samples that are obtained from 0-6 inches bgs. Subsample locations will be determined in the field based on access, property use considerations identified during the evaluation, and to provide adequate spatial coverage.

Post-Cleanup Sampling Depths: Following excavation of the top twelve to eighteen inches of soil, composite soil samples will be taken from the next six inches of soil at the bottom of the excavation for confirmation testing.

Field Sampling Methods

Soil samples will be collected using a stainless-steel push-probe, hand auger, spoon, hand trowel, or shovel (or similar device). The general procedure will be as follows.

1. Set grid or mark locations for subsample collection using pin-flags, stakes, or other marker.
2. Use auger, trowel, or shovel to remove surface materials (grass and roots) at each location. Save aside grass/sod plug to place back over hole.
3. Using push-probe, hand auger, spoon, hand trowel, or shovel, excavate and collect soil samples to a total depth of six inches bgs, taking care to prevent loose materials surrounding the excavation from falling in to the sample hole.
4. Place individual subsamples in a clean, stainless steel bowl or a zip top bag and homogenize by stirring and mixing to composite (mix) the soil. Composite soil samples shall consist of discrete aliquots of the same approximate volume. Soil samples must be mixed thoroughly to ensure that the sample is representative of the site conditions. Adequate mixing when using a round bowl for sample homogenization is achieved by stirring the material in a circular fashion, reversing direction, and occasionally turning over the material.
5. Following mixing, collect portion of the soil sample using gloved hand, spoon, or trowel and place into laboratory provided sample containers. Gloves should be changed and reusable equipment should be decontaminated between each unit.
6. Label sample container with unique sample number, sample time and date, sample location; note in field book/field logs, and log sample on chain-of-custody form.
7. Place labeled soil jars into a secure container and store in secured area pending shipment to analytical laboratory.
8. Replace excess sample materials into excavated sample holes and replace grass/sod plug, if applicable.
9. Decontaminate equipment between each unit. Decontamination of sampling equipment shall be performed to reduce the potential for cross-contamination. Decontamination will consist of a three step process: 1) physical removal of soil and debris from the reusable sampling material, 2) tap water rinse, and 3) final deionized water rinse.
10. Two photographs may be taken of each unit from different angles during the three phases of the sampling and cleanup effort: 1) prior to sampling; 2) during sampling; and 3) during and following cleanup activities.

Sample Handling Protocols

This section describes the sample handling requirements and field quality control (QC) sample requirements.

Sample Handling

Once composited soil samples are collected, labeled, logged, and placed into a cooler (or other secure shipping container), samples will be submitted to the laboratory in batches of approximately 20 composited soil samples per cooler or in the number collected that day. Soil samples will be submitted to the laboratory using chain-of-custody procedures.

Copies of the chains-of-custody forms will be placed into a zip top plastic bag taped to the inside lid of the cooler. One copy of the chain-of-custody form will be maintained by the field manager and one additional copy will be maintained by the laboratory project manager.

Field Quality Control Samples

Duplicates will be analyzed at a rate of 5% of the soil samples collected, or one duplicate sample per 20 samples. One duplicate sample will be collected per batch of samples if fewer than 20 samples are collected. Note: A batch is herein defined as six samples or more. No duplicate samples will be collected if five or fewer samples are collected for a given sampling task. Duplicates should be collected as the sampling program progresses and neighborhoods or by census block groups (as described in Chapter 4 of the Program Design), such that duplicates are collected for 5% of the total block group samples. At least one duplicate sample should be collected for each neighborhood block group sampled.

Sample Containers, Preservatives, and Holding Time Requirements

Sample integrity must be maintained during the course of sampling in order to assure QC. Once composited, soil samples will be placed into laboratory supplied 4 ounce glass sample jars, labeled, and logged on the chain–of-custody. Documentation procedures are further described in following sections. Samples shall be collected according to method requirements, and transported or shipped to an accredited laboratory within the recommended holding time identified in Table C-2.

Table C-2: Sample Container, Preservative, and Holding Time Requirements

Analysis Type	Method Number	Sample Container Volume Requirements	Recommended Sample Preservation Technique	Maximum Recommended Holding Time
Soil - Metals (Arsenic and Lead)	SW-846 Method 6010B or 6020	100-200 grams minimum; 4 ounce glass soil jar with Teflon-lined lid	None	6 Months

Samples will be submitted for analytical testing of arsenic and lead by United Stated Environmental Protection Agency (EPA) Method 6010 or 6020. Soil samples will be processed in the laboratory to obtain soil passing through a 2 millimeter (mm) sieve. Prior to digestion, the laboratory will remove the entire soil sample from its container, sieve as-is through a 2 mm sieve, then homogenize.

Laboratory analysis shall be conducted by a laboratory accredited by both Ecology and EPA.

Documentation

Field Data

A combination of a property evaluation forms, property photographs, sample logs/sheets, and chains-of-custody will be used to document field and sampling activities. Example field forms are included in Attachment B, and example interview and field sampling forms are included in Attachment C. Entries will include detail so that another person going to a property could reconstruct a particular situation without reliance on memory of the author. Field notebooks will be stored in the project file when not in use. The field notebooks will contain a variety of information including the date, starting and finishing time of activities, project number, documentation of safety meeting, weather, unexpected work stoppages due to change in conditions or safety moment, number and description of photographs, if taken (to be evaluated on a site-specific basis), and names of all sampling and/or investigative personnel present. All notebook entries shall be made in indelible ink, and each page initialed and dated by the sampler. The soil sample sheets shall include a full description of the sample, its origin, sampling time, date, and personnel. The sample will be assigned an identification code according to site-specific sample-naming protocols.

Chains-of-Custody

A chain-of-custody document supplied by the laboratory is filled out whenever samples are collected. The sample identification, date and time of collection, number of containers and analytical testing requested are all recorded on the chain-of-custody form. Sampler's signature and time and date of sample relinquishment to laboratory personnel are also recorded. A copy of the chain-of-custody form is obtained from the laboratory when turning over the samples and the copy is kept in the project file.

The filled in chain-of-custody forms will be verified to include the following:

- Contact and invoicing information.
- Correct sample nomenclature.
- Correct sample number, analysis and preservatives.
- Completed sample collection date and time.
- Any special handling or analysis instructions.

- Signatures documenting secure handling from the field personnel to the laboratory.

Sampling and Cleanup Documentation Naming Protocol

Sample identification or naming protocol for soil samples will be based on the facility code (predetermined location code), media being sampled (soil), and the depth at which the sample is obtained.

Sampling protocol (additional options for sampling during cleanup activities are indicated in bold):

1. County (17=King County, 27=Pierce County) (numbers are standard county codes)
2. Area of Access Group: AA through ZZ, Assigned when entered into Area wide Remediation Environmental Information System (AREIS) before sent access agreements
3. Facility Code 0001-9999 per access group
4. Unit Type: Y=Yard, E=Educational, and C=Cleanup Sample
5. Unit Number: 1, 2, 3, etc.
6. Depth interval: 1= 0-6 inches, 2= 6-12 inches, **3 = 12-18 inches, 4 = 18-24 inches**
7. Sample Type 4= regular, 5= duplicate, **6= XRF**

For example: **17-AA0001-Y1-1-4 =** King County, group AA, facility 0001, unit type Y", unit number 1, depth 1 (0-6 inches), regular sample.

Since the sample label will contain the date and time of sampling, this need not be included in the sample identification. Naming conventions are explained in more detail in Attachment E.

Post-Cleanup Sampling

The primary purpose of the post-cleanup sampling is to document arsenic and lead levels remaining in the top six inches of soil at the base of the excavation. Soil samples will be submitted to an analytical laboratory for analytical testing of arsenic and lead for post-cleanup documentation purposes. Additionally, field screening during the post-excavation sampling may be used to determine whether or not additional actions will be necessary.

Sampling Procedures

The post-excavation samples will be collected from the top six inches of the base of the excavation. Post-excavation sampling procedures will be performed in accordance with the sampling methods outlined previously. Example interview and cleanup sample documentation forms are included in Appendix E of the Program Design.

X-ray Fluorescence Screening

The use of XRF screening may be used to supplement the decision making process during the post excavation sampling efforts. XRF analyzers have proven capable of detecting arsenic above a

lower threshold limit of 10 ppm (Science Applications International Corporation, 2011). However, due to the decrease in accuracy at lower levels, XRF screening will only be used to confirm that soil at the bottom of post-cleanup excavations are above or below 100 ppm and 200 ppm. XRF field screening will be conducted in general accordance with EPA Method 6200 and the instrument manual for the XRF unit used.

The XRF field screening methodology is an in-situ method, such that no preparation of the soil sample is performed prior to the XRF measurement. Soil samples will be collected from the base of the excavation at eight subsample locations and composited into a stainless steel bowl and homogenized. The XRF screening will be performed on samples obtained from the top six inches of the base of excavations. One 8-part composite soil sample will be collected, homogenized, field screened with XRF. Care will be taken consistent with the composite sampling efforts to avoid collection of vegetative debris in the bags. An aliquot will be removed from the bowl and placed into a plastic bag and sealed for field screening using the XRF. The soil will be screened directly through the bag with an XRF analyzer. The screening samples will be analyzed for 120 seconds to measure total arsenic and lead levels. The results will be collected electronically by the XRF unit for later download and recorded in the field notes.

Evaluating XRF Screening Results

The XRF measurement will be compared against the arsenic action level of 100 ppm to determine if the installation of a geotextile membrane is warranted, as follows:

- If XRF results are less than or within 10% of 100 ppm, the soil sample will be submitted for analytical testing and the excavation will be immediately backfilled. If the XRF results are greater than 100 ppm but less than 200 ppm, a geotextile may be placed into the base of the excavation and backfilled with clean soil. Geotextile may be placed if soil concentrations are greater than 100 ppm; however, if site constraints do not permit placement of the geotextile, Ecology may elect not to install the geotextile.
- If XRF results are greater than 200 ppm, an additional 6 inches of soil will be excavated. If an additional six inches of soil is removed, a composite soil sample will be obtained from the new base of the excavation and screened using XRF.
- If XRF results from the new excavation base are greater than 100 ppm, a geotextile will be placed into the excavation prior to backfilling with clean soil. If XRF results are less than 100 ppm, no geotextile will be placed and the excavation will be backfilled with clean soil. The sample screened using XRF will also be submitted to the analytical laboratory for sample processing (drying and sieving) and analytical testing (digestion and analysis) and designated the post-cleanup confirmation analysis for the unit.

EPA Method 6200 requires the collection and laboratory analysis of confirmation samples at a frequency of at least one confirmation sample per 20 samples XRF screened. However, because soil at the base of all excavations will be analyzed both by XRF and using an analytical laboratory, the laboratory analysis will serve both purposes and will be conducted at a frequency greater than the required 1 per 20 samples.

XRF Calibration

The XRF analyzer will be calibrated at the beginning of daily activities and following equipment maintenance, correction of malfunction or change or update of the analyzer software. In addition, a standard reference material sample and a blank sample ("clean" quartz or silicon dioxide matrix) or

a site-specific reference material will be analyzed at the start of each work day. Furthermore, a calibration check will be performed at the close of each day. The performance and results of equipment calibrations as well as any errors or maintenance will be documented in the field log book.

Laboratory Analysis and Documentation

The collection and handling of analytical samples as well as the completion of field and analytical documentation will be performed in accordance with the procedures outlined in preceding sampling sections. Example field forms, including chain of custody, are included in Attachment B. Laboratory quality control procedures are discussed in the QAPP.

Data Management

Data generated during the Yard Program will be standardized and managed using four Ecology databases:

1. Property, resident, and owner specific information will be stored in Area wide Remediation Environmental Information System (AREIS)
2. Environmental data or sample results will be stored in Environmental Information Management System (EIM)
3. Sampling agreements, maps, and cleanup documents will be stored in Document Storage and Retrieval System (DSARS)
4. Property photos will be stored in Photo and Image Management System (PIMS)

In addition to the sample naming protocol described previously, data input into the four databases listed above will also be standardized. Procedures for standardizing data entry for the four databases are presented in Attachment E.

Investigation-Derived Waste Management

Investigation derived waste will consist of soil cuttings, decontamination water, and solid waste.

Any unused soil sample material will be returned back to the unit from which the sample was obtained. If needed, sample voids will be filled with existing site material or imported sand or topsoil and covered with the existing cover (gravel, grass, bark, etc.).

Decontamination water used for cleaning the sampling equipment will be disposed of within the unit where the samples were collected in low-use/low-traffic areas of the property. Care will be taken by sampling crews to dispose of water where it will not erode, pond, or harm existing plants, and sampling crews will use best judgment for where to place water for infiltration.

Solid investigation derived waste may consist of used gloves, paper towels, and disposable spoons/trowels or other sampling equipment. These items will be collected and secured in garbage bags, removed from the properties daily, and deposited as typical household waste in appropriate solid waste receptacles.

Health and Safety Program

A site-specific health and safety program will be developed by Ecology and/or contractors who will be working in the field to implement this SAP. The health and safety program will include at a minimum, identification of potential physical and chemical hazards, identification of key personnel, field personnel training requirements, contact information for field, management, and Ecology personnel, procedures to follow and forms to use if accidents occur, hospital route maps and contact info, and site travel routes.

References

Science Applications International Corporation (SAIC). 2011. XRF Data Evaluation, Everett Smelter Upland Area. Memorandum to Frank Reinhart, Washington State Department of Ecology. 14 June 2011.

Attachment A. Acronyms

ACRONYMS

AREIS	Area-wide Remediation Environmental Information System
bgs	below ground surface
DQO	data quality objective
DSARS	Document Storage and Retrieval System
Ecology	Washington Department of Ecology
EDD	Electronic data deliverable
EIM	Environmental Information Management
EPA	United States Environmental Protection Agency
mm	millimeter
MQO	Measurement quality objective
MTCA	Model Toxics Control Act
PIMS	Photo and Image Management System
Program Design	Program Design and Implementation Plan
ppm	parts per million
QAPP	Quality Assurance Project Plan
QC	quality control
SAP	Sampling and Analysis Plan
TSP	Tacoma Smelter Plume
XRF	X-ray fluorescence
Yard Program	Residential Yard Sampling and Cleanup Program

Attachment B - Example Field Forms

LOGO
UNIQUE PROPERTY ID

TAILGATE SAFETY MEETING

Project Name: Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program

Date: _____

Client: _____

Project No.: _____

Site Address: _____

Items discussed in this meeting:

Recommended PPE:

Hospital Location/Directions:

Attendance/Signatures:

Print Name/Company	Signature

_____ _____

Project Manager Date

LOGO
UNIQUE PROPERTY ID

Name: _____
Date: _____ Page _____ of _____

DAILY FIELD REPORT

Project No.: Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program
Task No.: _____
Site Name: _____
Weather: _____

Signature: _____ Date: _____

Hours: _____ on-site _____ travel _____ total

LOGO
UNIQUE PROPERTY ID

ADDRESS

CHAIN-OF-CUSTODY RECORD

Project Information	Analytical Information	Matrix Codes
Project Name: Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program		DW = Drinking Water GW = Ground Water WW = Water SW = Surface Water SO = Soil SL = Sludge OI = Oil LIQ = Other Liquid AIR = Air SOL = Other Solid WP = Wipe
Street:		
City: State: WA		
Project No.: PNR0520		
Project Contact:		
Email:		
Sampler(s) Name(s) (Printed):		
Client/Owner:		

Sample Identification	Collection			Container Information				Remarks
	Date:	Time:	Matrix:	Total No. of Bottles:	Other:	None:	Preserved:	

Laboratory:	Turnaround Time:	Total No. of Containers:	Method of Shipment:	Laboratory Comments and Log No.:

Relinquished by (Signature):	Date: / Time:	Relinquished by (Signature):	Date: / Time:	Relinquished by (Signature):	Date: / Time:	Relinquished by (Signature):	Date: / Time:
Printed Name:		Printed Name:		Printed Name:		Printed Name:	
Company:		Company:		Company:		Company:	
Received by:	Date: / Time:	Received by:	Date: / Time:	Received by:	Date: / Time:	Received by:	Date: / Time:
Printed Name:		Printed Name:		Printed Name:		Printed Name:	
Company:		Company:		Company:		Company:	

Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program

UNIQUE PROPERTY ID

PHOTOGRAPH LOG

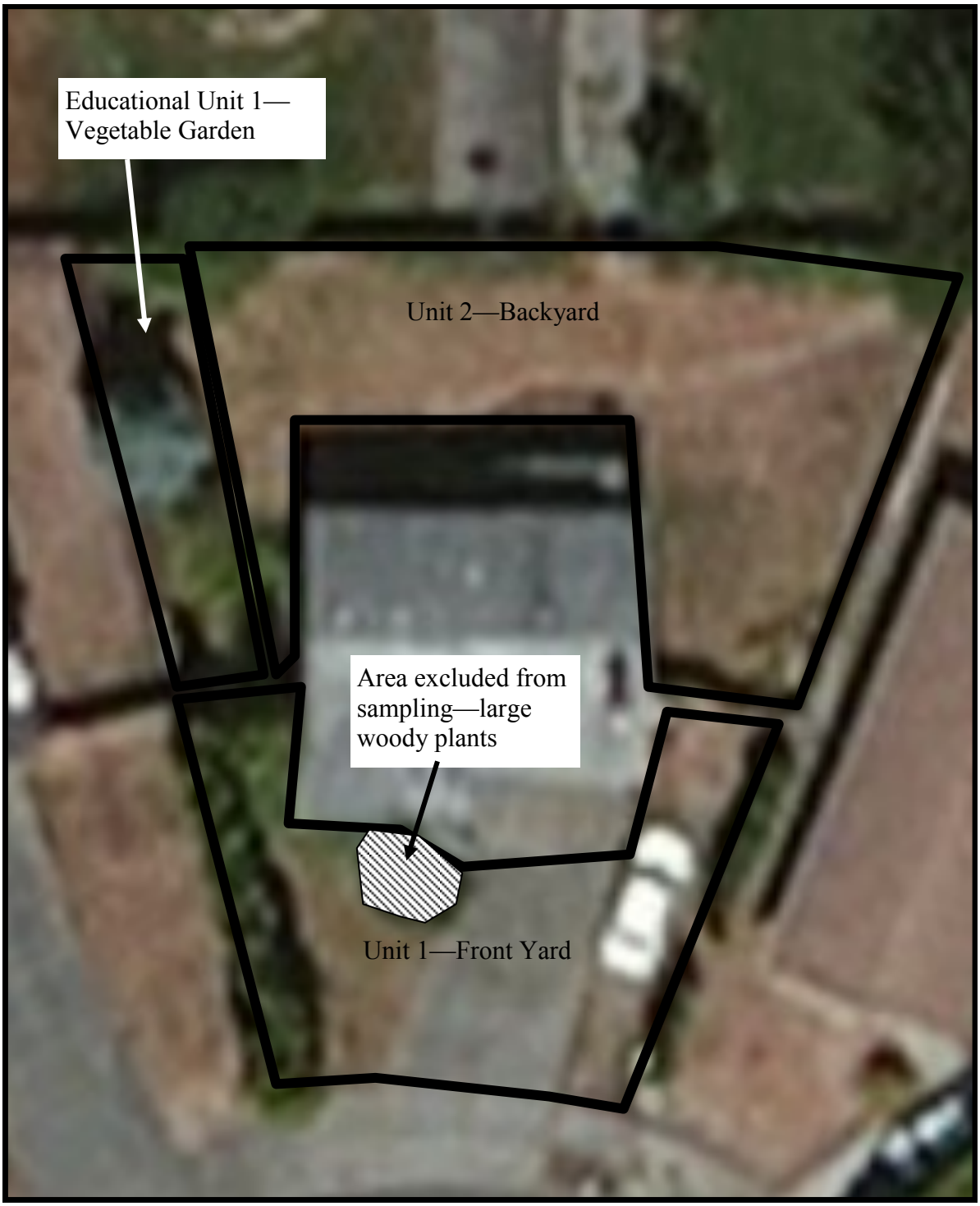
Project No.: ______________________ Task No.: ______________________

Site Name: ______________________

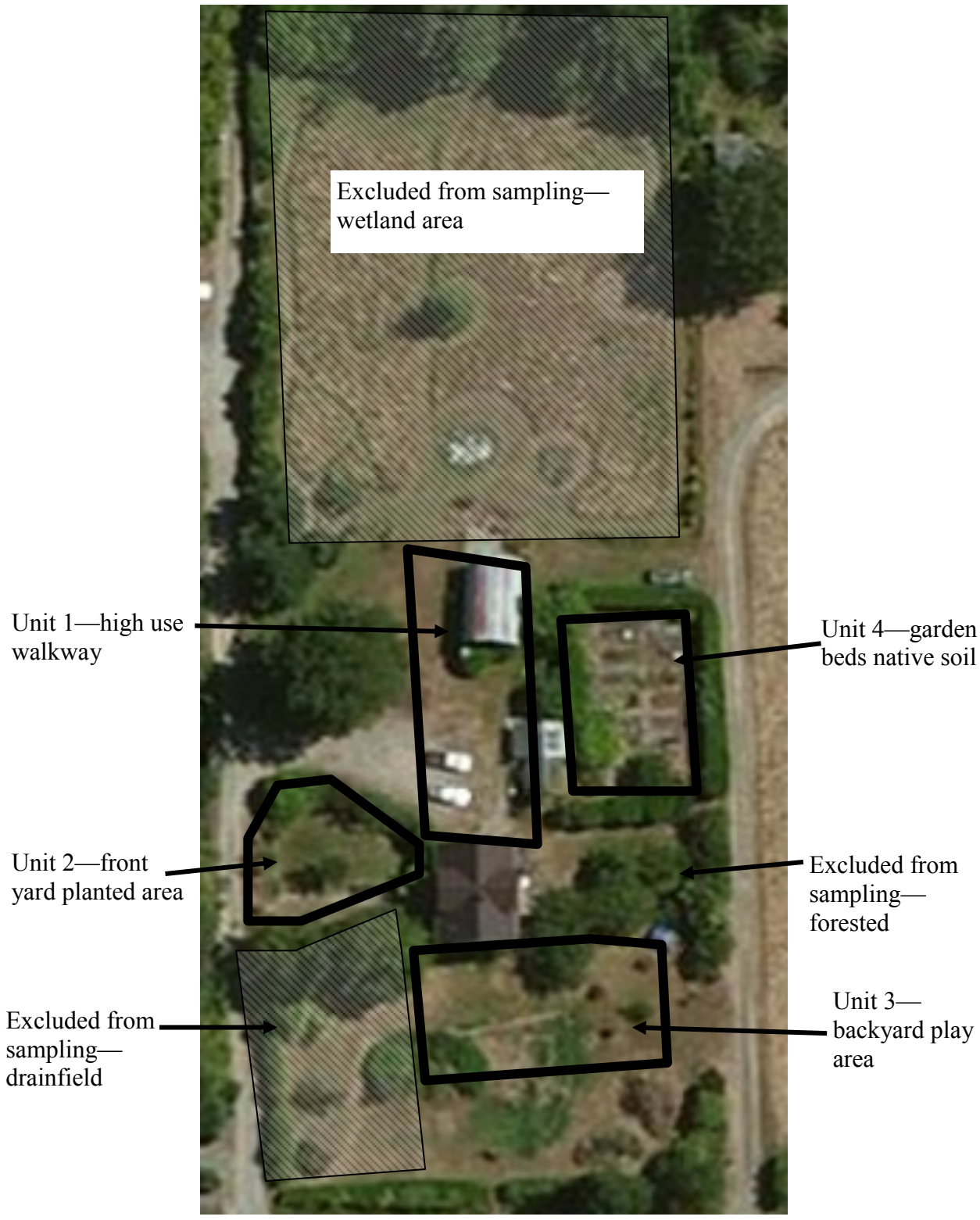
Date	Roll #	Photo #	Initals	Direction Facing	Description

Attachment C - Example Property-Specific Sampling Plans

Draft Example Small Property Sampling Plan
Property Name
Property Address



Draft Example Large Property Sampling Plan
Property Name
Property Address



Attachment D - Example Sampling Field Data Collection Forms

Field Sampling Data Collection Form

TSP Residential Yard Sampling and Cleanup Program

PROPERTY INFORMATION:

Date: _____ Time: _____ (Start) Time: _____ (End)

Property Address: _____ Site ID #: _____

Property Owner Name: _____ Day Phone: _____

Property Mailing Address: _____ Evening Phone: _____
(if different)

Property Coordinates: Latitude: _____ Longitude: _____
(At Front Door)

Comments: _____

OWNER INTERVIEW INFORMATION:

Property owner Present: *Yes/No*
(During Sampling)

Year Property Purchased: _____ Year Home Built (or Remodeled): _____

Home Improvements Since 1987: *Yes/No*
(Causing Disturbed Soils)

Treated Wood Structures: *Yes/No*
(Decks, Play Areas, etc.)

Underground Site Utilities: (Circle and Mark Map)

Irrigation	***Fuel Tank/Lines***	***Electrical***
Yes/No	*Yes/No*	*Yes/No*

Cable	***Septic System***
Yes/No	*Yes/No*

Comments: _____

Other Safety Concerns: (Circle and Mark Map)

Dogs	***Livestock***	***Steep/Unstable***	***Haz Plant***
Yes/No	*Yes/No*	*Yes/No*	*Yes/No*

Comments: _____

High Use Area: (Circle and Mark Map)

Raised Garden	***Play Area***	***Eating Area***	***Other***
Yes/No	*Yes/No*	*Yes/No*	*Yes/No*

Comments: _____

Areas to be Left Undisturbed: _____
(Per Property Owner Request)

Comments: _____

FIELD TEAM INFORMATION:

Field Team Members: _____

Weather Conditions: _____

Field Sampling Data Collection Form

TSP Residential Yard Sampling and Cleanup Program

UNIT #1:

Description: _____ Total Area (ft^2): _____

(Indicate on Map with Dimensions) (Approximate)

Photographs Taken: # _____

(Note Photos on Map)

Sample Information:

Date:	Time:	Sample ID #: ǂ	Depth (inch):	Aliquots (#):
		17-AA0001-Y1-1-4		

ǂ Sampling Convention: County Code (17=King, 27=Pierce)-AccessGroup (AA-ZZ) Facility Code (0001-9999)-Unit type (Y/E)Unit # (1,2,3, or 4)-Depth (1 or 2: 1=6", 2=12") -Sample Type (4 or 5: 4= Regular, 5=Duplicate)

Comments*: _____

*Note areas with unusual sampling conditions, inaccessible areas, areas excluded from sampling by owner, etc.)

UNIT #2:

Description: _____ Total Area (ft^2): _____

(Indicate on Map with Dimensions) (Approximate)

Photographs Taken: # _____

(Note Photos on Map)

Sample Information:

Date:	Time:	Sample ID #: ǂ	Depth (inch):	Aliquots (#):
		17-AA0001-Y2-1-4		

ǂ Sampling Convention: County Code (17=King, 27=Pierce)-AccessGroup (AA-ZZ) Facility Code (0001-9999)-Unit type (Y/E)Unit # (1,2,3, or 4)-Depth (1 or 2: 1=6", 2=12") -Sample Type (4 or 5: 4= Regular, 5=Duplicate)

Comments*: _____

*Note areas with unusual sampling conditions, inaccessible areas, areas excluded from sampling by owner, etc.)

Cleanup Sampling Field Data Collection Form

TSP Residential Yard Cleanup Program

PROPERTY INFORMATION:

Property Address: _____ Site ID #: _____

Property Owner Name: _____ Phone: _____

Sample Information:

Date:	Time:	Sample ID #: ǂ	Photos Taken	Geotextile (Y/N)	***Comments:***
		17-AA0001-C1-3-4			

ǂ Sampling Convention: County Code (17=King, 27=Pierce)-AccessGroup (AA-ZZ) Facility Code (0001-9999)-Unit type (C) Unit # (1,2,3, or 4)-Depth (1, 2, 3, or 4: 1=6", 2=12", 3=12"-18", 4=18"-24") -Sample Type (4, 5, or 6: 4= Regular, 5=Duplicate 6= XRF)

Comments*: _____

Attachment E – Data Standardization

Attachment E – Data Standardization

Area-wide Remediation Environmental Information System (AREIS)

The following information at a minimum will be tracked for each residence:

- Identification and contact information: property program, unique property identifier, position, and address; once provided owner and/or resident name, phone number, contact information.
- Access information: dates and attempts made to gain access (letter, knock and talks). Was access granted? (yes, no, no response)
- Date of assessment and sampling date (s)
- Evaluation of concentration ranges for each unit.
- Outreach conducted specific to that property.
- Contact information, homeowner questions, comments, and complaints.
- Date of notification letter sent to property owner and/or resident.
- Date of follow up visit for planning cleanup activities.
- Date of signed cleanup agreement.
- Date of pre-cleanup visit with contractor.
- Date of completed cleanup walk through.
- Date of cleanup activities, cost of cleanup activities, and the contractor who completed the work.
- Date of warranty.
- Date of final cleanup notebook provided to property owner.

The external format of AREIS is called the public portal where anyone can input an address or parcel number and find out sampling results and cleanup information for any residence where Ecology has conducted sampling or cleanup information.

Consistency between Databases

To ensure consistency between the databases the following naming/numbering convention will be used.

1. User Study ID (must be 8 or less characters)
   TSPPCRES (Pierce County)
   TSPPCEPA (Pierce County EPA Property)
   TSPKCRES (King County)

2. User Location ID (must be 15 or less characters)
   This represents the study, and facility
   TSPPCRESXXXXXX
   TSPKCRESXXXXXX

   XXXXXX= Sequential alphanumeric zone and facility code assigned by AREIS. The first two XX will be letters that start with AA and proceed from there to designate the zone the properties are located inside. The first letter in the property code signifies the block group or sequence group. The second letter in the property code signifies the access group. The numbers that follow will start with 0001 and could proceed through 9999.

   Example: TSPKCRESAA0001= Property 0001 in zone AA of King County.

Each facility will have one GPS location taken from either the parcel centroid or the front door of the residence (latitude and longitude). In general, only one GPS location per property will be obtained; however, if a second GPS coordinate is needed, the location identification number would us the "-2".

For residences, Ecology will use address matching software to identify a latitude/longitude for the property and it will be uploaded during the upload process into AREIS. This will enable us to plot the residence even if they do not respond to our program. For those residences that grant access, a GPS will be taken during the assessment to verify the latitude and longitude of the residence.

Environmental Information Management System (EIM)

EIM is Ecology's database for sampling results from environmental investigations. The EIM submittal will include at a minimum: 1) the sample identification information, 2) sample collection details, 3) analytical methods, and 4) analytical results. The EIM submittal will be presented in tabular format to facilitate the upload of data to EIM.

1. Sample identification or naming protocol for soil samples will be based on the unit name (predetermined location code), media being sampled (soil), and the depth at which the sample is obtained. For example:

    - County (17=King County, 27=Pierce County) (numbers are standard county codes for Yard Program)
    - Area of Access Group: AA through ZZ, Assigned when entered into AREIS before sent access agreements
    - Facility Code 0001-9999 per area group
    - Unit Type: Y=Yard, E=Educational, C=Cleanup Sample
    - Unit: 1, 2, 3, etc.
      Depth intervals: Sampling: 1 = 0-6 inches, 2 = 6-12 inches, 3 = 12-18 inches, 4 = 18-24 inches
    - Sample Type 4= regular, 5= duplicate, 6= XRF measurement

    Examples:
    17-AA0001-Y1-1-4 = King County, group AA, facility 0001, unit type "Y", unit number 1, depth 1 (0-6 inches), regular sample.

    17-AA0001-E2-1-4 = King County, group AA, facility 0001, unit type "E", unit number 2, depth 1 (0-6 inches), regular sample.

    17-AA0001-C1-4-4 = King County, group AA, facility 0001, unit type "C", unit number 1, depth 4 (18-24 inches), regular sample.

2. The sample collection entry will include an option noting how the sample was obtained: 8-point composite, discrete, or other.

3. The analytical method entry will note the analytical method requested: Method 6010 or 6020.

4. The analytical results obtained from the laboratory electronic data deliverable (EDD), including both arsenic and lead testing results.

Document Storage and Retrieval System (DSARS)

DSARS is Ecology's database for storing documents related to cleanup sites. DSARS will include the following documents: access agreements, field sampling plans, and property cleanup plans. The naming convention for these documents will be developed once the database is linked to AREIS.

Photo and Image Management System (PIMS)

PIMS is Ecology's database for managing photographs and images, and will include Yard Program photos taken of the unit before, during, and after cleanup. The naming convention for the photographs will be developed once the database is linked to AREIS.

Appendix D

Appendix D

Quality Assurance Project Plan

Program Design and Implementation Plan

Appendix D - Quality Assurance Project Plan

Tacoma Smelter Plume
Residential Yard Sampling and Cleanup Program

June 2013

Approved by:

Signature:	Date:
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Toxics Cleanup Program
Washington State Department of Ecology
Olympia, Washington

Table of Contents

List of Figure and Tables

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Figure

Tables

Attachment

Abstract

Each study conducted by the Washington State Department of Ecology must have an approved Quality Assurance Project Plan (QAPP). The QAPP describes the study objectives and procedures to be followed to achieve those objectives.

This QAPP establishes the quality assurance (QA) objectives and the quality control (QC) procedures for the soil sampling and analysis to be carried out under the Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program (Yard Program). Ecology will fund the Yard Program with monies from the State of Washington's 2009 settlement with Asarco for the future costs of cleaning up the Tacoma Smelter Plume. Ecology has planned for implementation of the Tacoma Smelter Plume Yard Program through 2021.

The Tacoma Smelter Plume is contaminated primarily by arsenic and lead in soil. The Yard Program will cover residential properties within the most highly contaminated areas of the Tacoma Smelter Plume, defined as the Service Area. The Service Area is the area where average arsenic levels may be over 100 parts per million (ppm). The Yard Program will provide resources for soil sampling at single-family residential and multi-family residential properties within the Service Area.

The Yard Program will provide laboratory analytical data regarding arsenic and lead levels at residential properties to support public outreach and education and to help guide the cleanup decision process. The Yard Program will also provide laboratory analytical data for post-cleanup soil sampling to support public outreach and education after cleanup activities.

Introduction

This Quality Assurance Project Plan (QAPP) establishes the quality assurance (QA) objectives and the quality control (QC) procedures for the soil sampling and analysis that will be carried out under the Washington Department of Ecology (Ecology) Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program (Yard Program). This QAPP will be used in conjunction with the Program Design and Implementation Plan (Program Design), Sampling and Analysis Plan (SAP) (Appendix C of the Program Design), and Health and Safety Plan completed by Ecology and each participating Ecology Contractor.

This QAPP was prepared in accordance with the following Ecology and United States Environmental Protection Agency (EPA) guidelines:

- Ecology Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Publication No. 04-03-030, Revision of Publication No. 01-03-003; Revised October 2011)

- EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, March 2001; Reissued May 2006)

The Program Design provides a project description and history for the Tacoma Smelter Plume. Figure D-1 displays the boundaries of the project area for the Tacoma Smelter Plume Yard Program. The Yard Program will clean up residential properties within the most highly contaminated areas of the Tacoma Smelter Plume, defined as the Service Area (Figure D-1). Average arsenic levels are predicted to exceed 100 parts per million (ppm) in the Service Area.

Ecology will fund the Tacoma Smelter Plume Yard Program with $64 million from the State of Washington's 2009 settlement with Asarco for the future costs of cleaning up the Tacoma Smelter Plume. The Program Design presents the schedule for implementation of the Tacoma Smelter Plume Yard Program.

Project Organization

Personnel assigned to the Yard Program must familiarize themselves with the pertinent protocols and procedures presented in this QAPP and the SAP. Soil sampling activities conducted for the sampling of residential properties will be conducted by the Ecology or its Field Sampling Contractor(s). Soil sampling for post-cleanup documentation will be conducted by Ecology or its designee. Ecology staff will provide project oversight and coordination of the Contractors. Laboratory analysis shall be conducted by a laboratory accredited by both Ecology and EPA.

Field personnel will be responsible for submitting samples to the laboratory, tracking samples, receiving the hard copy and electronic data deliverable (EDD) reports from the laboratory, and verifying data. Field personnel will upload such data to Ecology's Environmental Information Management (EIM) system. Ecology will provide technical assistance for data submittals to EIM and will be responsible for uploading data to Ecology's Area-wide Remediation Environmental Information System (AREIS) database.

Table D-1 outlines the affiliations, roles, and responsibilities for the Yard Program team. Individuals and firms are not identified in this QAPP and will be determined during Yard Program implementation.

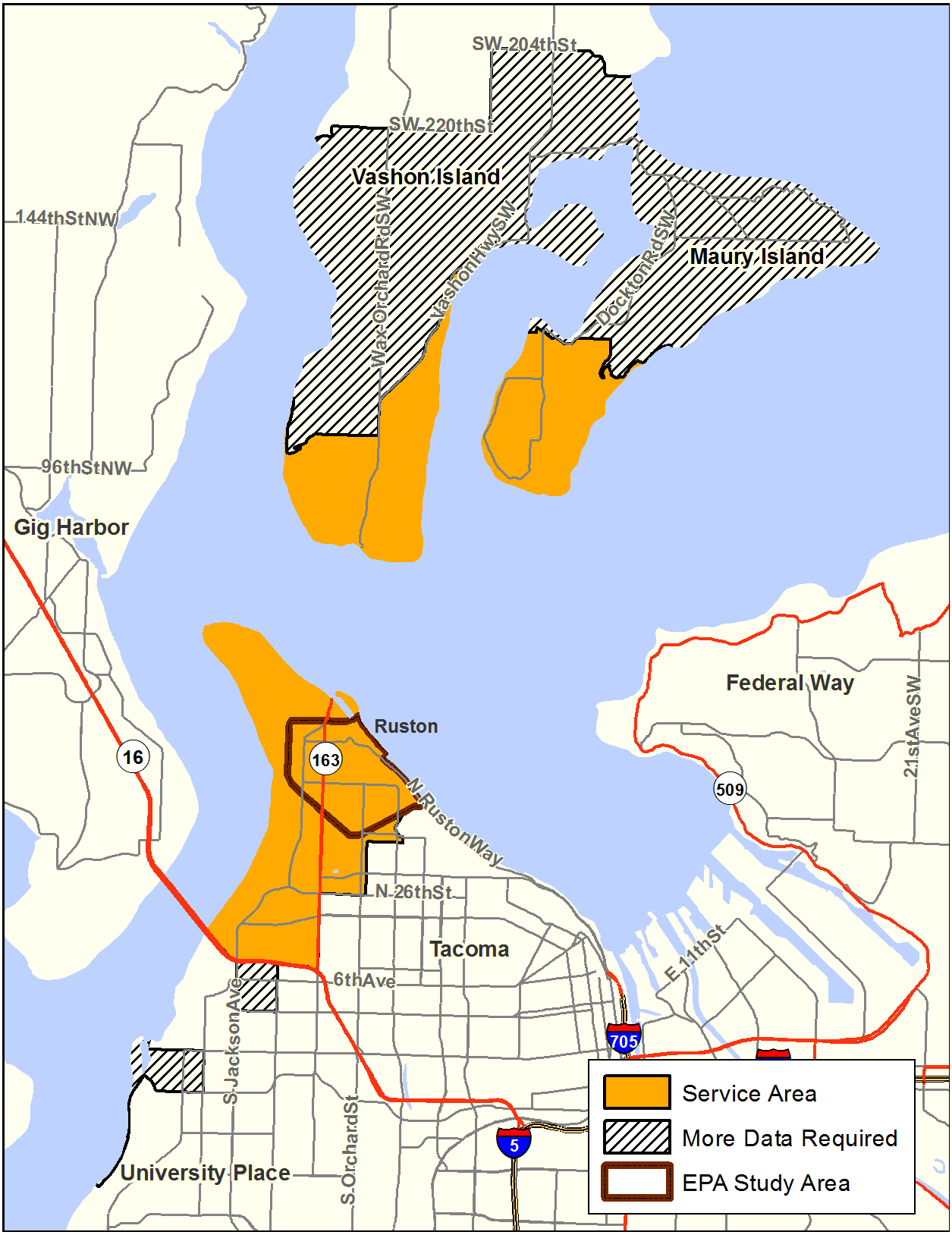


Figure D-1. Program Service Area Boundary

Table D-1 Project Roles and Responsibilities

Affiliation	Title/Role	Responsibilities
Ecology	Program Manager	Oversee Yard Program management
Ecology	Project Lead	Oversee Yard Program contractors
Ecology	QA Officer	Oversee QA of Yard Program implementation
Ecology	Database Administrator	Manage EIM and AREIS databases
Contractor(s)[1]	Project Manager	Oversee Yard Program field operations and reporting
Contractor(s)	QA Officer	Oversee QA of contractor operations
Contractor(s)	Field Manager	Manages Yard Program field operations
Contractor(s)	Field Personnel	Conduct Yard Program sampling
Contractor(s)	Project Chemist	Coordinate with laboratory and oversee reporting
Contractor(s)	Database Administrator	Manage receipt of laboratory EDDs, verify data, and upload data to EIM
Laboratory	Project Manager	Oversee laboratory operations for Yard Program
Laboratory	QA Officer	Oversee QA of laboratory operations
Laboratory	Project Analysts/Chemists	Conduct laboratory analyses and reporting
Laboratory	Database Administrator	Manage deliverables of laboratory EDDs and reports

[1]Ecology staff may also conduct soil sampling field operations during implementation of Tacoma Smelter Plume Yard Program.

Quality Assurance Objectives

The goal of the Yard Program is to reduce human health risk from arsenic and lead in soils at residential properties within the Service Area. The objectives of soil sampling and analysis of the Yard Program are to:

- Provide chemical data needed to assess arsenic and lead levels at residential properties to support public outreach and education and help guide cleanup decisions.
- Provide chemical data for post-cleanup soil sampling to support public outreach and education after cleanup activities.

The Yard Program includes single-family and multi-family residential properties within the Tacoma Smelter Plume Service Area that contain yards or other high use areas where people may have frequent direct contact with soil. Ecology is addressing child play areas under the separate Soil Safety Program.

The Yard Program will be implemented only at properties where owners provide signed access agreements to Ecology. Chemical data obtained through the soil sampling and analysis will be compared to state cleanup levels and Yard Program action levels (Table D-2). The Program Design provides background information on the Yard Program action levels for residential properties.

Table D-2 Constituents of Concern and Action Levels

Constituent of Concern	Yard Program Action Levels (parts per million [ppm])	State Cleanup Levels (ppm)
Arsenic	100 (90-threshold level)	20
Lead	500	250

Decision Quality Objectives

Analytical results from this project will be used to assess arsenic and lead levels for surface soils at high use areas for single-family and multi-family residential properties. The sampling results will be used to determine the cleanup actions needed to provide protection against risk from exposure to contaminated soil.

It is important to ensure that the sample results are sufficiently representative to provide a high degree of confidence that residential properties containing arsenic or lead above Yard Program action levels (Table D-2) are addressed through cleanup actions and education and outreach. It is also important to ensure that properties that do not contain elevated arsenic and lead levels are not unnecessarily included in the Yard Program.

Measurement Quality Objectives

Measurement quality objectives (MQOs) are qualitative or quantitative statements of the precision, accuracy (or bias), sensitivity, representativeness, completeness, and comparability necessary for the data to fulfill project objectives. MQOs and QC procedures identified for the Yard Program are described in the following and summarized in Table D-3. In addition to the MQOs listed in Table D-3, the laboratory shall follow other QC measures for instrument calibration and laboratory performance specified in the applicable methods and according to the laboratory's Standard Operating Procedures (SOPs). Applicable methods include analysis of soil samples for arsenic and lead by either EPA Method 6010 (inductively coupled plasma [ICP]) or EPA Method 6020 (inductively coupled plasma-mass spectrometry [ICP-MS]).

Precision

Precision is an appraisal of the reproducibility of a set of measurements. Precision is defined as the variability of a group of measurements compared to their average value. Variability for environmental monitoring programs contains both an analytical and a field component.

Analytical precision will be evaluated by the analyses of matrix spike duplicate and laboratory duplicate samples, which can be mathematically expressed as the relative percent difference (RPD) between duplicate sample analyses. RPD is calculated using the following equation:

$$RPD = \frac{(S - D)}{\left(\frac{(S + D)}{2}\right)} * 100$$

Where:
RPD = Relative percent difference
S = First sample value
D = Second (duplicate) sample value.

The frequency of analysis of matrix spike duplicate and laboratory duplicate samples, where applicable, will be one per batch (which typically consists of up to 20 samples) for each sample matrix received.

Field duplicate samples will be submitted blind to the laboratory as a way to determine field variability. The frequency of field duplicate samples will be at least one duplicate per 20 samples collected (or 5% of the samples).

Precision quantities will be calculated for analyses with method reporting limits of the same order of magnitude and with detected levels greater than or equal to five times the method reporting limits. In instances where no criteria have been established (e.g., field duplicates), RPD project goals will be 50 percent for well homogenized soil samples.

Bias and Accuracy

Bias is the systematic or persistent distortion of a measurement process that causes error in one direction. Accuracy refers to how close a measurement is to the true value. Bias and accuracy will be evaluated by analyzing matrix spike samples and laboratory control samples and can be mathematically expressed as the percent recovery of an analyte that has been used to fortify a field sample or clean laboratory matrix sample at a known level prior to analysis. The percent recovery (R) for a matrix spike sample is calculated as follows:

$$R = \frac{(SSR - SR)}{SA} * 100$$

Where:
SSR = Spiked sample result
SR = Sample result
SA = Spike added.

The following calculation is used to determine percent recovery (R) for a laboratory control sample or reference material:

$$R = \frac{RM}{RC} * 100$$

Where:
RM = Reference material result
RC = Known reference concentration

Method blank samples will be used to evaluate data bias. Results for method blanks can reflect systematic bias that results from contamination of samples during analysis. Arsenic and lead detected in method blank samples will be evaluated as potential indicators of bias.

Representativeness

Representativeness concerns the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Where appropriate, sampling locations will be selected on both a systematic and biased (judgmental) sampling basis in an attempt to spatially cover the decision unit(s) defined for each residential property. The process for determining decision units and soil sampling locations is presented in the Program Design and SAP.

Comparability

Comparability is a qualitative QA criterion that expresses the confidence in the ability to compare one data set with another. Comparability among data sets is achieved by using similar sampling procedures and analytical methods. Sampling procedures will be performed as specified in the SAP. Analytical procedures will be conducted according to the methods discussed in this QAPP.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system. Measurement of completeness (C) can be defined as the ratio of acceptable measurements obtained to the total number of planned measurements for an activity. Percent completeness is defined as:

$$C = \frac{M_a}{M_t} * 100$$

Where:
C = Completeness
Ma = Number of acceptable data per target QC limits
Mt = Total number of data points.

The goal for completeness is 100% for collection of valid samples from residential properties where sampling is required. The goal for completeness of valid measurements obtained is at least 90 percent of all samples submitted to laboratory.

Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest. The method detection limit (MDL) is defined as the statistically calculated minimum amount that can be measured with 99 percent confidence that the reported value is greater than zero. MDLs are specified in the individual methods and developed by the laboratory for each analyte of interest representing the aqueous and solid matrices within the capability of an analytical method.

The method reporting limit (MRL) is the lowest value to which the laboratory will report an unqualified quantitative result for an analyte. The MRL is always greater than the statistically determined MDL. MRLs for this project are based on MTCA Method A cleanup levels for unrestricted land uses. Target MRLs for arsenic and lead are 20 ppm and 5 ppm, respectively.

Table D-3 Quality Control Samples for Analysis of Arsenic and Lead in Soil

Measurement Quality Objective	Quality Control Test	Minimum Frequency	Acceptance Criteria[1]	Corrective Action
Precision	Field Duplicates	1 per 20 samples collected (5%)	50% RPD of primary and duplicate results.	Qualitative review to assess effect on overall project precision. Only result for primary sample will be used in data evaluations.
	Laboratory Duplicates	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	20% RPD of primary and duplicate results, if levels of both are >5xMRL. If either the sample or duplicate result is <5xMRL, the difference in the levels must be <2xMRL.	If sample or duplicate is >5xMRL, and if results are >20% RPD, then flag samples accordingly. If sample or duplicate is <5xMRL, and difference is >2xMRL, flag associated samples accordingly.
Accuracy	Matrix Spike (MS)	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	Where the field sample level is less than 4X the amount spiked, the %R must be 75% to 125%. For analytes where the field sample level is greater than 4x the amount spiked, no evaluation will be made.	If MS is outside control limits, report blank spike results (if within acceptable limits) and flag samples accordingly.
	Lab Control Sample/ Blank Spike	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	% Recovery of 80-120.	If recovery is out of control limits, reanalyze associated batch. If still out of limits, flag samples accordingly.
	ICP Serial Dilution	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	When original sample result is >50xMDL, then RPD between undiluted & diluted <10% or suspect matrix interference.	Redigest and reanalyze associated samples. If failure occurs, evaluate results post digestion spike. Flag if RPD > 10%.
	Method Blanks	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	Absolute value of blank result <RL, or associated sample results must be >10 times blank level.	Reanalyze batch.

[1]Acceptance criteria based on analysis by EPA Method 6010 or 6020.

Sampling Process Design

The Yard Program sampling process design for soil sampling and analysis includes both pre- and post-cleanup soil sampling:

- **Sampling:** Composite soil samples will be collected at defined unit(s) at each residential property. Composite soil samples will be submitted to a mobile laboratory or an offsite analytical laboratory for analysis of arsenic and lead by EPA Method 6010 or 6020.
- **Post-cleanup sampling:** Composite soil samples will be collected at the bottom of excavation areas. Composite soil samples will be field screened for arsenic and lead levels using x-ray fluorescence (XRF), or submitted to an offsite analytical laboratory for analysis of arsenic and lead by EPA Method 6010 or 6020.

The SAP outlines the sampling process design in more detail.

Sampling Procedures

Sampling Protocols

Sample collection and field measurement procedures for the soil sampling and analysis are set forth in the SAP. The SAP also sets forth the procedures for decontaminating sampling equipment and disposing of waste from field operations.

Sample Identification and Documentation

Samples will be placed in appropriate containers, preserved and stored properly, and traceable from collection through disposition after analysis. Written records [e.g., chain-of-custody (COC) and field sampling forms and logbooks] will be maintained for each sample throughout sample collection, transport, storage, and analysis. The SAP sets forth project sample packaging and shipping procedures.

Field daily logs, field logbooks, and/or other field forms will be maintained to document all sample collections. The sampler will select an appropriate sample container before obtaining samples and will record the sample number on the field form for each sample. QC samples will be noted on the daily field log, in the field logbook, or on other field forms, as appropriate.

At the time of sample collection, samplers will use waterproof ink to provide the following information on the sample labels:

- Project name
- Sample location or sample identification
- Sample type
- Sample depth (if appropriate)
- Analysis requested
- Sampling date and time
- Name of sampler.

Ecology and its Contractors will use a consistent scheme for sample numbering. The sample identification scheme to be used for soil sampling is set forth in the SAP.

Sample Containers, Preservation Method, and Holding Times

Table D-4 lists the sample analyses, matrix, method numbers, containers, preservation methods, and holding times associated with the analyses to be performed by a mobile or an offsite analytical laboratory. During sample collection, samples will be placed in pre-cleaned 4-ounce glass sample containers supplied by the Contract Laboratory. No chemical preservatives are required.

Table D-4 Sampling Containers, Preservation Method, and Holding Times

Method	Analysis	Matrix	Container Size	Container Material	Storage Conditions	Holding Time	Minimum Dry Mass Required
EPA Method 6010 or 6020	Arsenic, Lead	Soil	4 ounce	Glass	None specified	6 months	50 grams

Sample Custody

Sample integrity must be maintained to assure QC. COC procedures will be followed from initial sampling through completion of laboratory analyses.

Field Custody Procedures

The sampler will fill out a COC form upon sample collection and maintain field sample chain-of-custody records during sampling. The COC form will include sample information as well as chain of possession. At a minimum, the COC form will contain the following information:

- Sample identification number
- Time and date of collection
- Field sampler's name
- Sample matrix
- Type, quantity, and volume of sample containers
- Project number
- Any preservatives added
- Required analyses
- Requested analytical turn-around-time
- Additional information the laboratory may need to perform the requested analysis, such as holding time, etc.

At the conclusion of sampling each day, individual samples will be packed securely inside plastic coolers. Ice may be used to preserve samples but is not required The COC form will be enclosed in plastic and affixed to the cooler, which will be sealed such that the seal must be broken to open the cooler.

If field personnel request a change to the COC form after receipt by the laboratory, they will revise, initial, and forward a copy of the COC form to the laboratory. This revised form will supersede the original COC form. A copy of the original COC form and any documented changes to the original COC form will be included as part of the final analytical report. This record will be used to document sample custody transfer from the sampler to the laboratory and will become a permanent part of the project file.

Sample Packaging and Shipment

Samples will be packed and shipped in accordance with applicable and current U.S. Department of Transportation (DOT) regulations and International Air Transport Association

(IATA) standards as provided in the most current edition of IATA Dangerous Goods Regulations for hazardous materials shipments.

Laboratory Custody Procedures

The Laboratory Sample Custodian will be responsible for samples received at the laboratory. The Laboratory Sample Custodian will be familiar with custody requirements and the potential hazards associated with the environmental samples. In addition to receiving samples, the Laboratory Sample Custodian will also be responsible for documenting sample receipt, storage before and after sample analysis, and proper sample disposal.

Upon sample receipt, the laboratory will accomplish the following tasks.

- Inspect the sample containers for integrity and verify that custody seals on the shipping coolers are intact.
- Mark the chain-of-custody/sample analysis request forms with the temperature of the samples upon receipt and condition of the sample containers.
- Sign (with date and time of receipt) the COC/sample analysis request forms, thereby assuming custody of the samples, and assign laboratory sample identification numbers.
- Compare the information of the COC/sample analysis request forms with the sample labels to verify sample identity. Resolve any inconsistencies with a field sampling representative before allowing sample analysis to proceed.
- Place the samples in a secured, climate-controlled storage area.

If a sample breaks or appears to be damaged, the QA Coordinator will be contacted for a decision about sample disposition. Original samples will remain in a secured storage area at all times except during analysis. Access to the storage area will be restricted to designated laboratory personnel. Following analysis, samples will be retained in a secured area until the Ecology Project Manager or designee issues other instructions.

Measurement Methods

Analytical Procedures

Prior to digestion, the entire soil sample will be removed from its container, sieved as-is through a 2-millimeter (mm) sample sieve, and then homogenized, consistent with MTCA protocols [WAC 173-340-740(7) (d)]. The portion of the sieved homogenized material that is not needed for the primary analysis will be returned to the original container and returned to the sample storage area. The sample will then be prepared using EPA Method 3050B. Total arsenic and lead in the soil samples will be analyzed by either EPA Method 6010 or 6020. MQOs for this project are listed in Table D-3. Sample results will be reported on a dry-weight basis.

Field Procedures

The use of XRF screening may be used to supplement the decision making process during the post excavation sampling efforts. However, due to the decrease in accuracy at lower levels, XRF screening will only be used as a supplemental aid to analytical testing and will not be used instead of laboratory analytical testing.

The XRF screening may be performed on composite samples collected from the base of excavations. For the XRF screening, following homogenization of the subsamples, the soil

sample will be collected into an unused sealable plastic bag, homogenized, and moderately compressed by hand. Care will be taken consistent with the composite sampling efforts to avoid collection of vegetative debris in the bags. The soil will be screened directly through the bag with an XRF analyzer. The screening samples will be analyzed for total arsenic levels for 120 seconds and the results will be recorded in the field notes. The SAP provides further details on the XRF field screening methodology.

EPA Method 6200 requires the collection and laboratory analysis of confirmation samples at a frequency of at least one confirmation sample per 20 samples XRF screened. As described in the SAP, composite samples from the base of the excavation will be submitted for laboratory analysis of total arsenic and lead by EPA Method 6010 or 6020. The results of the laboratory analyses and XRF measurements should be evaluated with a least squares linear regression analysis. If the measured concentrations span more than one order of magnitude, the data should be log-transformed to standardize variance which is proportional to the magnitude of measurement. The correlation coefficient (r) for the results should be 0.7 or greater for the XRF data to be considered screening level data.

Quality Control

Calibration Procedures

Calibration is the process of verifying, adjusting, or fine-tuning the measurements produced by a given instrument to agree with known values. In general, the calibration process involves analyzing commercially prepared calibration standards of known levels or values, which span either the measurement range of the instrument or the range of values anticipated to be encountered in a given investigation. The measured value produced by the instrument is then compared to the published value for that calibration standard, and the difference is compared to project, method, or instrument acceptance criteria. If the difference between the published and measured values for the calibration standard is smaller than the acceptance criteria, then the instrument is considered to be in calibration. If the difference exceeds the applicable acceptance criteria, the instrument is considered to be out of calibration and must be recalibrated before any measurements made with the device are considered valid.

The following describes field and laboratory equipment calibration procedures.

Field Instruments

Field instruments that may be used during the soil sampling activities include the XRF analyzer for field screening during post-cleanup sampling. The XRF analyzer will be calibrated in accordance with the manufacturer's instructions and recommendations. The XRF analyzer will be calibrated at the beginning of daily activities and following any equipment maintenance, correction of malfunction or change or update of the analyzer software. Furthermore, a calibration check will be performed at the close of each day. The performance and results of equipment calibrations as well as any errors or maintenance will be documented in the field log book.

Laboratory Instruments

Laboratory instrument calibration is necessary to verify that the analytical system is operating correctly and functioning at the proper sensitivity to meet the contract required quantitation limits (CRQL). Calibration establishes the dynamic range of an instrument, establishes response factors to be used for quantitation, and demonstrates instrument sensitivity. Criteria for

calibration are specific to the instrument and the analytical method. Laboratory instruments will be calibrated in accordance with the analytical method and laboratory SOPs.

Instruments will be calibrated in accordance with the analytical method and laboratory SOPs. The laboratory will use primary reference standards obtained from the National Institute of Standards and Technology, EPA Cooperative Research and Development Agreement vendors, American Association of Laboratory Accreditation vendors, or other reliable commercial sources. When the laboratory receives the standards, the date received, supplier, lot number, purity, level, and expiration date will be recorded in a standard logbook. The laboratory will maintain files of the vendor certificates for the standards and make them available upon request.

Instrument calibration information will be documented and will include, at a minimum, the equipment calibrated, reference standards used for calibration, calibration techniques, actions, acceptable performance tolerances, frequency of calibration, and calibration documentation format. The laboratory will maintain records of standard preparation and instrument calibration. Calibration records will include daily checks using standards prepared independently of the calibration standards, and instrument response will be evaluated against established criteria.

The analysis logbook, maintained for each analytical instrument, will include, at a minimum, the date and time of calibration, the initials of the person performing the calibration, and the calibration reference number and level. Instruments will be calibrated in accordance with the criteria specified by the applicable analytical method.

Quality Control Samples

Field Quality Control

Field Duplicates

Field duplicate samples are designed to monitor overall sampling and analytical precision. In general, one duplicate sample will be collected per 20 samples, or one duplicate sample will be collected per batch of samples if fewer than 20 samples are collected. Note: A batch is herein defined as six samples or more. No duplicate samples will be collected if five or fewer samples are collected for a given sampling task. At least one duplicate sample should be collected for each neighborhood block group during sampling.

Soil field duplicate samples will consist of collecting a sample, homogenizing the sample, and splitting the sample into two equal aliquots. Duplicate samples will be treated as separate samples from the originals and not identified to the laboratory as duplicate samples. Duplicate samples will be labeled using the sample numbering scheme outlined in the SAP. Field duplicate samples will be documented on the daily field report, in the field logbook, or other appropriate field form.

XRF Field QC Samples

A standard reference material sample and a blank sample ("clean" quartz or silicon dioxide matrix) will be analyzed using the XRF unit at the start of each work day.

Laboratory Quality Control

The general objectives of the internal laboratory QC program are to:

- Verify that procedures are documented, including changes in administrative or technical procedures.

- Verify that analytical procedures are validated and conducted according to method guidelines and laboratory SOPs.
- Monitor the performance of the laboratory using a systematic inspection program.
- Verify that data are properly reported and archived.

Laboratory QC consists of a laboratory and a matrix component. The laboratory component measures the performance of the laboratory analytical process during sample analyses, while the matrix component measures the effects of a specific medium on the method performance. The QC samples used to assess these two components are described below. Corrective actions for instrument calibrations or QC sample data that are out of compliance are typically described in the laboratory-specific QA/QC program.

The laboratory will conduct internal QC checks for analytical methods in accordance with the individual method requirements and the laboratory SOPs. The laboratory will notify the Contractor Team Project Manager or Contractor Project Chemist in writing before making corrective action changes to procedures described in this QAPP, or to the laboratory standard analytical methodology. The Ecology Project Manager will need to approve these proposed corrective actions in writing prior to implementation.

The laboratory will, at a minimum, analyze internal QC samples at the frequency specified by the analytical method, the laboratory's internal quality program, and as listed in Table D-3. Method-specific QC procedures, frequency of QC sample analysis, acceptance criteria (control limits), and corrective actions identified in the laboratory SOPs provided by the Laboratory will be in accordance with Table D-3. The following discusses holding times and the QC samples used by the laboratory to assess data quality.

Sample Holding Time

Sample holding time is the length of time that a sample or sample extract can be expected to remain representative of environmental conditions. Holding times for the proposed analyses are listed in Table D-4. Samples will not be analyzed outside specified method holding times without approval of the Contractor Project Chemist. After sample analysis, the laboratory will archive all remaining sample material for all samples (100 percent) for up to two months following the issuance of the laboratory report to Ecology. The laboratory is responsible for disposal of remaining samples after the holding time has elapsed. The laboratory must obtain approval from the Contractor Project Manager before sample disposal.

Method Blank Samples

Method blank samples will be used to monitor the laboratory preparation and analytical systems for interferences and contamination from glassware, reagents, sample manipulation, and the general laboratory environment. The method blank sample is an analyte-free matrix (reagent grade water or laboratory grade sand) to which compounds, as specified in the method, will be added in the same volumes or proportions as used in sample processing and will be taken throughout the entire sample preparation/extraction and analytical process. Method blank samples will be analyzed at the frequency specified by the analytical method, in the laboratory QA program, Table D-3, and the laboratory SOPs.

Matrix Spikes and Matrix Spike Duplicate Samples (MS/MSDs)

MS/MSDs measure matrix-specific method performance and will be used to assess accuracy and precision. MS/MSD samples will be used to assess the influence of the sample media (media interference) on the analysis. Samples for MS/MSD analysis will be site specific and

analyzed at a frequency of 5 percent of the total number of samples (no less than one in twenty samples). Samples submitted as MS/MSDs should be as representative as possible of site conditions.

Each MS/MSD sample will be spiked with the compounds specified by the analytical method prior to sample extraction or analysis in accordance with the laboratory SOPs. MS recovery criteria are specified in Table D-3. Composite matrices should be constructed from portions of samples from the sample lot, homogenized, labeled as a batch matrix, and analyzed as a batch sample for MS/MSD.

Matrix Duplicates

Matrix duplicates will be used to assess laboratory precision. A matrix duplicate consists of a single grab sample split into two equal portions and submitted to the laboratory as two separate samples. To evaluate precision, the RPD between the investigative sample and its matrix duplicate will be calculated and compared to the project acceptance criteria as discussed in Table D-3.

Laboratory Batch Quality Control Logic

Site sample data for this project will be associated with batch QC samples that were extracted concurrently with the site samples and analyzed in the same analytical batch (sequenced on the same instrument relative to the primary sample results). For this project, a sample batch is a group of 20 or fewer environmental samples of the same matrix that are extracted within the same time period (concurrently) or in limited continuous sequential time periods. Samples in each batch will be from a similar matrix (e.g., soil) and treated in a similar manner, and the same reagents will be used for each sample batch.

Corrective Action

Corrective action procedures will be implemented to address nonconformance in field and laboratory data acquisition. Deficiencies are unauthorized deviations from procedures outlined in this QAPP. A nonconformance is a deficiency that affects data quality and renders the data unacceptable or indeterminate. Deficiencies related to field and laboratory measurement systems include, but are not limited to, damage of samples during transport to laboratory facilities, laboratory instrument malfunctions, and laboratory QC sample failures.

The Contractor QA officer, in consultation with the Contractor Project Manager, will determine whether a deficiency constitutes nonconformance. If a nonconformance does exist, the Contractor Project Manager, in consultation with the Contractor QA Officer, will determine the disposition of the nonconforming data or activity and necessary corrective action(s). Corrective actions may include qualification of the data as estimated (J) or rejected (R). If the data is qualified as R, additional corrective actions may include collection of additional samples or reanalysis of the existing samples as authorized by the Ecology Project Manager.

Field Corrective Actions

Every technical staff member of the field teams during sampling is responsible for verifying that QC procedures are followed. The technical staff will notify the Contractor Project Manager if a field sampling issue is identified that will impede the ability to meet the QA objectives outlined in this QAPP. Corrective measures will be determined and implemented as appropriate.

The technical staff member, along with the Contractor Project Manager, will document the issue, the corrective measures, and the results. If the problem is determined to be minor, documentation in a field logbook may be sufficient. The Ecology Project Manager will be notified

when field sampling issues result in corrective actions that affect the schedule and cost of the program, such as the need to collect additional samples.

Laboratory Corrective Actions

Laboratory personnel are responsible for verifying that laboratory QC procedures are followed. The laboratory will be responsible for implementing corrective action for analytical procedures. Corrective action procedures are described in Table D-3, in the individual methods, or in the laboratory QA manual. If QC data are unacceptable, the cause will be determined and corrected. Corrective actions that affect the integrity of the project analytical data will require re-analysis of the affected sample or qualification of these data in the final data report.

The options for laboratory corrective action depend on the deficiencies. Options for corrective action may include, but are not limited to:

- Re-calibrating the analytical instrument
- Re-analyzing samples (must be completed within holding time requirements)
- Qualifying results

When appropriate corrective action measures have been defined and the analytical system is determined to be in control, the analyst will document the problem, the corrective action, and the data demonstrating that the analytical system is in control. Copies of this documentation will be provided to the laboratory supervisor and the laboratory QA coordinator. The Laboratory Project Manager will notify the Contractor Project Manager, as soon as practicable, when laboratory QA issues result in corrective actions affecting the schedule and cost of the program, such as the need to collect additional samples. The Contractor will notify the Ecology Project Manager when laboratory QA issues result in corrective actions affecting the schedule and cost of the program.

Data Management Procedures

Data management for the Yard Program will be conducted in accordance with the procedures outlined in Data Management Plan (Chapter 8 of the Program Design), the SAP (Appendix C of the Program Design), and the AREIS Database Manual (Appendix H of the Program Design).

The data generated during the Yard Program will be prepared in the form of an electronic data submittal to be uploaded into the Ecology EIM and AREIS databases. The databases standardize the study information and facilitate research and review for both the field and analytical results. The template for laboratory electronic data deliverables will be Ecology's EIM format. The reporting requirements will include the sample collection information supplied by the field teams including the sample and property identifiers, the sample date and time, the sample matrix, the sample type and the sample analysis. The laboratory report will include the sample analysis date, the analytical results, the reporting and detection limits for each analysis and any data qualifying notes for the analytical results.

Laboratory data will be acquired and managed in accordance with the procedures outlined in the Data Management Plan (Chapter 8 of the Program Design). The sampling team will create a data management tracking table to verify the correct analysis of all samples and to ensure compliance with sample collection requirements (i.e., sufficient sample volumes, duplicates, matrix spike samples, etc.). Laboratory data will be uploaded to Ecology's EIM System and the AREIS database system. The Contractor, or Ecology if conducting the soil sampling, will be responsible for uploading final laboratory results to EIM. Ecology will manage the upload of laboratory data to the AREIS database. Laboratory reports will not be uploaded into the Ecology databases unless they are fully completed.

Locational data will be acquired and managed in accordance with the procedures outlined in the Data Management Plan (Chapter 8 of the Program Design), the SAP (Appendix C of the Program Design), and the AREIS Database Manual (Appendix H of the Program Design). The x and y coordinates for the centroid of each DU will be entered into Ecology's ARIES database.

Performance Audits

The type and frequency of performance audits that may be conducted during the Yard Program are described below.

Laboratory Operations

Performance Evaluation Audits

Performance evaluation audits establish the quality of measurement data by analyzing samples provided specifically for the evaluation. Such audits evaluate the performance of the laboratory technicians and the instrumentation or analytical systems on which they work. A performance evaluation audit is accomplished by providing performance evaluation samples containing specific pollutants (in appropriate matrices) whose identities and/or levels are unknown to the technician. Laboratories participate in both internal and external performance testing to assess overall laboratory performance and qualify for various federal, state, and independent certification programs.

System and Technical Laboratory Audits

The laboratory QA Manager performs system and technical audits according to a predetermined schedule and when requested by laboratory management. Ecology or its Contractor may conduct a laboratory audit if corrective actions are needed during the Yard Program (e.g., a laboratory repeatedly does not meet QC criteria, or overall laboratory performance is questionable). This audit will be project-specific and will focus only on the laboratory's performance for this project. A laboratory audit report will be prepared and submitted to the Laboratory Project Manager and the Ecology Project Manager or designee.

Field Operations

A readiness review will be conducted before each field task requiring sampling to verify that the necessary preparations have been made for efficient and effective completion of the task-related field activities. The Field Manager will verify that the necessary field equipment has been assembled for the field activity and that the applicable subcontractors, if necessary, have been scheduled. Deficiencies noted during this readiness review will be corrected before field activities begin.

Field personnel must maintain continual communication with project members during all field activities so that corrective actions can be implemented if issues arise.

Data Verification

Data verification will be performed for field and laboratory data collected under the Yard Program as described below. Validation of laboratory data will not be completed.

Field Data Verification

Field QA procedures involve reviewing field notes for completeness, errors, and consistency. Duplicate measurements and documentation of conditions in field notes will support verification of field measurements. The Contractor has primary responsibility for field data verification.

Laboratory Data Verification

The laboratory will verify that analytical methods and protocols specified in this QAPP were followed; that calibrations, QC checks, and intermediate calculations were performed for samples; and that the data are consistent, correct, and complete, without errors or omissions. Evaluation criteria include the acceptability of instrument calibration, procedural blanks, check standards, recovery and precision data, and the appropriateness of assigned data qualifiers. The laboratory will prepare a written case narrative describing the results of its data review.

The Contractor, or Ecology if conducting the sampling, will be responsible for verifying that laboratory data meets project MQOs. The Contractor will also review the laboratory case narrative describing QA issues to assess the need for corrective actions. The Contractor will review for errors 10 percent of the project data prepared for EIM. If significant data entry errors are discovered, a more intensive review will be undertaken before finalizing and loading project data into Ecology's EIM database. After the reviewing and verifying the laboratory data, the Contractor will upload it to Ecology's EIM database.

Data Quality (Usability) Assessment

The Ecology Project Manager or designee will review the field and laboratory data verifications reported by the Contractor. Ecology will make the final determinations, based on these assessments, on whether the data will be accepted, accepted with appropriate qualifications, or rejected with re-analysis considered.

References

United States Environmental Protection Agency. 2006. EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, March 2001; Reissued May 2006).

Washington Department of Ecology. 2011. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Publication No. 04-03-030, Revision of Publication No. 01-03-003; Revised October 2011)

Attachment A. Glossary and Acronyms

GLOSSARY

Accreditation - A certification process for laboratories, designed to evaluate and document a laboratory's ability to perform analytical methods and produce acceptable data. For Ecology, it is "Formal recognition by (Ecology) that an environmental laboratory is capable of producing accurate analytical data." (WAC 173-50-040)

Accuracy - The degree to which a measured value agrees with the true value of the measured property. EPA recommends that this term not be used, and that the terms "precision" and "bias" be used to convey the information associated with the term "accuracy."

Analyte - An element, ion, compound, or chemical moiety (arsenic, lead) which is to be determined.

Bias - The difference between the population mean and the true value. Bias usually describes a systematic difference reproducible over time, and is characteristic of both the measurement system and the analyte(s) being measured. Bias is a commonly used data quality indicator.

Blank - A synthetic sample free of the analyte(s) of interest. In chemical analysis, a blank is used to estimate the analytical response to all factors other than the analyte in the sample. In general, blanks are used to assess possible contamination or inadvertent introduction of analyte during various stages of the sampling and analytical process.

Calibration - The process of establishing the relationship between the response of a measurement system and the level of the parameter being measured.

Completeness - The amount of valid data obtained from a data collection project compared to the planned amount. Completeness is usually expressed as a percentage; a data quality indicator.

Data verification - Examination of a dataset for errors or omissions, and assessment of the data quality indicators related to that dataset for compliance with acceptance criteria (MQOs). Verification is a detailed quality review of a dataset.

Duplicate samples - Two samples taken from and representative of the same population, and carried through sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variability of all method activities, including sampling and analysis.

Laboratory control sample - A sample of known composition prepared using contaminant-free water or an inert solid that is spiked with analytes of interest at the midpoint of the calibration curve or at the level of concern. It is prepared and analyzed in the same batch of regular samples using the same sample preparation method, reagents, and analytical methods employed for regular samples.

Matrix spike - A QC sample prepared by adding a known amount of the target analyte(s) to an aliquot of a sample to check for bias due to interference or matrix effects.

Measurement Quality Objectives - Performance or acceptance criteria for individual data quality indicators, usually including precision, bias, sensitivity, completeness, comparability, and representativeness.

Measurement result - A value obtained by performing the procedure described in a method.

Method - A formalized group of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, data analysis), systematically presented in the order in which they are to be executed.

Method blank - A blank prepared to represent the sample matrix, prepared and analyzed with a batch of samples. A method blank contains all reagents used in the preparation of a sample, and the same preparation process is used for the method blank and samples.

Method Detection Limit - The minimum level of an analyte that, in a given matrix and with a specific method, has a 99 percent probability of being identified, and reported to be greater than zero.

Percent Relative Standard Deviation - A statistic used to evaluate precision in environmental analysis.

Program Design - The abbreviation for the Program Design and Implementation Plan. This is the document that explains how and why Ecology will do yard sampling and cleanup work for the Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program.

Precision - The extent of random variability among replicate measurements of the same property; a data quality indicator.

Quality Assurance - A set of activities designed to establish and document the reliability and usability of measurement data.

Quality Assurance Project Plan - A document that describes the objectives of a project and the processes and activities necessary to develop data that will support those objectives.

Quality Control - The routine application of measurement and statistical procedures to assess the accuracy of measurement data.

Relative Percent Difference - Commonly used to evaluate precision; a data quality indicator.

Replicate samples - Two or more samples taken from the environment at the same time and place, using the same protocols. Replicates are used to estimate the random variability of the material sampled.

Representativeness - The degree to which a sample reflects the population from which it is taken.

Sensitivity - In general, the rate at which the analytical response (e.g., absorbance, volume, meter reading) varies with the level of the parameter being determined. In a specialized sense, it has the same meaning as the detection limit.

Service Area - The area of the Tacoma Smelter Plume where arsenic levels are most likely to exceed 100 ppm. This area encompasses southern Vashon-Maury Island, Ruston, and areas of northwest Tacoma to Highway 16.

Spiked blank - A specified amount of reagent blank fortified with a known mass of the target analyte(s); usually used to assess the recovery efficiency of the method.

Standard Operating Procedure – A document that describes in detail a reproducible and repeatable organized activity.

Model Toxics Control Act – **Legislation** passed by citizens of the State of Washington through an initiative in 1988, and later amended by the legislature. It regulates the identification, investigation, and cleanup of facilities where hazardous substances have been released into the environment. It also provides for public involvement in the decision-making process. The Model Toxics Control Act is Chapter 70.105D of the Revised Code of Washington (RCW).

ACRONYMS

AREIS	Area-wide Remediation Environmental Information System
COC	chain of custody
CRQL	contract required quantitation limits
DOT	U.S. Department of Transportation
EPA	United States Environmental Protection Agency
Ecology	Washington Department of Ecology
EDD	Electronic data deliverable
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
IATA	International Air Transport Association
ICP	inductively coupled plasma
ICP-MS	inductively coupled plasma-mass spectrometry
MDL	method detection limit
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Model Toxics Control Act
MQO	Measurement quality objective
Program Design	Program Design and Implementation Plan
ppm	Parts per million
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
R	recovery
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
XRF	X-ray fluorescence
Yard Program	Residential Yard Sampling and Cleanup Program

Appendix E

Outreach Materials for the Yard Program

Appendix E
Outreach Materials for the Yard Program

Sampling Access Outreach

Includes:

- Soil Sampling Offer Letter
- Property Access Agreement and Survey for Sampling
- Door Hangers
- Out of Program Letter

Soil Sampling Offer Letter

June 6, 2013

Homeowner or Current Resident
[STREET ADDRESS]
[CITY STATE ZIP]

Dear Homeowner or Current Resident:

Your yard may have arsenic and lead from the former Asarco smelter in north Tacoma. The Washington Department of Ecology (Ecology) is offering cleanup for the most contaminated yards using a settlement from Asarco. We would like to sample your yard to see if it qualifies for soil replacement in our **Residential Yard Sampling and Cleanup Program** (Yard Program).

Will you allow our soil samplers from **Tacoma Pierce County Health Department** to take soil samples from your yard at [ADDRESS]?

The Yard Program is voluntary.
This program is voluntary and you may opt out at any time. We urge you to sign up now because this is a one-time offer. We will attempt to contact you up to three times unless you decline sampling. Once you decline, you cannot join the program later.

How to sign up for sampling
By **[**DATE**]**, return your completed, signed access agreement form in the enclosed envelope. You may also send a scanned copy to me at [E-MAIL] or fill out a form at [WEB ADDRESS]. Once you return the completed access agreement, Tacoma Pierce County Health Department will contact you to set up an appointment. You do not have to be home at the time of sampling, but it is helpful.

How soil sampling works
When they arrive, the samplers will announce themselves. If you can be at the property at the time of sampling, they will ask a few questions about what areas you use the most. They will use small tools to dig 20-30 small holes, six inches deep. They will then fill the holes with topsoil and cover them. This should take about 2-3 hours.

How we decide if your yard qualifies for cleanup
We will send you your results along with a letter explaining next steps. Ecology will clean up any part of your yard with:

- Arsenic over 100 parts per million; or
- Lead over 500 parts per million.

Things to think about…

- **You may have to wait a year or more for cleanup.** Depending on the number of yards that need cleanup, it may take longer to reach certain neighborhoods. We will work with you to help reduce your family's exposure to soil while you wait.
- **You may have elevated arsenic or lead but not qualify for cleanup.** Ecology will not require you to clean up your own yard. We can give you advice on ways to reduce exposure, and ideas for landscaping that covers contaminated soil.
- **Disclosure when selling your home.** State law requires owners to disclose known soil contamination when selling a home. We recommend consulting a real estate professional if you have questions.
- **Your participation helps protect future generations.** Arsenic and lead stay in the soil for a very long time, and many people are unaware of the risk. By agreeing to soil sampling, you can help protect yourself and future owners.

Can you help us reach your neighbors?
Everyone on your block is receiving a letter. Do you have neighbors that are unable to read this letter or respond within the next two weeks? We would greatly appreciate a call or e-mail from you so we make sure we don't miss them.

Questions?
For more information about the Tacoma Smelter Plume, see the enclosed Dirt Alert brochure. Visit our webpage and click on the yard program: www.ecy.wa.gov/toxics/tacoma-smelter.html or contact me at Amy.Hargove@ecy.wa.gov.

Thank you in advance for your reply!

Sincerely,

Amy Hargrove
Remediation Manager
Amy.Hargrove@ecy.wa.gov
(360) 407-6262

Jill Jacobson
Yard Program Outreach Coordinator
Jill.Jacobson@ecy.wa.gov
(360) 407-6245

Additional Materials:
- Access agreement
- Envelope
- Dirt Alert brochure

If you need this letter in another format, please call (360) 407-6245. Persons with hearing loss can call 711 for Washington Relay Service. Persons with speech disability can call (877) 833-6341.

Property Access Agreement and Survey
For Tacoma Smelter Plume Yard Program Sampling

DEPARTMENT OF ECOLOGY
State of Washington

Owner Name_____
Last First

Street Address _____
Street City State Zip

Mailing Address _____
Street/PO Box City State Zip

Phone: Day _____ Evening _____

Best time/days to call _____

E-mail address_____

Property Questions
Your answers to the following questions will help us plan for soil sampling and avoid damaging your property.

1. **Age of home:** What year was the home on the property built? _____

2. **Recent soil disturbance:** Since 1987, has the property had any major projects that disturbed surface soils? This could include landscaping, adding new sod, rototilling, grading, or new building construction.

   - ❑ Yes (please continue to 2a and 2b below)
   - ❑ No

   2a. What year(s)? _____

   2b. Where on the property and what type of project(s)? _____

   _____

   _____

   _____

3. **Undisturbed areas:** Are there any areas that are not landscaped, or that have been wooded or covered in natural vegetation for the past 25 years or longer? If so, please describe them briefly: _____

   _____

   _____

4. **Sprinklers:** Does the property have an underground sprinkler system?

   ❑ Yes → At what depth is it buried? _____
   ❑ No

5. Does the property have any utilities or other items underground that our samplers could hit and damage or that could cause injury? (i.e. electrical wires for a water fountain)

   ❑ Yes → At what depth is it buried? _____

   Please Describe: _____

   ❑ No

6. **Other things to be aware of:** Do the samplers need to be careful about dogs or other pets? Are there any unsafe areas they should stay away from? Please describe:

   _____

Agreement Language
This section describes what you are agreeing to if you sign this form. Please contact Ecology if you have any questions or concerns (bottom of page).

I am the **owner** of the property identified above, and give my permission for representatives of the Washington Department of Ecology to enter the property and take soil samples to analyze for **arsenic** and **lead**. Note that if you are not the property owner, your landlord must provide a signed access agreement to allow Ecology and its representatives to collect a soil sample from the property listed above.

I understand that the data collected from my property are subject to requests for public disclosure under the Public Record Act or the Freedom of Information Act. I understand that the data collected will be placed on a public database. Ecology must provide the data, including my name and address, if requested under these acts. However, my name and address will not be published in any report generated by the Washington Department of Ecology or its representatives. I understand that I may have to disclose data collected from my property on Form 17 (Real Property Transfer Disclosure Statement) at time of sale.

❑ I would like a copy of the results from samples collected on my property.

I agree to hold harmless the Washington Department of Ecology and its employees, agents, and representatives from any and all liability arising directly or indirectly from the sampling, testing, evaluation, and disclosure related to the subject project.

_____ _____
Property owner signature Date

Please return your completed form in the enclosed postage-paid envelope, or mail to Jill Jacobson, TCP-SWRO, Department of Ecology, P.O. Box 47775, Olympia, WA 98504-7775, or scan and e-mail to Jill.Jacobson@ecy.wa.gov.

Form to Decline Soil Sampling and Cleanup
Tacoma Smelter Plume Yard Program

DEPARTMENT OF ECOLOGY
State of Washington

Ecology is offering to sample the soil in your yard for arsenic and lead to see if it qualifies for cleanup (soil replacement). If you wish to decline sampling and do not want Ecology to contact you again, please complete this form. Once you decline sampling, you cannot join the program later.

Owner Name_____
Last First

Street Address _____
Street

_____
City State Zip

Agreement Language
This section describes what you are agreeing to if you sign this form. Please contact Ecology if you have any questions or concerns (bottom of page).

I am the **owner** of the property identified above, and **decline** to participate in the Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program (Yard Program). I have been informed about the health risks of arsenic and lead. Department of Ecology will record my decision to not participate in a database that may be viewed by the public.

I understand that Department of Ecology will not offer any further soil sampling or cleanup for my property under the Yard Program. I also understand that once I decline the Yard Program I may not reenter the program.

A future owner of this property may be able to opt in to the Yard Program if funding remains.

_____ _____
Property owner signature Date

Please return your completed form in the enclosed postage-paid envelope, or mail to Adrianna Jarosz, 1201 3rd Avenue, Suite 330, Seattle, WA 98101 or scan and e-mail to AJarosz@Geosyntec.com.

SORRY WE MISSED YOU

The Washington Department of Ecology sent you a letter about the **Residential Yard Sampling and Cleanup Program** (Yard Program).

We are offering to sample your soil for arsenic and lead to see if your yard qualifies for cleanup (soil replacement).

To sign up for soil sampling, please contact our sampler's within two weeks at (206) 496-1455.

DEPARTMENT OF
ECOLOGY
State of Washington

SORRY WE MISSED YOU

Dear Homeowner or Current Resident,

The soil in your yard may have elevated levels of arsenic and lead from the former Asarco smelter in north Tacoma.

The Washington Department of Ecology (Ecology) is offering cleanup (soil replacement) for the most contaminated yards. Our soil sampler's can take free soil samples in your yard to see if it qualifies for soil replacement.

If your yard qualifies, Ecology staff would work with you to develop a property cleanup plan, then would remove contaminated soil and replace it with new soil before restoring your landscaping.

This is our second or third attempt to contact you to offer soil sampling. Please sign up for sampling within two weeks to be included in the program.

If you are **renting** this property, please help us by sharing this information with the property owner as soon as possible.

We look forward to working with you!

To sign up for soil sampling,
please contact us within two weeks.

Geosyntec Consultants
1201 3rd Avenue, Suite 330
Seattle, WA 98101
(206) 496-1455
Ajarosz@Geosyntec.com

Tacoma Smelter Plume
Washington Department of Ecology
www.ecy.wa.gov

[Insert TPCHD letterhead]

[Insert Date]

Homeowner or Current Resident
[STREET ADDRESS]
[CITY STATE ZIP]

Dear Homeowner or Current Resident:

Recently, the Tacoma Pierce County Health Department (the Health Department) sent you a letter and visited your home to talk to you about the **Residential Yard Sampling and Cleanup Program** (Yard Program). We offered to test the soil in your yard for arsenic and lead to see if your yard qualifies for cleanup (soil replacement). A copy of the original letter is enclosed in the envelope.

We either received a form from you declining sampling or you did not respond to our attempts to contact you. The purpose of this letter is to confirm that you are **out of the program**.

Do you feel you received this letter in error?
If you feel that you have received this letter in error, and wish to participate in sampling, please contact us immediately.

Are you a new homeowner?
If the previous owner of your property refused sampling from Ecology, we may be able to re-enter your yard in the program, as resources allow. To find out if you can re-enter the program, contact me at Amy.Hargrove@ecy.wa.gov or call 360-407-6262.

We recommend that you take "healthy actions" now to limit exposure to soils.
The soils in your yard could have high levels of arsenic and lead from the former Asarco smelter. Exposure is mostly from accidentally eating soil, and sometimes from swallowing particles breathed in, but not from touching it. Arsenic can cause cancer and lead can harm children's developing brains and nervous systems. You can take the following actions **now** to reduce your family's exposure:

- Wash hands after contact with soil, especially for children.
- Take off shoes at the door or use a doormat.
- Vacuum regularly and dust with a damp cloth.
- Wipe pets' paws and brush off their fur before coming inside.
- Wear a dust mask while working in dry soils.

The enclosed brochures offer more detailed advice. For health questions, please contact the Tacoma-Pierce County Health Department at dirtalert@tpchd.org or 253-798-6492.

Questions?
For more information about the Tacoma Smelter Plume, see the enclosed Dirt Alert brochure. For more information about Ecology's Yard Program, visit: www.ecy.wa.gov/toxics/tacoma-smelter.html or contact Amy.Hargove@ecy.wa.gov.

Thank you in advance for your reply!

Sincerely,

[Insert Signature]

[Insert Name]
Dirt Alert Program
Tacoma-Pierce County Health Department
(253) 798-6492
DirtAlert@tpchd.org

Enclosed Materials:

- Copy of the original letter
- Dirt Alert brochure

If you need this letter in another format, please call (360) 407-6245. Persons with hearing loss can call 711 for Washington Relay Service. Persons with speech disability can call (877) 833-6341.

Appendix E
Outreach Materials for the Yard Program

Sampling Results Outreach

Includes:

1. EPA Study Area:

- Above 90 ppm Letter
- 20-90 ppm Letter
- Below 20 ppm with No EPA Cleanup Letter
- Below 20 ppm with EPA Cleanup Letter

2. Vashon and Tacoma (Outside EPA Study Area):

- Above 90 ppm Letter
- 20-90 ppm Letter
- Below 20 ppm

3. Letter Attachments:

- Sample Results and Map

- Soil Cleanup Contact (Sign-Up) Form
- Soil Sampling and Cleanup Decline Form
- Dirt Alert Brochure
- Groundcover Brochure
- Healthy Gardening in Contaminated Soils

(Insert Date)

Homeowner or Current Resident
[Insert Address]

Dear Homeowner or Current Resident:

The Washington Department of Ecology (Ecology) is offering soil replacement, at no to minimal cost, for your yard at (Insert Address). The soil in your yard has high levels of arsenic from the former Asarco smelter. This contamination may pose a risk to you and your family

To sign up or decline cleanup, complete the enclosed pink form and return it in the postage-paid envelope by **[**2 weeks from mail date**].** You can also e-mail the information from the form to Amy.Hargrove@ecy.wa.gov. This program is voluntary and you can choose to decline the program. We urge you to sign up now because this is a one-time offer.

Why we are offering soil cleanup for your yard now…
In the past, Asarco or the U.S. Environmental Protection Agency (EPA) sampled your soils. At that time, the levels in your yard may have qualified for cleanup using EPA's cleanup "action level" of **230 parts per million** (ppm) for arsenic. If your levels did qualify, EPA removed and replaced only the soils with arsenic over 230 ppm or lead over 500 ppm.

In 2009, the State of Washington received a settlement from Asarco to clean up yards with over **100 ppm arsenic**. As a result, Ecology is now offering the **Residential Yard Sampling and Cleanup Program** in the Tacoma Smelter Plume. We have reviewed your sampling results and the soil in your yard has levels of arsenic over **100 ppm**.

After you sign up, we will contact you to set up a meeting within 1-2 months.
The purpose of this meeting is to gather more information about your yard to help plan for cleanup. We will look at the following:

- Whether your yard has changed significantly since it was sampled (such as landscaping).
- If we need to work around any trees, large plants, or structures.
- How you would like your yard restored after cleanup.

We recommend that you take "healthy actions" now to limit exposure to soils.
Although there is not an immediate health risk, Ecology is concerned about long-term exposure to arsenic and lead. Arsenic can cause cancer and lead can harm children's developing brains and nervous systems. You can take the following actions **now** to reduce your family's exposure:

- Wash hands after contact with soil, especially for children.
- Take off shoes at the door or use a doormat.
- Vacuum regularly and dust with a damp cloth.

- Wipe pets' paws and brush off their fur before coming inside.
- Wear a dust mask while working in dry soils

The enclosed brochures offer more detailed advice. For health questions, please contact the Tacoma-Pierce County Health Department at dirtalert@tpchd.org or 253-798-3503.

How to read the soil sampling results for your yard.
The enclosed paperwork includes a map of your property and a table of sampling results. This paperwork is also available online at: https://fortress.wa.gov/ecy/areispublic/.

On the map, EPA divided your yard into "subunits" to help decide where cleanup was needed. Each subunit has results for arsenic (As) and lead (Pb), at four depths below the ground surface. Ecology is looking at the top 0-6 and 6-12 inches of soil and comparing it to our threshold levels*. Your yard qualifies for cleanup in any of the following cases:

- Average arsenic across the whole property is over 90 ppm.
- Average lead is over 500 ppm.
- Arsenic in at least one subunit is over 200 ppm.
- Lead in at least one subunit is over 1,000 ppm.

* The Yard Program aims to replace soils in yards with arsenic over 100 ppm, but we are comparing sampling results against a threshold of 90 ppm. Ecology uses this lower threshold to ensure we clean up more yards over the action level of 100 ppm.

Questions?
Visit our webpage and click on the yard program: www.ecy.wa.gov/toxics/tacoma-smelter.html or contact me at Amy.Hargove@ecy.wa.gov.

We look forward to working with you.

Sincerely,

Amy Hargrove

Amy Hargrove
Remediation Manager
Amy.Hargrove@ecy.wa.gov
(360) 407-6262

Additional Materials:

- Sample results sheet and property map
- Form to return
- Postage-paid envelope
- Dirt Alert brochure

If you need this letter in another format, please call (360) 407-6245. Persons with hearing loss can call 711 for Washington Relay Service. Persons with speech disability can call (877) 833-6341.

Letter to Homes with 20-90 PPM (EPA Study Area)

(Insert Date)

Homeowner or Current Resident
(Insert Address)

Dear Homeowner or Current Resident:

The Washington Department of Ecology (Ecology) is notifying homeowners about arsenic and lead soil sampling results for their yards. The soil in your yard at [Insert property address] has elevated levels of arsenic or lead from the former Asarco smelter. The purpose of this letter is to help you reduce contact with contaminated soils in your yard.

Your yard was sampled sometime in the last 20 years.
In the past, Asarco or the U.S. Environmental Protection Agency (EPA) sampled your soils as part of the Asarco Superfund cleanup. The levels in your yard may have qualified for cleanup using EPA's cleanup "action level" of **230 parts per million** (ppm) for arsenic. If your levels did qualify, EPA would have completed removed and replaced only the soils with arsenic above 230 ppm.

Your soils are above the state cleanup levels for arsenic and lead.
Whether or not EPA did any cleanup, your results show arsenic and lead above the state's cleanup levels.

- The state cleanup level for arsenic in soil is 20 parts per million (ppm).
- The state cleanup level for lead in soil is 250 parts per million (ppm).

There is no immediate health concern but there is a long term risk.
At the arsenic and lead levels found in your yard, long-term, daily exposure slightly raises the risk of certain health problems. Children are at greater risk than adults. Arsenic can cause cancer and lead can harm children's developing brains and nervous systems.

We recommend that you take "healthy actions" now to limit exposure to soils.
Exposure is mostly from accidentally eating soil, and sometimes from swallowing particles breathed in, but not from touching it. You can take the following actions now to reduce your family's exposure:

- Wash hands after contact with soil, especially for children.
- Take off shoes at the door or use a doormat.
- Vacuum regularly and dust with a damp cloth.
- Wipe pets' paws and brush off their fur before coming inside.
- Cover bare patches of soil in your yard with grass, bark, gravel, or pavers.

We recommend these actions while gardening:

- Garden in raised beds and mix organic material with soils.
- Wash fruits and vegetables with a scrub brush, making sure all dirt is removed.
- Peel carrots, potatoes, and other root crops. Throw away the peelings.

The enclosed brochures offer more detailed advice. For health concerns or questions about next steps, please contact the Tacoma-Pierce County Health Department at dirtalert@tpchd.org or 253-798-3503.

Your yard does not qualify for Ecology's Residential Yard Sampling and Cleanup Program (Yard Program).

In 2009, the State of Washington received a settlement from Asarco to clean up yards with arsenic levels over **100 ppm arsenic**. Ecology is now offering cleanup for these yards. We looked at the soil sampling results for your property and determined that the yard does not qualify for cleanup under the Yard Program.

How to find the soil sampling results for your yard.

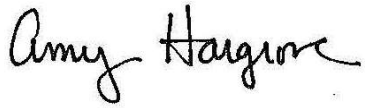
Your soil sampling results are available online at: https://fortress.wa.gov/ecy/areispublic/.
If you plan to sell your house, we recommend consulting with a real estate professional about disclosure of your sampling and cleanup record. Keep in mind that all yard sampling and cleanup data is available on Ecology's public database.

Questions?

Visit our webpage for more information on the Yard Program:
http://www.ecy.wa.gov/programs/tcp/sites_brochure/tacoma_smelter/2011/yard.html

Please contact me if you have any other questions or concerns.

Sincerely,



Amy Hargrove
Remediation Manager
Amy.Hargrove@ecy.wa.gov
(360) 407-6262

Additional Materials:

- TPCHD Dirt Alert brochure
- Groundcover brochure

If you need this letter in another format, please call (360) 407-6245. Persons with hearing loss can call 711 for Washington Relay Service. Persons with speech disability can call (877) 833-6341.

Letters to homes under 20 PPM with no EPA cleanup, (EPA Study Area)

[Insert date]

Homeowner or Current Resident
[Insert Address]

Dear Homeowner or Current Resident,

The Tacoma-Pierce County Health Department is notifying homeowners about arsenic and lead soil sampling and cleanup results for their yards. Some homes in your neighborhood have high levels of arsenic and lead from the former Asarco smelter. The soil in your yard at [PROPERTY ADDRESS] **does not need cleanup**.

Why we are contacting you now...
In the past 20 years, Asarco or the EPA sampled your soils as part of the Asarco Superfund cleanup. In 2009, the State of Washington received a settlement from Asarco to clean up yards with a parcel average of arsenic above **100 parts per million (ppm)**. The Health Department looked at the sampling results for your property and if cleanup work was completed by the EPA.

How the Health Department evaluated soil sampling results for your yard.
Your arsenic and lead levels are in parts per million (ppm). One part per million is about the same as a half a drop of water in a full bathtub and equal to one milligrams/kilogram.
We determined that the parcel average for arsenic in the top 0-6 inches of soil is [Parcel Average], which is below Ecology's action level of 100 ppm. The parcel average for arsenic is also below state cleanup levels which are based on state law—the Model Toxics Control Act. Ecology considers an area cleaned up if the level of arsenic and lead in the soil is less than or equal to the state cleanup level.

- The state cleanup level for arsenic in soil is 20 ppm.
- The state cleanup level for lead in soil is 250 ppm.

We still recommend "healthy actions" to limit exposure to soils.
Your yard and most local schools, childcares, and parks now have soils below state cleanup levels. However, other soils in your neighborhood may be contaminated. Exposure is mostly from accidentally eating soil, and sometimes from swallowing particles breathed in, but not from touching it. It's a good idea to take some simple actions to reduce your family's exposure:

- Wash hands after contact with soil, especially for children.
- Take off shoes at the door or use a doormat.
- Vacuum regularly and dust with a damp cloth.
- Wipe pets' paws and brush off their fur before coming inside.

Questions?
The enclosed brochure shows other affected areas and lists more healthy actions. For health questions, please contact the Tacoma-Pierce County Health Department at dirtalert@tpchd.org or 253-798-6492.

How to find the soil sampling results for your yard.
Your soil sampling results are available online at: https://fortress.wa.gov/ecy/areispublic/.

Sincerely,

[Insert Signature]

[Insert Name]
Tacoma-Pierce County Health Department
(253) 798-6492
DirtAlert@tpchd.org

Enclosed Materials:

- TPCHD Dirt Alert brochure

If you need this letter in another format, please call (360) 407-6245. Persons with hearing loss can call 711 for Washington Relay Service. Persons with speech disability can call (877) 833-6341.

Letter to Homes with Under 20 PPM, EPA Action (EPA Study Area)

[Insert date]

Homeowner or Current Resident
[Insert Address]

Dear Homeowner or Current Resident,

The Tacoma-Pierce County Health Department is notifying homeowners about arsenic and lead soil sampling and cleanup results for their yards. Some homes in your neighborhood have high levels of arsenic and lead from the former Asarco smelter. All or parts of the yard at [Insert property address] were remediated by the U.S. Environmental Protection Agency (EPA).

Why we are contacting you now…
In the past 20 years, Asarco or the EPA sampled your soils as part of the Asarco Superfund cleanup. In 2009, the State of Washington received a settlement from Asarco to clean up (replace soils) yards with a parcel average of arsenic above **100 parts per million (ppm)**. The Health Department looked at the sampling results for your property and the cleanup work completed by the EPA.

The Health Department evaluated soil sampling results for your yard.
Your arsenic and lead levels are in parts per million (ppm). One part per million is about the same as a half a drop of water in a full bathtub and equal to one milligrams/kilogram. We determined that the parcel average for arsenic in the top 0-6 inches of soil is [Parcel Average], which is below Ecology's action level of 100 ppm. The parcel average for arsenic is also below the state cleanup levels which are based on state law - the Model Toxics Control Act. Ecology considers an area cleaned up if the level of arsenic and lead in the soil is less than or equal to the state cleanup level.

- The state cleanup level for arsenic in soil is 20 ppm.
- The state cleanup level for lead in soil is 250 ppm.

Contaminated soils may still remain on your property in areas EPA did not sample, such as under decks, on steep slopes and under large structures. You may also have contamination in deeper soils that EPA did not sample or remove.

We still recommend "healthy actions" to limit exposure to soils.
Your yard and other places in the neighborhood could have remaining contamination. Exposure is mostly from accidentally eating soil, and sometimes from swallowing particles breathed in, but not from touching it. It's a good idea to take some simple actions to reduce your family's exposure:

- Wash hands after contact with soil, especially for children.
- Take off shoes at the door or use a doormat.
- Vacuum regularly and dust with a damp cloth.
- Wipe pets' paws and brush off their fur before coming inside.

Questions?
The enclosed brochure shows other affected areas and lists more healthy actions. For health questions, please contact the Tacoma-Pierce County Health Department at dirtalert@tpchd.org or 253-798-6492.

How to find the soil sampling results for your yard.
Your soil sampling results are available online at: https://fortress.wa.gov/ecy/areispublic/.
The Seller's Disclosure Statement (Form 17) asks if there is any soil contamination on the property. Ecology considers an area cleaned up if the level of arsenic and lead in the soil is less than or equal to the cleanup level. If you plan to sell your property or house, we recommend consulting with a real estate professional about disclosure of your sampling and cleanup record. Keep in mind that all yard sampling and cleanup data is available on Ecology's public database.

Sincerely,

[Insert Signature]

[Insert Name]
Tacoma-Pierce County Health Department
(253) 798-6492
DirtAlert@tpchd.org

Enclosed Materials:

- TPCHD Dirt Alert brochure
- EPA soil handling brochure

If you need this letter in another format, please call (360) 407-6245. Persons with hearing loss can call 711 for Washington Relay Service. Persons with speech disability can call (877) 833-6341.

Letter to homes above 90 PPM, cleanup offer (Outside EPA Study Area)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

[Insert Date]

[NAME]
[ADDRESS]
[CITY STATE ZIP]

Dear [PROPERTY OWNER NAME:

In [Insert year], the Tacoma Pierce County Health Department (the Health Department) took soil samples from your yard at [PROPERTY ADDRESS]. The soil in your yard has high levels of arsenic and lead from the former Asarco smelter. The Washington Department of Ecology (Ecology) is offering cleanup (soil replacement) for no to minimal cost for your yard. Enclosed are the results from your yard and a map showing where the samples were taken.

To sign up or decline cleanup, complete the enclosed pink form and return it in the postage-paid envelope by [2 weeks from mail date]. You can also e-mail the information from the form to Amy.Hargrove@ecy.wa.gov. This program is voluntary and you can choose to participate or decline. We urge you to sign up now because this is a one-time offer.

Why we are offering soil cleanup for your yard now...
In 2009, the State of Washington received a settlement from Asarco to clean up yards with over 100 ppm arsenic. As a result, Ecology is now offering the Residential Yard Sampling and Cleanup Program (Yard Program) in the Tacoma Smelter Plume. One or more areas of your yard qualify for cleanup because the levels are above our threshold levels:

- 90 ppm for arsenic.
- 500 ppm for lead.

Threshold level: The Yard Program aims to replace soils in yards with arsenic over 100 ppm, but we are comparing sampling results against a threshold of 90 ppm. Ecology uses this lower threshold to ensure we find more yards over the action level of 100 ppm.

After you sign up, we will contact you to set up a home visit within 1-2 months.

The purpose of this visit is to gather more information about your yard to help plan for cleanup. Some areas are excluded from clean up, such as around trees or large plantings, rock walls, ponds, or under pavement. We will look at the following during the visit:

- Where soils are accessible to dig out.
- If we need to work around any trees, large plants, or structures.
- Where we can bring in digging equipment.
- How you would like your yard restored after cleanup.

We recommend that you take "healthy actions" now to limit exposure to soils.
Although there is not an immediate health risk, Ecology is concerned about long-term exposure to arsenic and lead. Arsenic can cause cancer and lead can harm children's developing brains and nervous systems. You can take the following actions to reduce your family's exposure:

- Wash hands after contact with soil, especially for children.
- Take off shoes at the door or use a doormat.
- Vacuum regularly and dust with a damp cloth.
- Wipe pets' paws and brush off their fur before coming inside.

The enclosed brochures offer more detailed advice. For health questions, please contact Tacoma-Pierce County Health Department at DirtAlert@tpchd.org or (253) 798-6492.

If you have questions or concerns about the yard cleanup program, please contact me or our outreach coordinator.

We look forward to working with you!

Sincerely,

[NAME]
Field Coordinator
[EMAIL][PHONE]

[NAME]
Cleanup Manager
[NAME] [EMAIL][PHONE]

Enclosed Materias:

- Results and map
- Form to return
- Postage-paid envelope
- Dirt Alert brochure

If you need this letter in another format, please call (360) 407-6245. Persons with hearing loss can call 711 for Washington Relay Service. Persons with speech disability can call (877) 833-6341

Letters to homes 20-90 PPM (Outside EPA Study Area)

[NAME]
[ADDRESS]
[CITY STATE ZIP]

[DATE]

Dear [PROPERTY OWNER NAME],

Recently, the Tacoma-Pierce County Health Department (Health Department) took soil samples from your property at [PROPERTY ADDRESS]. The soil in your yard has elevated levels of arsenic or lead from the former Asarco smelter. The purpose of this letter is to help you reduce contact with contaminated soils in your yard. Enclosed are the results from your yard and a map showing where the samples were taken.

How to understand your sampling results…
Your arsenic and lead levels are in parts per million (ppm). One part per million is about the same as a half a drop of water in a full bathtub and equal to one milligram/kilogram. The Health Department looked at the soil sampling results for your property and determined that no part of your yard has arsenic or lead above the Department of Ecology's (Ecology) cleanup action levels for the Residential Yard Sampling and Cleanup Program (Yard Program). The cleanup **action** levels are:

- Arsenic over 100 parts per million; or
- Lead over 500 parts per million.

However, the Health Department did find that part or all of your yard has arsenic or lead levels above state cleanup levels. The state cleanup level for arsenic in soil is 20 ppm and for lead in soil is 250 ppm. Ecology sets state cleanup levels based on state law—the Model Toxics Control Act. Ecology considers an area cleaned up if the level of arsenic and lead in the soil is less than or equal to the cleanup level.

There is no immediate health concern but there is a long term risk.
At the arsenic and lead levels found in your yard, long-term, daily exposure slightly raises the risk of certain health problems. Exposure is mostly from accidentally eating soil, and sometimes from swallowing particles breathed in, but not from touching it. Children are at greater risk than adults.

We recommend that you take "healthy actions" now to limit exposure to soils.
You can take the following actions now to reduce your family's exposure:

- Wash hands after contact with soil, especially for children.
- Take off shoes at the door or use a doormat.
- Vacuum regularly and dust with a damp cloth.
- Wipe pet's paws and brush off their fur before coming inside.

- Cover bare patches of soil in your yard with grass, bark, gravel, or pavers.

We recommend these actions while gardening:

- Garden in raised beds and mix organic material with soils.
- Wash fruits and vegetables with a scrub brush, making sure all dirt is removed.
- Peel carrots, potatoes, and other root crops, Throw away all the peelings.

You have completed Ecology's Yard Program.
Some of your neighbors may get letters from Ecology offering soil cleanup if they have high levels of arsenic or lead. Your yard does not qualify for cleanup because the levels of arsenic are below 100 ppm.

We understand that it may be frustrating to find out that you have contamination and Ecology cannot clean it up. We set these criteria to ensure we cleanup the highest contaminated properties with the limited funding.

You can address soil contamination during landscaping projects.
Ecology does not require homeowners to clean up their own soils. However, if you are planning any landscaping projects, this is a good time to cover or mix contaminated soils. Please see the enclosed brochure and contact us for further advice.

Your results are also available online at https://fortress.wa.gov/ecy/areispublic/.
If you need another copy of your results, you can find them online in our public database.
The Seller's Disclosure Statement (Form 17) asks about soil contamination on the property. We recommend consulting with a real estate professional about disclosure of your sampling and cleanup record if you sell your house.

The enclosed brochures offer more detailed advice. For health concerns or questions about reducing exposure, please contact Tacoma Pierce County Health Department at (253) 798-6492.

Sincerely,
[Insert signature]
]Insert Name]
Dirt Alert Program
Tacoma-Pierce County Health Department
(253) 798-6492
DirtAlert@tpchd.org

Enclosed Materials

- Results and map
- TPCHD Dirt Alert brochure
- Groundcover brochure

If you need this letter in another format, please call (360) 407-6245. Persons with hearing loss can call 711 for Washington Relay Service. Persons with speech disability can call (877) 833-6341.

Letters to homes under 20 PPM (Outside EPA Study Area)

[NAME]
[STREET ADDRESS]
[CITY STATE ZIP]

[DATE]

Dear [NAME OF PROPERTY OWNER],

Recently, the Tacoma-Pierce County Health Department took soil samples from your property at [PROPERTY ADDRESS]. **Arsenic and lead levels in your samples were <u>below</u> state cleanup levels.** Your yard does not need cleanup under the Department of Ecology's (Ecology) Residential Yard Sampling and Cleanup Program (Yard Program). Enclosed are the results from your yard and a map showing where the samples were taken.

Your soils are <u>below</u> the state cleanup levels for arsenic and lead.
Your results show arsenic and lead levels in parts per million (ppm).

- The state cleanup level for arsenic in soil is 20 parts per million (ppm).
- The state cleanup level for lead in soil is 250 parts per million (ppm).

We still recommend "healthy actions" to limit exposure to soils.
Your yard and most local schools, childcares, and parks now have soils below state cleanup levels. However, other soils in your area may be contaminated. Exposure is mostly from accidentally eating soil, and sometimes from swallowing particles breathed in, but not from touching it. It's a good idea to take some simple actions to reduce your family's exposure:

- Wash hands after contact with soil, especially for children.
- Take off shoes at the door or use a doormat.
- Vacuum regularly and dust with a damp cloth.
- Wipe pets' paws and brush off their fur before coming inside.

The enclosed brochure shows other affected areas and lists more healthy actions. For health questions, please contact the Tacoma-Pierce County Health Department at dirtalert@tpchd.org or 253-798-3503.

You have completed Ecology's Yard Program.
Some of your neighbors may get letters from Ecology offering soil cleanup if they have high levels of arsenic or lead. Your yard does not need cleanup.

Your results are also available online at https://fortress.wa.gov/ecy/areispublic/.
If you need another copy of your results, you can find them online in our public database.

Questions?
For health concerns or questions about reducing exposure, please contact Tacoma Pierce County Health Department at (253) 798-6492.

Thank you for your participation!

Sincerely,

[Insert signature]

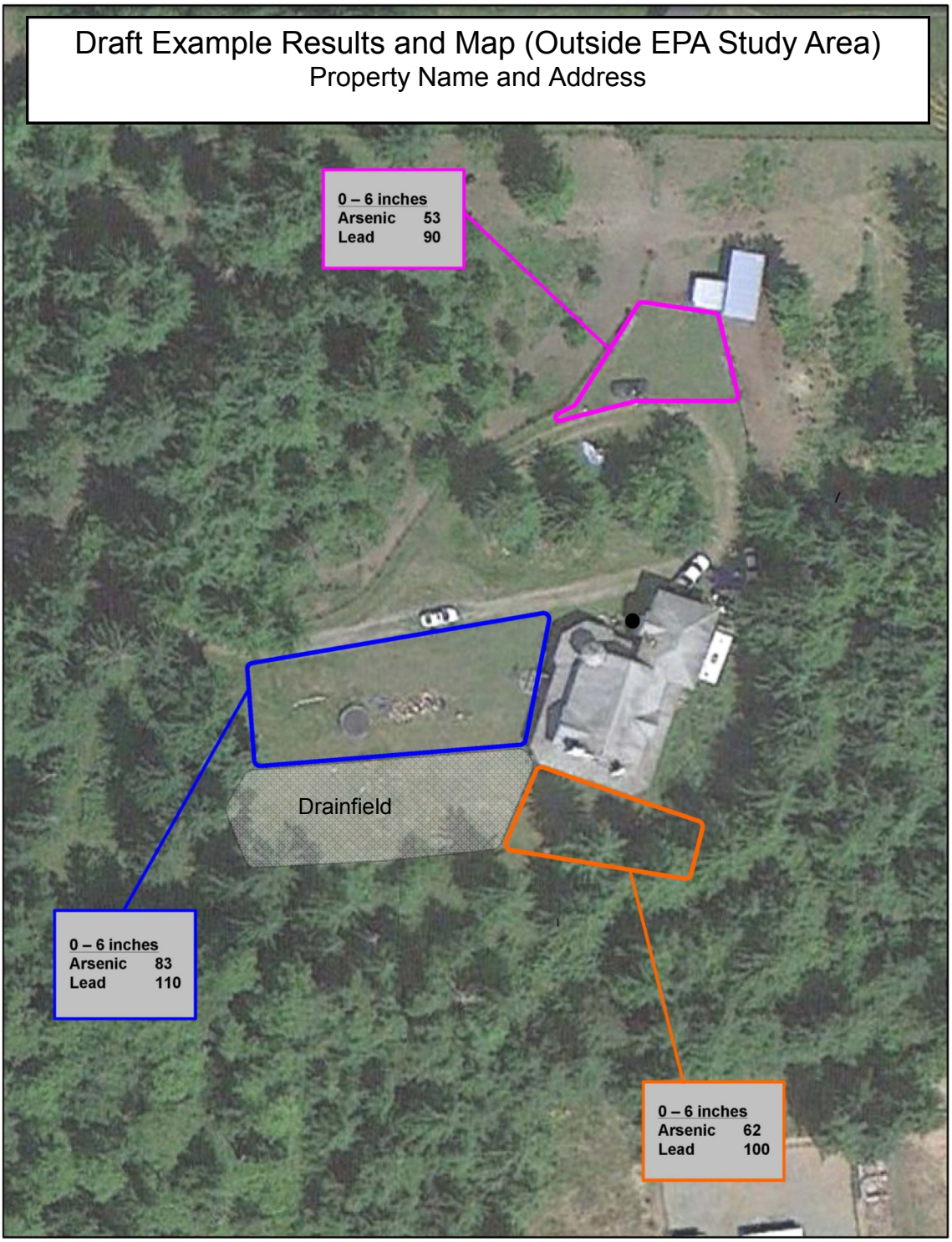
]Insert Name]
Dirt Alert Program
Tacoma-Pierce County Health Department
(253) 798-6492
DirtAlert@tpchd.org

Enclosed Materials:
- Dirt Alert brochure

If you need this letter in another format, please call (360) 407-6245. Persons with hearing loss can call 711 for Washington Relay Service. Persons with speech disability can call (877) 833-6341.

Draft Example Results and Map (Outside EPA Study Area)

Property Name and Address



Legend:

High Use Areas

- Unit 1
- Unit 2
- Unit 3
- Drainfield Area (approximate) (excluded from soil sampling)

GPS Survey Point Location
Lat N 47° 21.551'
Long W 122° 27.433'

Tacoma Smelter Plume
Yard Program Results

DEPARTMENT OF ECOLOGY
State of Washington

Site ID

Notes:
1. Arsenic and lead concentrations are in parts per million (ppm)
2. All locations are approximate and not to scale

N

Soil Cleanup Contact Form
Ruston/North Tacoma Study Area Homes
Tacoma Smelter Plume Yard Program

DEPARTMENT OF ECOLOGY
State of Washington

As described in the attached letter, soil arsenic levels in your yard may qualify for cleanup. The Department of Ecology would like to meet with you. If you are interested in learning more, please fill out your contact information below. If you wish to decline cleanup and do not want Ecology to contact you again, see page two of this form.

(Owner) Name_____
Last First

Street Address _____
Street City State Zip

Mailing Address _____
Street/PO Box City State Zip

Phone: Home _____ Mobile_____

Best time/days to call _____

E-mail address_____

If enough people are interested, we will hold a neighborhood meeting to share more about the cleanup process and timing. What time works best for you?

- ❑ Weekday evening (Monday-Thursday)
- ❑ Other time: _____
- ❑ I am not interested

Please return your completed form in the enclosed postage-paid envelope, or mail to Amy Hargrove, TCP-SWRO, Department of Ecology, P.O. Box 47775, Olympia, WA 98504-7775, or scan and e-mail to Amy.Hargrove@ecy.wa.gov.

Form to Decline Soil Sampling and Cleanup
Tacoma Smelter Plume Yard Program

DEPARTMENT OF ECOLOGY
State of Washington

Owner Name_____
Last First

Street Address _____
Street

_____
City State Zip

Agreement Language
This section describes what you are agreeing to if you sign this form. Please contact Ecology if you have any questions or concerns (bottom of page).

I am the **owner** of the property identified above, and **decline** to participate in the Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program (Yard Program). I have been informed about the health risks of arsenic and lead. Department of Ecology will record my decision to not participate in a database that may be viewed by the public.

I understand that Department of Ecology will not offer any further soil sampling or cleanup for my property under the Yard Program. I also understand that once I decline the Yard Program I may not reenter the program.

A future owner of this property may be able to opt in to the Yard Program if funding remains.

_____ _____
Property owner signature Date

Please return your completed form in the enclosed postage-paid envelope, or mail to Amy Hargrove, TCP-SWRO, Department of Ecology, P.O. Box 47775, Olympia, WA 98504-7775, or scan and e-mail to Amy.Hargrove@ecy.wa.gov.

Tacoma-Pierce County
Health Department
Environmental Health Division

dirtalert@tpchd.org
www.tpchd.org/dirtalert
(253) 798-6492

3629 South D St. • Tacoma, WA 98418

Tacoma - Pierce County Health Department
Healthy People in Healthy Communities
www.tpchd.org

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Printed on recycled paper with post-consumer content • 2/2011

ARSENIC AND LEAD In the Soil

PROTECT YOUR FAMILY!

www.tpchd.org/dirtalert • (253) 798-6492

Tacoma - Pierce County Health Department
Healthy People in Healthy Communities
www.tpchd.org

Arsenic and Lead in Pierce County

For almost 100 years, arsenic, and lead, were blown from a smoke stack throughout Pierce and King Counties from the ASARCO copper smelter in Ruston, Washington. The smelter closed in 1986. Even though the smelter is no longer operating the arsenic and lead remain in the soil and will continue to be a health risks for years to come.

Pierce County communities most affected are:

- North Tacoma
- Northeast Tacoma
- West End Tacoma
- University Place
- Fircrest
- Lakewood
- Steilacoom
- Parts of Gig Harbor, Fox Island, Anderson Island, Fort Lewis and Dupont.

For more information, contact Tacoma-Pierce County Health Department at dirtalert@tpchd.org or (253) 798-6492, or visit www.tpchd.org/dirtalert.

The Risk to Human Health

Eating and breathing dust that contains arsenic and lead can contribute to poor health, especially in young children.

- Lead is linked to developmental disabilities in children and may affect I.Q.
- Arsenic may cause cancer later on in life and may also contribute to heart disease.
- At greatest risk are children under the age of 6 because they put things into their mouths.
- Dust can be inhaled and is eaten when it falls on food or anything that is put into their mouths.

Contact Your Healthcare Provider

If you are concerned about exposure to arsenic, lead or other contaminants, contact your health care provider for more information.

Tom the Gardener

Healthy Actions

Important Safety Guidelines

Healthy Actions are simple things you and your family can do to reduce contact with arsenic and lead in dirt. Even relatively small changes can help everyone to reduce their risk of contact with arsenic, lead and other harmful chemicals.

FOR MORE INFORMATION, PLEASE CONTACT:

Dirt Alert
Environmental Health Division
Tacoma-Pierce County Health Department
(253) 798-6492 • www.tpchd.org/dirtalert
dirtalert@tpchd.org

or

Tacoma Smelter
Plume Project
Washington Department of Ecology
(360) 407-6257 • www.ecy.wa.gov

Kick Off Your Shoes

Dust and dirt are tracked inside on shoes.

Leave your shoes at the door or use a “wipe-off” mat to greatly reduce dirt and dust that gets into your home.

Provide a shoe rack or designate an area for shoes at your door.

Use Plenty of Soap and Water

Dirt is found on hands, toys, shoes, clothing and pets. Washing dirt off is a healthy thing to do. (Hand sanitizers do not remove arsenic and lead from hands.)

Wash your hands well before eating and after working or playing in the soil. Use a scrub brush to clean dirt from under your nails.

Wash heavily soiled clothing separately from other laundry.

Wash children’s toys, bedding, and pacifiers frequently.

Keep Pets Clean

Pets walk, roll, and lie down in dirt and soil. When pets come into the house, their fur and paws bring in soil and dust too.

Wipe off all excess dirt and mud before your pet comes into your home. Brush and bathe your pet regularly.

Restrict your pet to parts of your home that are free from carpeting and upholstery.

Give pets their own “bed” or place within your home.

Mop, Dust and Vacuum

People and pets track in dirt or it can enter your home in the form of small dust particles through windows and doors. Dust and dirt settles on carpeting, throw rugs, curtains, upholstered furniture, as well as windowsills and bookcases.

Damp-dusting and vacuuming at least once a week decreases the amount of dust and dirt in your home.

Always use a damp-mop or a damp-cloth when you dust.

Maintain Your Home and Yard

Covering bare patches and keeping up with home-maintenance keeps harmful dirt away from your family.

Cover bare patches in your yard with a ground cover such as grass, gravel, wood/mulch product or native plants – they require less watering and maintenance.

Maintain the painted surfaces of your home. Homes built before 1978 may have been painted with paint containing lead. When lead-paint chips or wears away, it becomes a major source of lead, both inside and outside the home.

Have your soil tested.

Eat a Healthy Diet

Iron, calcium and vitamin C help to decrease absorption of lead.

Eat a diet rich with these nutrients. Include foods like broccoli, spinach, potatoes, dairy products and citrus fruits.

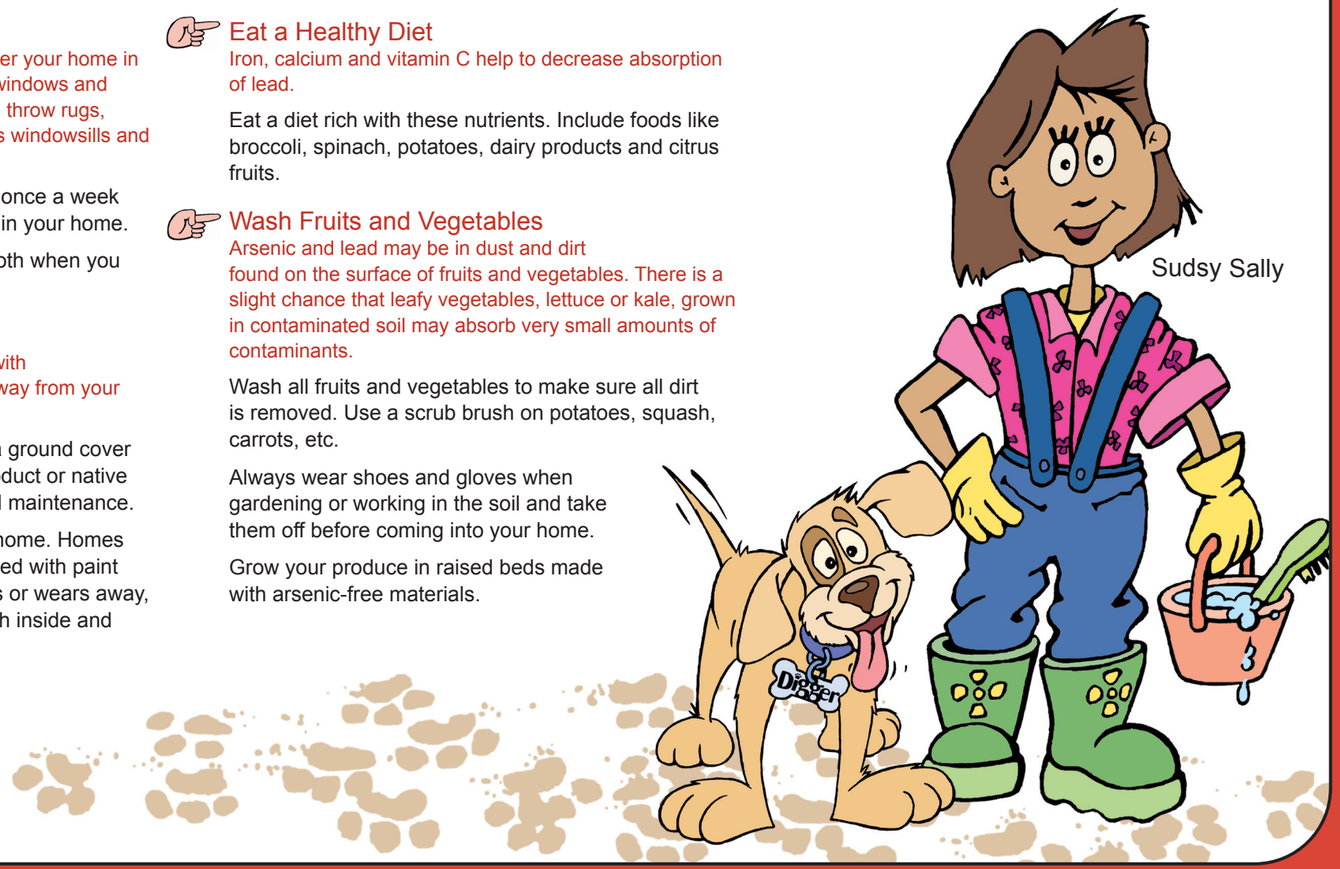
Wash Fruits and Vegetables

Arsenic and lead may be in dust and dirt found on the surface of fruits and vegetables. There is a slight chance that leafy vegetables, lettuce or kale, grown in contaminated soil may absorb very small amounts of contaminants.

Wash all fruits and vegetables to make sure all dirt is removed. Use a scrub brush on potatoes, squash, carrots, etc.

Always wear shoes and gloves when gardening or working in the soil and take them off before coming into your home.

Grow your produce in raised beds made with arsenic-free materials.

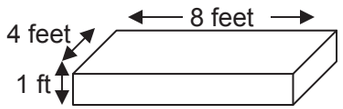


MOP • WASH • SCRUB • DUST • WIPE

Raised Garden Beds

What is Involved
Moderate labor is required to construct raised beds but it is a relatively simple process. Here's an example of how to calculate how much soil you'll need to fill a 4 feet wide by 8 feet long by 1 foot deep bed.

- (4 x 8) x 1 = 32 cubic feet
- There are 27 cubic feet in 1 cubic yard
- 32 divided by 27 = 1.2 cubic yards



2009 Cost Estimates*
Garden topsoil prices can range from $20 to $29 per cubic yard. Look in the phone directory under *Topsoil* to find a listing of local topsoil businesses. A 3 feet by 5 feet roll of landscaping fabric can range from $9.92 to $13.49 per roll.

Things to Think About
For added protection, use a heavy duty landscape fabric over the contaminated soil, then construct your raised bed on top of the landscape fabric.

Do not use older, treated wood. The majority of treated wood produced before 2004 was treated with chromate copper arsenate, which can contaminate your clean soil with arsenic. Unfinished cedar is a good choice and will last many years. Stone, concrete or other masonry products are also good choices.

Who to Contact
Local topsoil businesses or nurseries.

Common Ground Covers

What is Involved
Bark and wood chips are ideal for flower gardens, under hedges, around decorative bushes, trees, and children's play areas. The depth of cover is up to you, but remember that more is better, especially for use in children's play areas. Decorative rock or pea gravel can also be used in various landscaping applications. Pea gravel at depths of 12 inches or more works well under children's play sets and Jungle Gyms.

2009 Cost Estimates*
Bark and wood chips can range from $22.50 to $28 per cubic yard. Pea gravel can range from $22 to $24.50 per cubic yard. Other decorative type rock can range from $23 to $43 per cubic yard.

Things to Think About
For added protection, lay down a permeable landscape fabric before spreading any chosen ground cover.

Who to Contact
Landscapers, topsoil businesses, or nurseries.

Grass Cover

What is Involved
A well maintained solid layer could provide a barrier to contaminated soils.

2009 Cost Estimates*
A five-pound bag of grass seed can range from $17.50 to $38. The average cost of sod is $3.09 per roll if you haul. A roll is 2 feet by 5 feet. The cost will increase if you have it delivered.

Things to Think About
The two benefits of having a deeper clean topsoil layer are: 1) increased protection from contaminated soil, and 2) healthier turf. You may want to supplement your topsoil with compost or mulch before you plant fresh sod.

Who to Contact
Landscapers, nurseries, hardware stores, or sod farms.

Tacoma-Pierce County Health Department—always leading the way toward a healthier and safer Pierce County.

Sand Boxes and Rubber Mats

What is Involved
Families with young children may want to consider the use of sand boxes, with covers to keep the cats out. Rubber mulch under play sets can also be considered. Be sure to check that the rubber mulch is safe for children.

2009 Cost Estimates*
Sand can range from $22 to $24.50 per cubic yard. Rubber mulch can range from $9 to $13 per 0.8 cubic feet. This product is only sold in bags.

Things to Think About
Be sure to check with the *Consumer Product Safety Commission* (CPSC) and the *American Standard for Testing Materials* (ASTM) before purchasing recycled rubber products.

Who To Contact
Local hardware stores or topsoil businesses.

**** $$ Cost Estimates Effective Spring 2009***

Rev. 7/2009

Note: If you know that there are elevated levels of arsenic and lead in your yard, you must notify the future property owners or tenants of the need to maintain cover.

Impermeable Caps

What is Involved
Concrete and asphalt can also be used to cover, or *cap,* areas that have contaminated soils. Examples would be patios, sport courts, and driveways. Brick and stone pavers can also be used to satisfy decorative needs. Garages, sheds, or permanent structures are other forms of caps.

2009 Cost Estimates*
Pavers and bricks can range from $2.65 to $3.42 per square foot and can require a lot of the homeowner's time and effort. For large jobs, look in the phone directory under *Concrete Contractors.*

Things to Think About
Check local building codes and apply for all applicable permits prior to construction.

Who to Contact
- Tacoma Building Permits
  253 591-5030
- Pierce County Building Division, Permit Information
  253 798-3739
- Local hardware stores

Unconventional Ground Covers/Barriers

What is Involved
The use of bushy or thorny plants will produce a thick canopy, effectively keeping people out of a contaminated area. Some examples are Rugosa Roses, Winterberry, Oregon Grape, Mountain Boxwood, Mock Orange, and Holly. A combination of plants can give a nice, natural look to any areas, allowing a safe haven for wildlife, as well as discouraging foot traffic

2009 Cost Estimates*
The prices for plants can range greatly depending upon the size and variety. Contact your local nursery or shop online for the best value.

Things to Think About
The plantings will take some time to grow, so you may want to rope the area off until plantings are well established.

Who to Contact
Local nurseries or the following websites are helpful.
- http://seedlings.uidaho.com/
- http://gardening.wsu.edu/
- http://www.piercecountycd.org.images/treeSale09_order.pdf

Soil Removal and Replacement

What is Involved
If none of the other options fit your needs, you may want to dig and haul the soil off your property.

2009 Cost Estimates*
Soil removal and proper disposal is very costly and labor intensive.

Things to Think About
Technical and regulatory consultation should be sought prior to starting any soil removal.

Who to Contact
Please consult with Tacoma-Pierce County Health Department at **253 798-3503**, or Washington State Department of Ecology at **360 407-6262**, for proper soil disposal procedures.

* ***$$ Cost Estimates Effective Spring 2009***

Approximate weights per cubic yard
- 3-way Topsoil = 1,500 lbs
- Sand = 2,600 lbs
- Bark = 800 lbs
- Rock = 2,500 lbs

Reduce Your Contact
With Arsenic and Lead

Ground Cover Choices for the Homeowner

The information in this brochure provides suggestions on how to minimize your family's exposure to soils with elevated levels of arsenic and lead. Elevated levels are more than 20 parts per million of arsenic, or 250 parts per million of lead in your soil. This brochure gives you many choices to minimize your family's risk of exposure.

The type and depth of cover you choose will provide different levels of protection. For example, a raised garden bed with twelve inches of clean topsoil protects better than six inches of clean topsoil. But, six inches of clean topsoil protects better than gardening in native soils. Other than completely removing the soil, the options in this brochure are considered temporary solutions.

If you have questions or ideas on how to make this information better, please call:

253 798-3503

Tacoma | Pierce County
Health Department
Healthier. Safer. Smarter.
www.tpchd.org

DEPARTMENT OF
ECOLOGY
State of Washington

NOTE: Washington State Department of Ecology does not consider these solutions to satisfy the state's environmental clean-up laws.

Good gardening habits

- ✓ Wear gloves and shoes while gardening, and remove them before entering the house.
- ✓ Avoid gardening on windy, dusty days, or cover face with a dust mask or bandana.
- ✓ Moisten soil before gardening to control dust.
- ✓ Cover bare patches of ground with a soil cover such as gravel, wood mulch or plants.
- ✓ Don't smoke, eat or drink while gardening.
- ✓ Wash soil off your skin and brush soil off clothes after gardening.
- ✓ Wash hands after gardening.
- ✓ Use a scrub brush to clean dirt from under your nails.

Enjoying fruits and vegetables

Eating dusty or muddy fruits or vegetables can cause you to accidentally eat soil.

- ✓ Wash fruits and vegetables with a scrub brush, making sure all dirt is removed.
- ✓ Peel carrots, potatoes, and other root crops. Throw away the peelings.

For more information

Visit Public Health – Seattle & King County's web site: **http://www.metrokc.gov/health/tsp/arseniclead.htm** or call the Hazards Line **(206) 296-4692**

Consult "*Gardening on Lead and Arsenic Contaminated Soils*," by Frank J. Peryea, Ph.D. Washington State University soil scientist and horticulturist. The article may be obtained at: **http://cru.cahe.wsu.edu/CEpublications/eb1884/eb1884.pdf**

Funded in part by a grant from the Washington State Department of Ecology

Public Health
Seattle & King County
HEALTHY PEOPLE. HEALTHY COMMUNITIES.

King County

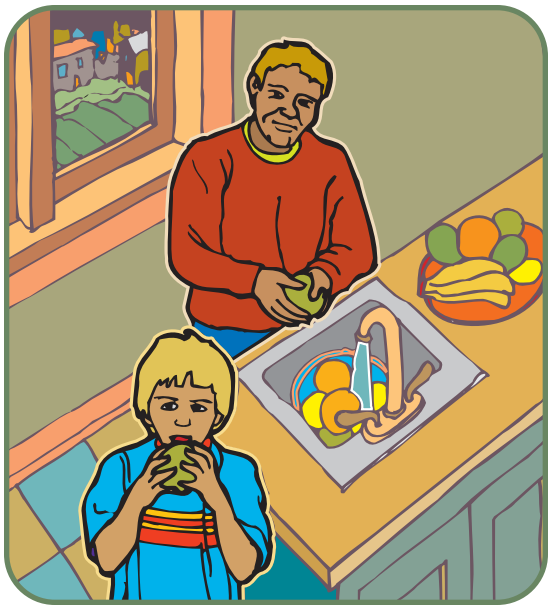
City of Seattle

Healthy Gardening in King County

Gardening in Soils with Heavy Metals

How soil can become contaminated

Soil can become contaminated from past industrial use, heavily traveled roadways, peeling and weathering lead-based paint, and past farming practices. Another source of arsenic and lead in King County soils is the now-closed ASARCO smelter that operated for about 100 years near Tacoma. Emissions from the smelter were carried by wind and deposited over a wide area.



Exposure

Most people do not eat soil on purpose, but when you work outdoors you take in small amounts of soil and dust as you breathe and swallow. Arsenic and lead are not well absorbed through the skin. People at greatest risk are those exposed to soil on a regular basis including gardeners, landscapers, children, and those who work with livestock.

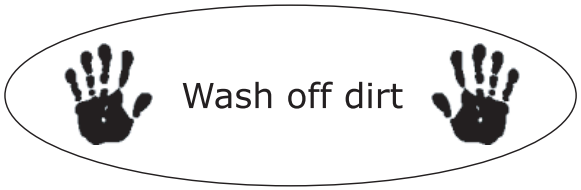
Plan and manage your garden to reduce uptake of metals.

The more you know about your soils the healthier your garden can be.

✓ Create gardens away from driveways and roads, and away from buildings that could be sources of lead paint dust or chips

✓ Garden in containers or raised beds:

- ☞ Build raised beds using cedar, plastic lumber, or concrete, and use ceramic pots for container gardens. Do not use arsenic-treated (CCA) lumber for raised beds.
- ☞ Place a geotextile fabric (special plastic sheet) over contaminated soils and underneath new soil you bring in. This will help prevent plant roots from growing down into contaminated soil. However, you may need to provide for bed drainage.
- ☞ Add organic material to raised beds, and mix soils well. Compost, manure and other organic additions are good for plants and they dilute contaminated soil.
- ☞ Keep the soil at a neutral pH of 7.0

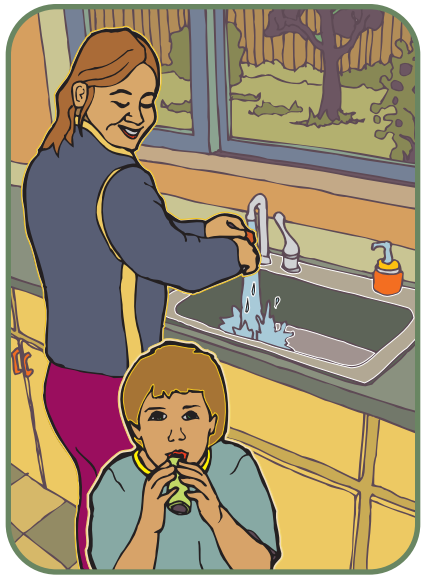


Health effects

Gardening in soil contaminated with metals is unlikely to cause sudden illness. However, if exposure occurs over many years, metals may build up in the body and cause harm. You can reduce the chance that you may become ill from long-term exposure by taking the precautions listed in this brochure.

How to tell if soil has heavy metals

Most of us do not know all of our property's past uses or possible sources of contaminants. If you are concerned about the metal levels in your soil, soil testing is an option. For information on how to test your soil, and for links to soil testing laboratories, visit our website at: **http://www.metrokc.gov/health/hazard/residenttesting.htm**



Appendix E
Outreach Materials for the Yard Program

Cleanup Orientation

Includes:

- Invitation to Cleanup Orientation Meeting
- Homeowner's Guide to Cleanup
- What to Expect for Cleanup (One Page Flyer)
- Cleanup Diagram
- Yard Restoration Options

DEPARTMENT OF
ECOLOGY
State of Washington

PO Box 47775
Olympia, WA 98504-7775

Cleanup Orientation Meeting

July 29th, 2013
6:00-8:30 pm
Point Defiance Elementary School
4330 N Visscher St Tacoma, WA 98407

DEPARTMENT OF
ECOLOGY
State of Washington

PO Box 47775
Olympia, WA 98504-7775

Cleanup Orientation Meeting

July 29th, 2013
6:00-8:30 pm
Point Defiance Elementary School
4330 N Visscher St Tacoma, WA 98407

Cleanup Orientation Meeting

Thank you for returning the interest form to participate in cleanup (soil replacement) as part of the **Residential Yard Sampling and Cleanup Program** in the Tacoma Smelter Plume. The Washington Department of Ecology invites you to attend an open house to learn more about the cleanup process and to schedule a home visit to start cleanup planning. If you are unable to attend the meeting but would like to set up a home visit, please call Jill Jacobson at (360) 407-6245.

Questions?

For information about the cleanup process:

Amy Hargrove
Cleanup Manager
Department of Ecology
(360) 407-6262
Amy.Hargrove@ecy.wa.gov

For copies of the meeting materials, please contact:

Jill Jacobson
Yard Cleanup Outreach Coordinator
Department of Ecology
(360) 407-6245
Jill.Jacobson@ecy.wa.gov

Cleanup Orientation Meeting

Monday, July 29th, 2013
6:00-8:30 pm
Point Defiance Elementary School Cafeteria
4330 N Visscher St Tacoma, WA 98407

Agenda

6:00-6:45 pm Open house
6:45-7:15 pm Presentation
7:15-7:45 pm Question & Answer
7:45-8:30 pm Open house

Cleanup Orientation Meeting

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Homeowners Guide to Yard Cleanup

DEPARTMENT OF ECOLOGY
State of Washington

Tacoma Smelter Plume-EPA Study Area **September 2013**

Introduction

The Department of Ecology (Ecology) is cleaning up (replacing soils) the most contaminated yards in the Tacoma Smelter Plume. The plume is a 1,000 square mile area of arsenic and lead soil contamination from the former Asarco smelter in North Ruston and Tacoma.

Ecology is now offering the Residential Yard Sampling and Cleanup Program (Yard Program). This program is voluntary and you can choose to participate in the program when we contact you. Ecology will work with property owners to design a soil replacement plan to remove contaminated soils.

This booklet explains what you need to know about:

- Tacoma Smelter Plume Cleanup Background
- Residential Yard Sampling and Cleanup Program
- Steps in the cleanup and restoration process
- Contact Information
- Safety Considerations
- Health information
- How to prepare for the first yard visit

Tacoma Smelter Plume Cleanup Background

For almost 100 years, the Asarco Company operated a copper smelter in Tacoma. Air pollution from the smelter settled on the surface soil over more than 1,000 square miles of the Puget Sound basin. Arsenic, lead, and other heavy metals are still in the soil as a result of this pollution.

In 2009, the State of Washington received a settlement from Asarco, including $94 million to pay for cleanup of the Tacoma Smelter Plume.

Contacts

DEPARTMENT OF ECOLOGY

Amy Hargrove
Cleanup Manager
(360) 407-6262
Amy.Hargrove@ecy.wa.gov

Steve Needles
Field Coordinator
(360) 407-0242
Steve.Needles@ecy.wa.gov

Jill Jacobson
Outreach Coordinator
(360) 407-6245
Jill.Jacobson@ecy.wa.gov

HEALTH QUESTIONS

Tacoma-Pierce County Health Department
(253) 798-6492
DirtAlert@tpchd.org
Webpage: http://www.tpchd.org/DirtAlert

ARSENIC IN SOIL DATABASE

Find your soil sampling results and cleanup record at:
https://fortress.wa.gov/ecy/areispublic/

MORE INFORMATION

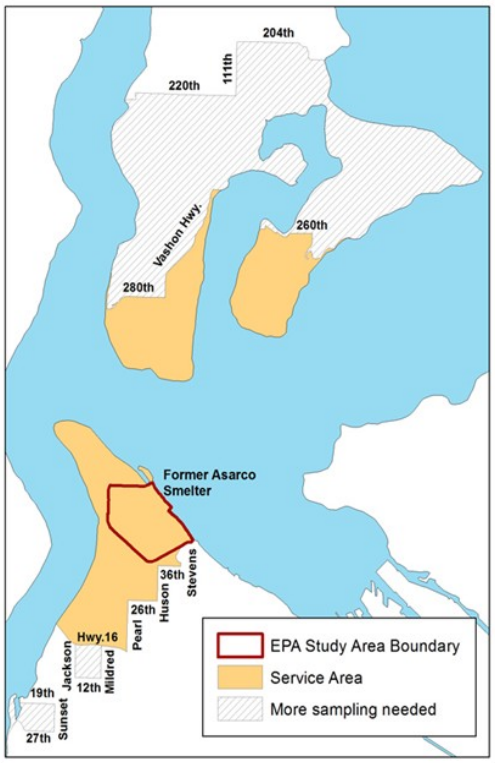
Visit Ecology's website:
http://www.ecy.wa.gov/toxics/tacoma-smelter.html

FS ID #89267963

Residential Yard Sampling and Cleanup Program

Yard Program Service Area

The Environmental Protection Agency (EPA) has cleaned properties with arsenic levels of 230 parts per million (ppm) and above in the Ruston/North Tacoma EPA study area. Ecology has a lower action level of 100 ppm for arsenic. We are offering cleanup for yards where the property has average arsenic between 100 - 230 ppm.



Many yards in the EPA Study Area of Ruston and north Tacoma were already sampled by the EPA. Ecology is evaluating these results and will recommend cleanup for properties where contamination is found above our action levels.

Action levels are:

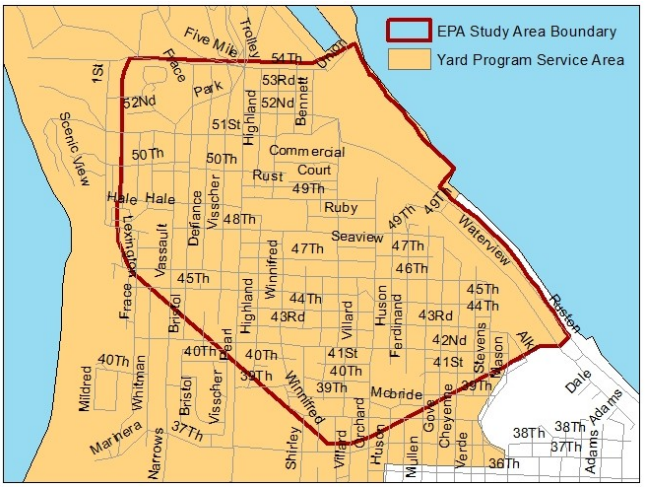
- Arsenic ≥ 100 parts per million (ppm)
- Lead ≥ 500 ppm

The Yard Program aims to replace soils in yards with arsenic over 100 ppm, but we are comparing sampling results against a threshold of **90 ppm**. Ecology uses this lower threshold to ensure we find more yards over the action level of 100 ppm.

How does Ecology evaluate EPA sampling data?

If a property is within the EPA study area, Ecology looks at existing sampling results and any cleanup already done. We are evaluating whether:

- The top 12 inches of soil across the whole parcel has 90 ppm arsenic or higher.
- The top 12 inches of soil across the whole parcel has 500 ppm lead or higher.
- Any single "subunit" has over 200 ppm arsenic.
- Any single subunit has over 1,000 ppm lead.



A property qualifies for cleanup planning when they meet one of the above criteria. Some areas are excluded from clean up, such as around trees or large plantings, rock walls, ponds, or under pavement. We will walk you through all of this during the first home visit.

Steps in the Cleanup Process

The following section describes the steps of a typical yard cleanup. Your cleanup might look different, depending on the layout and size of your yard. Cleanup planning can take several months and cleanup can take several weeks depending on the size of the property and the amount of contamination.

Planning and Cleanup involves several steps:

1. Create a property cleanup plan & agreement
2. Ecology hires a contractor
3. Contractor prepares the property
4. Remove Soil and Sample
5. Replace Soil
6. Restore Landscaping
7. Ongoing care for new landscaping
8. Cleanup Paperwork

Read more for details about each step in the cleanup process.

Step 1

Cleanup Plan & Agreement

- Ecology will call you to set up a visit at your property.
- During this visit, Ecology staff will meet with you at your property to discuss cleanup options and to review your yard.
- Before this visit, please complete the homeowner checklist in the back of this packet.
- Ecology will develop a cleanup plan for your yard using information from the checklist and the visit, In some cases, Ecology may schedule a second visit to discuss the cleanup plan.
- If you agree to the cleanup plan, Ecology will ask you to sign a cleanup agreement.

Step 2

Ecology hires a contractor

- After Ecology receives the signed cleanup agreement, we will proceed with hiring a contractor for the next available construction season.
- Ecology's construction season for the Yard Program is from March to October. This season may be shorter during years with more rainfall.
- Ecology will notify you when we have hired a contractor and set a date for cleanup in your yard.

Steps in the Cleanup Process (continued)

Step 3 Contractor Prepares the Property

- The contractor and Ecology will take photos and video to assess the yard area.
- For your safety, the contractor will install temporary plastic fencing, called high-visibility silt fencing.
- Once fencing is up, they will ask you to stay out of the fenced areas.
- The contractor will remove or relocate the fencing to provide pathways to your home as needed.
- The contractor may temporarily relocate your parking areas as needed.

Step 4 Remove Soil and Sample

- During removal, contractors will haul existing sod, plants and contaminated soil away from your property.
- Equipment used for removal includes excavators, backhoes and hand tools.
- To control dust, the contractor will bring water and spray it on dry soil as needed.
- After the contractor removes 18 inches of soil, Ecology will collect samples at the base of excavation.
- If the soil at the base has arsenic above 90 ppm or lead above 500 ppm, the contractor will install an indicator fabric.

Step 5 Replace Soil

- The contractor will bring new soil to your yard and fill in the areas that were excavated.
- The contractor will place topsoil over the clean backfill soil.
- The contractor will reconstruct any rock or retaining walls that are damaged or disturbed during construction.
- The contractor will also install or replace any sprinklers that are moved or damaged during construction.

Steps in the Cleanup Process (continued)

Step 6 Restore Landscaping

- The contractor will restore the yard based on measurements and photographs taken during the development of the cleanup plan agreement and from surveying by the contractor.
- The contractor will use either sod or hydro seed to replace lawn areas, and will maintain the new lawn for up to 30 days after installation.
- Ecology will notify the homeowner and tenants when it is safe to walk on the lawn.
- Fencing may remain for several weeks to protect new plants and sod or hydro-seed.
- Landscape features and decorations will be restored.

Step 7 On-going care for new landscaping

- You, the homeowner, are responsible for basic on-going landscape care of your restored lawn or plants, including:
  - Watering plants, sod and hydro-seed.
  - Weeding regularly.
  - Replenishing mulch.
  - Adding fertilizers as needed.
- Please contact Ecology immediately if you notice a problem with your new lawn or plants within the first year after restoration.

Step 8 Cleanup Paperwork

- When cleanup and restoration is finished, we will give you copies of the paperwork that details all the work that was completed.
- You can pass on this paperwork to future property owners and share it with prospective buyers to address concerns about contamination on your property.
- Ecology will also keep a record of the cleanup work for your yard on our public database at https://fortress.wa.gov/ecy/areispublic/.

How we will keep you informed during cleanup...

Ecology staff will use several different methods to keep you informed about the cleanup activities on your property and in your neighborhood, including:

- Phone calls
- Door hangers
- Flyers
- Website or Blog
- Emails
- On-site visits
- Open house meeting
- Fact sheets

Questions?

Cleanup Process:

If you have questions about the yard cleanup process, please contact a staff member on Ecology's Yard Program team:

Amy Hargrove
Cleanup Manager
(360) 407-6262
Amy.Hargrove@ecy.wa.gov

Steve Needles
Field Coordinator
(360) 407-0242
Steve.Needles@ecy.wa.gov

Jill Jacobson
Yard Cleanup Outreach
(360) 407-6245
Jill.Jacobson@ecy.wa.gov

Hannah Aoyagi
Project Planner & Outreach
(360) 407-6790
Hannah.Aoyagi@ecy.wa.gov

Health Questions:

If you have health questions about arsenic and lead in your soil, please contact:

Tacoma-Pierce County Health Department
(253) 798-6492
DirtAlert@tpchd.org

Visit their webpage at:
http://www.tpchd.org/DirtAlert

Sampling Results or Cleanup Records:

Find your soil sampling results or cleanup records at the Arsenic in Soil Database:
https://fortress.wa.gov/ecy/areispublic/

More information:

For more information, visit Ecology's website at:
http://www.ecy.wa.gov/programs/tcp/sites_brochure/tacoma_smelter/2011/yard.html

Safety considerations during property cleanup

Access to areas on your property:

- Our contractors will clearly designate the pathways to your home with fences.
- On the street, the contractor will clearly identify traffic routes and parking areas.
- The contractor will make sure that the cleanup work does not interrupt mail, garbage and delivery service.
- We will notify you in advance if your mailbox needs to be moved temporarily.
- School bus service should not be impacted by cleanup. Minor changes in pick up locations may be needed. Ecology will contact you before changes are made.
- Access to sheds and detached garages may be interrupted during construction.

Safety:

- Keep a close eye on kids and pets during cleanup. Keep them away from the cleanup area.
- Relocate any personal belongings you want to protect or keep safe.
- Be aware when you are coming and going from your home.
- Let us know if you need handicapped accessible routes.
- Keep taking healthy actions.
- Stay away from construction equipment and materials. Don't assume they can see or hear you.

Health Information

Although the contamination does not necessarily pose an immediate health risk, arsenic and lead are harmful and may pose a long-term health risk.

Arsenic can cause cancer and has been linked to several other health problems including heart disease and diabetes. Lead can cause behavioral problems, learning disabilities and reduced physical growth in children.

Arsenic and lead are not well-absorbed through the skin. Arsenic and lead get into your body if you swallow small amounts of contaminated soil while eating with dirty hands or putting dirty fingers in your mouth. You can also be exposed if you inhale dust or dirt contaminated with lead or arsenic. Young children are more vulnerable than adults. Children will put their fingers and other things in their mouths more regularly. Also, because children are still growing, they are more sensitive to the effects of arsenic and lead than adults.

Healthy Actions are simple things you and your family can do to decrease contact with dirt that may contain arsenic, lead and other harmful chemicals.

Please review the healthy actions on the next page.

Healthy Actions

Use plenty of Soap and Water

Dirt is found on hands, toys, shoes, clothing and pets. **Wash** your hands well before eating and after working or playing in the soil. Use a scrub brush to clean dirt from under your nails. **Wash** heavily soiled clothing separately from other laundry. **Wash** children's toys, bedding, and pacifiers frequently. (Hand sanitizers do not remove arsenic and lead from hands.)

Mop, Dust and Vacuum

People and pets track in dirt or it can enter your home in the form of small dust particles through windows and doors. Dust and dirt settles on carpeting, throw rugs, curtains, upholstered furniture, as well as windowsills and bookcases. **Damp-dusting** and vacuuming at least once a week is recommended to decrease the amount of dust and dirt in your home. **Always** use a damp-mop or a damp-cloth when you dust.

Wash Fruits and Vegetables

Arsenic and lead may be in dust and dirt found on the surface of fruits and vegetables. There is a slight chance that leafy vegetables, like lettuce or kale, grown in contaminated soil may absorb very small amounts of contaminants. **Wash** all fruits and vegetables to make sure all dirt is removed. Use a scrub brush on potatoes, squash, carrots, etc. **Always** wear shoes and gloves when gardening or working in the soil and take them off before coming into your home. **Grow** your produce in raised beds made with arsenic-free materials.

Maintain Your Home and Yard

Covering bare patches and keeping up with home maintenance keeps arsenic and lead away from your family. **Cover** bare patches in your yard with a ground cover such as grass, gravel, wood/mulch product or native plants. **Wear** a dust mask while working in your yard during the dry season. **Maintain** the painted surfaces of your home. Homes built before 1978 may have been painted with paint containing lead. When lead-paint chips or wears away, it becomes a major source of lead, both inside and outside the home. **Have** your soil tested.

Eat a Healthy Diet

Iron, calcium and vitamin C help to decrease absorption of lead. **Eat** a diet rich with these nutrients. Include foods like broccoli, spinach, potatoes, dairy products and citrus fruits.

Keep Pets Clean

Pets walk, roll, and lie down in dirt and soil. When pets come into the house, their fur and paws bring in soil and dust too. **Wipe** off all excess dirt and mud before your pet comes into your home. Brush and bathe your pet regularly. **Restrict** your pet to parts of your home that are free from carpeting and upholstery. **Give** pets their own "bed" or place within your home.

Homeowner's Checklist

DEPARTMENT OF ECOLOGY
State of Washington

Tacoma Smelter Plume-EPA Study Area **September 2013**

Please take some time to fill out this form before you meet with Ecology staff to start cleanup planning. We will use this information to develop a cleanup plan for your property. Please bring it to the first home visit and share it with Ecology's Field Coordinator.

1 Plants

During cleanup, Ecology can remove small plants from your yard and replace them with a younger, smaller version of the same plant. We leave mature trees, shrubs and larger plants in place during cleanup. Crews will use care to excavate around the roots of larger plants and trees to remove as much contamination as possible.

Questions:

Are there any plants you do not want removed? ☐ **Yes** ☐ **No**

If yes, please list the plants you **do not** want removed?

_____

Are there any plants you want **removed** and replaced with grass? ☐ **Yes** ☐ **No**

If yes, please list the plants you want removed:

_____

_____

Do you want sod or hydroseed to replace your lawn?

_____

Do you have any wet spots in your yard, or problems with water drainage? ☐ **Yes** ☐ **No**

If yes, please explain:

_____

_____

2 Personal Items

We ask property owners to remove any personal items in their yard before construction. Personal items include decorations, patio furniture, play or sports equipment, vehicles, potted plants, portable sheds, etc.

Questions:

Do you have any large personal items in your yard that you will need assistance moving? ☐ **Yes** ☐ **No**

If yes, please list these items:_____

_____

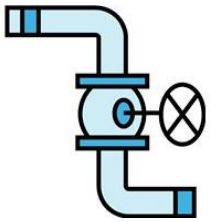
_____

Questions continue on next page...

Homeowner's Checklist

Continued…(Page 2 of 3)

3 Buried Utility Lines and Objects



Ecology's contractors will identify most public utilities before construction. However, we have encountered drain fields and other small, private utilities during cleanup. If any utilities are broken during cleanup, they will be repaired immediately by the contractor. If you are aware of any unmarked utilities on your property, please let us know.

Questions:

Do you have a **sprinkler system**, **drainage system** or any **buried electric lines** in your yard?

_____

Are you aware of any **buried utility lines** that are old or in poor condition?

_____

Do you have a **septic tank** or **underground storage tanks** (in use or abandoned)?

_____

Do you know of any buried **historical features** on the property?

_____

Please list any other buried objects on the property (pets or other objects)?

_____

_____

4 Landscaping

Crews will not dig under permanent features like sidewalks, rock walls, retaining walls, driveways, sheds, decks, pools/hot tubs, etc. We will take measures to protect retaining walls and foundations during excavation. Please provide us with details on the landscape features of your yard.

Questions:

Do you have any fences in your yard? ☐ **Yes** ☐ **No**

If yes, does the fence belong to you or your neighbor? _____

Do you have any rockeries, rock walls or retaining walls? ☐ **Yes** ☐ **No**

Do you have a shed? ☐ **Yes** ☐ **No**

If yes, does it have a foundation? _____

Please list any other features on your property we should know about?

_____

_____

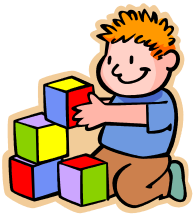
Questions continue on next page...

Homeowner's Checklist

Tacoma Smelter Plume-EPA Study Area **September 2013**

Continued…(Page 3 of 3)

5 Children



Safety is our top priority. Children must be kept away from the construction area at all times (including weekends and nights when work is not underway). The contractor staff cannot always see or hear children when work is underway.

Questions:

Do you have children living in or visiting this house often? Check one: ☐ **Yes** ☐ **No**

If yes, how many and what are their approximate ages?

_____

6 Pets

Pets must also be kept away from the construction area at all times (including weekends and nights when work is not underway). We will let the contractor know if there are pets living in the house. We can normally accommodate an area in a yard for dogs during cleanup, but we recommend keeping cats indoors during cleanup if possible.

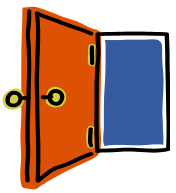
Questions:

Do you have any dogs? ☐ **Yes** ☐ **No** If yes, how many? _____

Do you have any cats? ☐ **Yes** ☐ **No** If yes, how many? _____

Will you need a small area in the yard for your dog (s) during cleanup? Check one: ☐ **Yes** ☐ **No**

7 Access to Property



Ecology's contractors will need to have access to your yard at all times during cleanup. The way we access your yard may change often. If you require specific access during cleanup, please let us know.

Questions:

Is there anyone in your home, or who visits your home regularly, that needs handicapped access?

_____

Is there anyone in your home, or who visits your home regularly, that has elderly or special needs?

_____

Do you have tenants living in your home? ☐ **Yes** ☐ **No**

If yes, where do the tenants access the property and enter the home?

_____

_____

DEPARTMENT OF ECOLOGY
State of Washington

Tacoma Smelter Plume

What to expect **Before, During** and **After** the cleanup process

BEFORE

1. If you qualify, an Ecology staff member will notify you by phone, mail or email to offer cleanup.

2. Ecology will meet with you to develop a cleanup plan.

3. Ecology will hire a contractor to complete the soil removal and yard restoration.

4. Ecology will contact you to meet and begin coordinating cleanup activities.

Homeowner's Checklist:

- ☐ Decide whether or not to participate in the cleanup program.
- ☐ Provide input on and approve the cleanup plan.
- ☐ Sign the cleanup agreement.
- ☐ Provide utility information, including irrigation, and underground wiring.
- ☐ Remove large objects within the cleanup area as discussed with Ecology, such as boats, trailers, vehicles, play sets, wood piles, animal housing, tool sheds, etc.
- ☐ Remove stumps, diseased trees, or vegetation if you want that area addressed.

DURING

1. Ecology staff and the contractor will do a pre-cleanup walk through.

2. The contractor will prepare the property for cleanup by:
   - Putting up temporary fencing.
   - Placing tarps over fragile objects.
   - Placing visual barriers around work

3. The contractor will complete soil removal and yard restoration.

4. The Ecology field coordinator will oversee and document cleanup work.

5. Ecology will take soil samples to confirm cleanup is finished.

6. Ecology will provide maintenance steps and warranty information for yard restoration.

Homeowner's Checklist:

- ☐ Follow health and safety guidelines.
- ☐ Secure pets.
- ☐ Maintain reasonable property access for contractors.
- ☐ Contact Ecology if an issue or concern arises.

AFTER

1. Ecology will review the quality of cleanup and yard restoration.

2. Ecology will meet with you to walk through the property, take photos and document the condition of the property.

3. Ecology will prepare a Project Closeout Report for homeowner.

4. Ecology will maintain project documentation and update property information on "Arsenic in Soil" public database.

Homeowner's Checklist:

- ☐ Do a property walk through with Ecology staff to identify concerns and ask any questions.
- ☐ Maintain new landscaping:
  - ☐ Water new sod, plants or seeded areas in yard.
  - ☐ Replenish mulch
  - ☐ Remove weeds
  - ☐ Add Fertilizer (if necessary)
- ☐ Reinstall any large objects that were moved for cleanup, such as tool sheds, play sets, etc.
- ☐ Contact Ecology if an issue or concern arises.

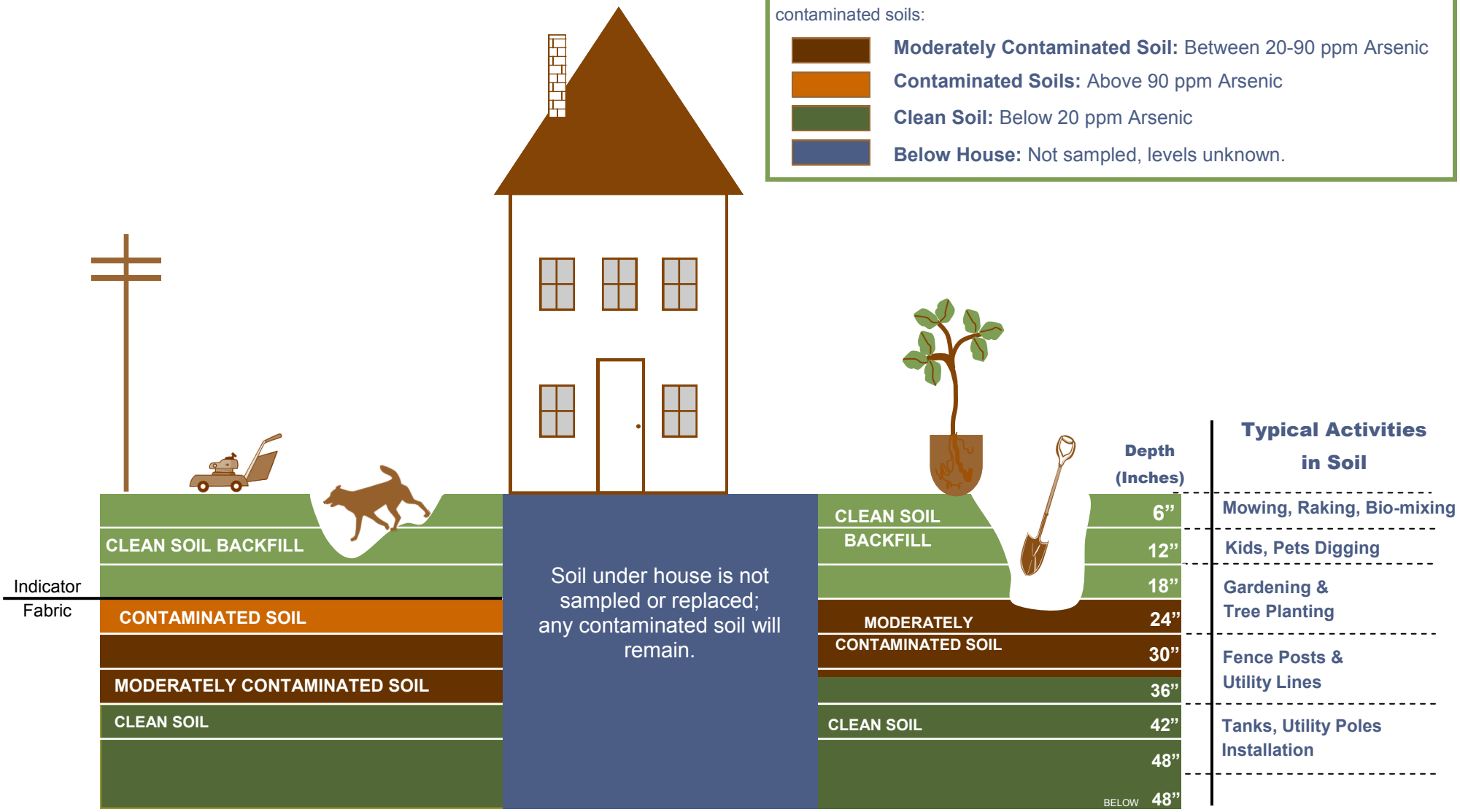
Questions? Call the Yard Program Outreach Coordinator at (360) 407-6245 or email Jill.Jacobson@ecy.wa.gov

DEPARTMENT OF ECOLOGY
State of Washington

Tacoma Smelter Plume - EPA Study Area
Typical Activities in Soil

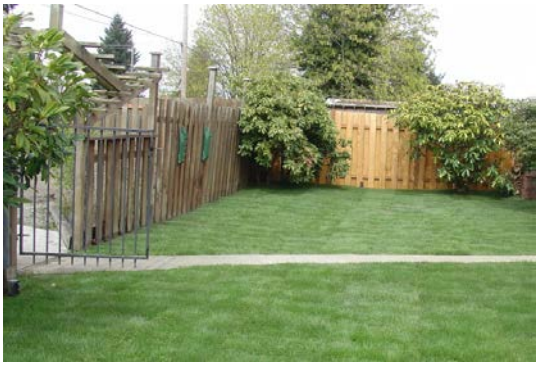
Soil Levels after Cleanup:
Your yard could have contamination in the deeper soils after cleanup is complete. The following diagram shows what activities could put you or your family in contact with contaminated soils:

- **Moderately Contaminated Soil:** Between 20-90 ppm Arsenic
- **Contaminated Soils:** Above 90 ppm Arsenic
- **Clean Soil:** Below 20 ppm Arsenic
- **Below House:** Not sampled, levels unknown.



Tacoma Smelter Plume Yard Program

Yard Restoration Options – Tacoma



Choice 1: Restore your yard to the way it looked before cleanup.

We can restore lawn, small plants, mulch or bark, gravel, and other kinds of landscape materials.

Limitations: If you have rare or expensive plants, we can work around that area or you can dig them up (at your own risk). We will also work around any large, mature landscaping, unless you wish to remove it before work begins.

Choice 2: Replace some or all of the lawn with mulch and plants.

We can replace lawn with mulch and plants that are right for your yard.

Pros: Reducing lawn area can lower your water, fertilizer, and pesticide use.
Cons: Plants may take several years to fill in and mature. Also, some plants will need extra watering and care for the first year.

Choice 3: Replace some lawn area with a rain garden.

Rain gardens collect rain water and help filter it into the ground.

Pros: Rain gardens reduce storm water runoff and can help your yard drain better.
Cons: Plants may take several years to fill in and mature. There may be some costs to you.

Ecology can only pay for the rain garden soil and some plants. We are trying to find local partners that can help finish the garden and install a way for water to flow in, and to safely overflow.

What you need to do…

You should be receiving this sheet as part of your soil sampling results packet. If so, here are your next steps:

- **Step 1:** Think about what kind of landscaping you want after soil cleanup. We encourage you to set up a meeting with a Master Gardener (contact info below). The Master Gardener can explain each option, plant choices, and maintenance.

- **Step 2:** Ecology will set up a meeting with you to discuss your yard cleanup. Please let us know how you want your yard restored.

- **Step 3:** You will review a draft cleanup and restoration plan and either sign it or meet with us to discuss changes.

Before cleanup begins, we will do a walk-through with you and the contractor. We will also do a walk-through after cleanup and restoration is done. The contractor will be responsible for maintenance for up to. We will give you information for maintaining your yard after that.

Landscaping Resources for Homeowners

The following resources can help you maintain and improve your landscaping.

- **Master Gardeners:** The Washington State University Extension runs a volunteer Master Gardener program. These experts can help you decide on landscaping, plants, and whether a rain garden is right for your yard.

- **Trees:** Tacoma is trying to increase tree cover within the city. The city also sometimes offers coupons for purchasing trees. For more information and planting advice, check http://www.cityoftacoma.org/Page.aspx?nid=790.

- **Native plants:** The Pierce Conservation District hosts an annual native plant sale in the early spring. Website: http://www.piercecountycd.org

- **Natural yard care:** The Tacoma-Pierce County Health Department offers brochures and advice for yard care that uses less water, fertilizers, and pesticides. Website: www.tpchd.org/naturalyardcare

Appendix E
Outreach Materials for the Yard Program

Cleanup Plan Development

Includes:

- Property Owner Checklist
- Before, During, and After Photos of a Cleanup Example
- Cleanup Plan and Agreement

Homeowner's Checklist

DEPARTMENT OF ECOLOGY
State of Washington

Tacoma Smelter Plume-EPA Study Area **September 2013**

Please take some time to fill out this form before you meet with Ecology staff to start cleanup planning. We will use this information to develop a cleanup plan for your property. Please bring it to the first home visit and share it with Ecology's Field Coordinator.

1 Plants

During cleanup, Ecology can remove small plants from your yard and replace them with a younger, smaller version of the same plant. We leave mature trees, shrubs and larger plants in place during cleanup. Crews will use care to excavate around the roots of larger plants and trees to remove as much contamination as possible.

Questions:

Are there any plants you do not want removed? ☐ **Yes** ☐ **No**

If yes, please list the plants you **do not** want removed?

_____

Are there any plants you want **removed** and replaced with grass? ☐ **Yes** ☐ **No**

If yes, please list the plants you want removed:

_____

_____

Do you want sod or hydroseed to replace your lawn?

_____

Do you have any wet spots in your yard, or problems with water drainage? ☐ **Yes** ☐ **No**

If yes, please explain:

_____

_____

2 Personal Items

We ask property owners to remove any personal items in their yard before construction. Personal items include decorations, patio furniture, play or sports equipment, vehicles, potted plants, portable sheds, etc.

Questions:

Do you have any large personal items in your yard that you will need assistance moving? ☐ **Yes** ☐ **No**

If yes, please list these items:_____

_____

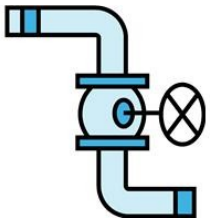
_____

Questions continue on next page...

Homeowner's Checklist

Continued…(Page 2 of 3)

3 Buried Utility Lines and Objects



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Questions:

Do you have a **sprinkler system**, **drainage system** or any **buried electric lines** in your yard?

_____

Are you aware of any **buried utility lines** that are old or in poor condition?

_____

Do you have a **septic tank** or **underground storage tanks** (in use or abandoned)?

_____

Do you know of any buried **historical features** on the property?

_____

Please list any other buried objects on the property (pets or other objects)?

_____

_____

4 Landscaping

Crews will not dig under permanent features like sidewalks, rock walls, retaining walls, driveways, sheds, decks, pools/hot tubs, etc. We will take measures to protect retaining walls and foundations during excavation. Please provide us with details on the landscape features of your yard.

Questions:

Do you have any fences in your yard? ☐ **Yes** ☐ **No**

If yes, does the fence belong to you or your neighbor? _____

Do you have any rockeries, rock walls or retaining walls? ☐ **Yes** ☐ **No**

Do you have a shed? ☐ **Yes** ☐ **No**

If yes, does it have a foundation? _____

Please list any other features on your property we should know about?

_____

_____

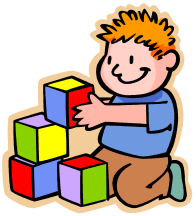
Questions continue on next page...

Homeowner's Checklist

Tacoma Smelter Plume-EPA Study Area **September 2013**

Continued…(Page 3 of 3)

5 Children



Safety is our top priority. Children must be kept away from the construction area at all times (including weekends and nights when work is not underway). The contractor staff cannot always see or hear children when work is underway.

Questions:

Do you have children living in or visiting this house often? Check one: ☐ **Yes** ☐ **No**

If yes, how many and what are their approximate ages?

_____

6 Pets

Pets must also be kept away from the construction area at all times (including weekends and nights when work is not underway). We will let the contractor know if there are pets living in the house. We can normally accommodate an area in a yard for dogs during cleanup, but we recommend keeping cats indoors during cleanup if possible.

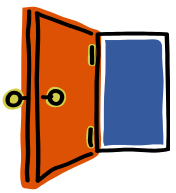
Questions:

Do you have any dogs? ☐ **Yes** ☐ **No** If yes, how many? _____

Do you have any cats? ☐ **Yes** ☐ **No** If yes, how many? _____

Will you need a small area in the yard for your dog (s) during cleanup? Check one: ☐ **Yes** ☐ **No**

7 Access to Property



Ecology's contractors will need to have access to your yard at all times during cleanup. The way we access your yard may change often. If you require specific access during cleanup, please let us know.

Questions:

Is there anyone in your home, or who visits your home regularly, that needs handicapped access?

_____

Is there anyone in your home, or who visits your home regularly, that has elderly or special needs?

_____

Do you have tenants living in your home? ☐ **Yes** ☐ **No**

If yes, where do the tenants access the property and enter the home?

_____

_____

Cleanup Process in the Yard Program

STEP 1: Ecology's Field Coordinator visits your yard to start cleanup planning.

Cleanup Process in the Yard Program

STEP 2:Equipment arrives to begin soil cleanup.

Cleanup Process in the Yard Program

STEP 3: Contaminated soil is removed. Grass and plants are also removed.

Cleanup Process in the Yard Program

STEP 4: New soil is brought in to replace the contaminated soil.

Cleanup Process in the Yard Program

STEP 5: Landscape materials are brought in, such as mulch, hydro-seed, sod or small plants.

Cleanup Process in the Yard Program

STEP 6: Landscaping is restored with sod or hydro-seed.

DEPARTMENT OF ECOLOGY
State of Washington

Yard Cleanup and Restoration Plan Agreement

Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program (Yard Program)

Property address: [PROPERTY ADDRESS]
Property owner name: [PROPERTY OWNER NAME]
Parcel number: [PARCEL NUMBER]
Site identification number: [ID #]

Introduction

This is an agreement between the Washington Department of Ecology (Ecology) and [PROPERTY OWNER NAME] (Property Owner).

Ecology notified you of arsenic and lead soil contamination in this yard, over the Yard Program threshold levels. Ecology then worked with the property owner on a cleanup and restoration plan for the yard. Ecology will manage and pay for the work described in this agreement, in Attachments A and B.

What to Do Before Signing This Agreement

This agreement and all attachments require the property owner's initials or signature. Please read the entire cleanup and restoration plan carefully before signing the cleanup agreement**.** Read all four pages of this agreement and the two attachments:

- Attachment A: Cleanup and Restoration Description
- Attachment B: Map of the Property

If you do not understand or agree to property specific work please contact Ecology so changes can be made before the document is final. Once you have signed the cleanup agreement and all attachments, Ecology cannot make further edits. Ecology needs a final cleanup plan before hiring a contractor to do the work.

Purpose of the Agreement

The purpose of this agreement is to:

- Explain the cleanup and restoration plan for this property that Ecology and the property owner agree on.
- Allow Ecology, contractors, and subcontractors access to the property.

Owner Initials:_____

Conditions of the Agreement

(1) How Long This Agreement Lasts:
This agreement starts when all parties have signed below. It will continue until Ecology tells the cleanup contractor in writing that all work on the property is complete and correct.

(2) Who Conducts the Work:
Ecology will hire and oversee the contractor who will do the soil cleanup and restore the yard. Ecology will work with the local health department to educate property owners and residents about health risks and ways to reduce contact with remaining contaminated soils.

(3) How We will Follow the Law:
Ecology agrees to comply with any federal, state, or local laws, ordinances, or regulations that may apply to the work.

(4) Who Pays for the Work:
Ecology will pay for the work performed by its contractors and subcontractors.

(5) Access to the Property:
The property owner allows Ecology staff, contractors and subcontractors to enter the property to do the work explained in this agreement. Ecology or its contractors will contact the property owner before work begins. Ecology shall have access to the property during normal work hours for the duration of this agreement.

(6) Responsibilities of Property Owner:
Before the contractor begins work:

1. Removing items from the work site that could block access to soils or pose a hazard to workers. These items include boats, trailers, vehicles, swing sets, wood piles, animal housing, tool sheds, and potted plants.
2. Notifying any tenants or residents of work being performed and ensuring access to the property.

During work:

1. Maintaining access for workers.
2. Securing pets during the work.
3. Contacting Ecology if an issue or concern arises.

After the work is complete:

1. Watering and maintaining new landscaping.
2. Maintaining cover material, such as gravel or wood chips, placed during the work.

Owner Initials:_____

(7) Responsibilities of Ecology:
Ecology responsibilities include:

1. Ensuring that the contractor provides visual safety barriers, like caution tape, around work site.
2. Ensuring the contractor reduces dust and noise impacts as much as possible. The contractor may spray water on the work site to keep down dust.
3. Ensuring the contractor follows health and safety plans to prevent damage to the property or hazards to property tenants.
4. Restoring or replacing landscape features affected by the work, close to original condition.
5. Providing instructions on care of sod, hydroseed or new plants.
6. Providing a record of the work performed on the property, including a copy of this agreement, all sampling results, and summary of the work performed.

(8) Indemnification:
The property owner agrees to indemnify and hold Ecology, its employees, and agents harmless from any claims or causes of action for death or injuries to persons or for loss or damage to property arising from or on account of acts or omissions of the property owner in implementing this agreement.

However, the property owner does not agree to indemnify Ecology nor hold Ecology or its agents harmless from any claims or causes of action arising out of the negligent acts of Ecology, its employees, consultants, or contractors, in implementing the activities pursuant to this agreement.

(10) The cleanup plan will be publicly-available on an online database.
Ecology will put a copy of this cleanup agreement on the online Arsenic and Soils Database at https://fortress.wa.gov/ecy/areispublic/.

(11) This is not a final cleanup.
This cleanup will not necessarily meet state Model Toxics Control Act standards for cleanup or arsenic and lead. The goal of this program is to reduce risk from exposure to contaminated soils. The goal is not to provide official documentation that this cleanup meets state standards.

(12) Cleanup enforcement
Ecology's general policy is to not enforce cleanup against residential home owners. Ecology will not require further action unless contamination poses an immediate and serious threat to human or environmental health.

(13) Other information about the agreement:
This agreement is the entire agreement between the parties. Changes to this agreement are only valid if they are put in writing and signed by the Ecology and the property owner. This

Owner Initials:_____

agreement shall be interpreted in accordance with the laws of the State of Washington. This agreement shall be effective as of the date signed.

We approve of the recommended Yard Program Cleanup and Restoration Plan as attached, and agree to follow the plan under the conditions in this agreement.

_____

Rebecca Lawson, PE, LHG **Date**
Regional Section Manager
Toxics Cleanup Program
Southwest Regional Office
Washington Department of Ecology

_____

[PROPERTY OWNER NAME] **Date**

Owner Initials:_____

Attachment A
Cleanup and Restoration Description
Version: Draft

This section explains the main parts of the cleanup process and defines many of the terms Ecology uses to describe cleanup actions. Attachment B shows these plans on a map of the yard, using colors and shading to show the different cleanup actions. Attachment B also has more details about what will happen on this property.

Soil Removal

Ecology will remove soil from the areas shaded in blue on the map in Attachment B. The notes section of the map gives the depth and size of the areas the contractor will dig up. In most areas, the dig will be 18 inches deep, except in the following cases where contaminated soils will be left at shallower depths:

- **Near structures and in-ground features like ponds or pools.** The closer to the structure or feature, the shallower the contractor will dig. For example, when the contractor is one foot away from the foundation of the house, they will only dig one foot deep. This leaves enough soil next to the foundation to keep it stable.
- **Around trees and shrubs.** Tree and shrub roots limit where Ecology can remove soils in a yard. Soil removal depths around trees and shrubs will vary depending on size of plant and root structure. Ecology will work with an arborist to develop a soil cleanup method that protects tree roots and helps preserve the life of the tree. In some cases, Ecology will not be able to remove contaminated soils from areas of the yard.

Soil Replacement

Ecology will replace all removed soils with new, clean soil. The top layer of soil will be a planting mix, to help the new landscaping grow. The contractor will grade the soil so that it matches the original yard. That means, a level yard should be level after the cleanup. If the yard sloped slightly, the new soil should match the same degree of slope.

Yard Restoration

There are four types of restoration actions that may occur to items on your property. Items may include plants, trees, or yard features like rock walls, fountains, or edging.

Owner Initials:_____

1. **Retained**: Items will remain in place, undamaged, during cleanup. These items may include plants, trees, or immovable sheds or concrete slabs.
2. **Removed**: Ecology will remove items and will not replace them.
3. **Removed and Reinstalled**: Ecology will remove items during cleanup, but will reinstall them once cleanup is complete.
4. **Removed and Replaced in Kind**: Ecology will remove items and replace them with the same or a similar plant, tree, or other item.

Owner Initials:_____

DEFINITIONS

Retained	Ecology will keep these items or areas of the yard unchanged and undamaged during the cleanup and restoration work. If a contractor damages a plant or tree during the work, they will remove it and replace in kind (see below). If a contractor damages any non-plant item, they will remove and reinstall (see below). Unless noted otherwise, Ecology will always retain the following: buildings (including homes), immovable sheds, concrete slabs, asphalt or concrete driveways, public utilities, utility poles, and mature or well-established trees and plants.
Removed	Ecology will remove these items but not replace them, unless noted in the restoration plan. For example, a property owner may ask to have a lawn area replaced mulch.
Removed and Reinstalled	Ecology will remove these items and reinstall them at the end of the work. Ecology can only reinstall items in good condition. If an item is rotten or deteriorated, Ecology will not replace it with new materials. Ecology will not reinstall any items that pose a health or safety hazard, or that might damage another area of the yard. In most cases, Ecology will only remove fencing if needed to complete cleanup work. Ecology will reinstall any fencing in the condition that it was removed in. Ecology will not replace rotten or deterioriated materials with new materials.
Removed and Replaced in Kind	This mostly applies to small plants or in the yard. The contractor will remove the existing plant and legally disposes of it off-site. The contractor will plant a replacement item, depending on availability. The new plant may be smaller and less mature, or of a slightly different variety. Plants must be living at the time the contractor visits the yard, before cleanup begins, to list the plants they need to purchase.

Owner Initials:_____

Appendix E
Outreach Materials for the Yard Program

Pre-Construction

Includes:

- Blog and List serv Update-Template
- Contstruction Alert Door hanger

Monday, September 23, 2013

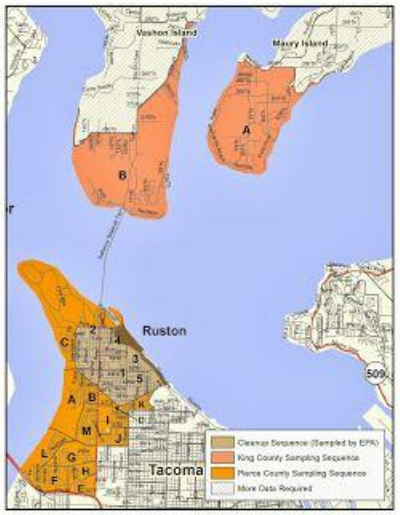
Tacoma Smelter Plume: Sampling begins on southern Vashon-Maury Island and in north Tacoma

By Jill Jacobson, Yard Program Outreach Coordinator, Toxics Cleanup Program

Ecology's Residential Yard Sampling and Cleanup Program (Yard Program) has started soil sampling in north Tacoma and on southern Vashon-Maury Island.

We are sampling residential yards for arsenic and lead contamination from the former Tacoma Asarco smelter.

To find out if your property is in the Yard Program service area, please visit our interactive map.



Sampling Schedule

Ecology plans to sample thousands of properties within the Yard Program service area (map to right), working neighborhood by neighborhood.

Tacoma Area

Tacoma-Pierce County Health Department (TPCHD) is leading the sampling efforts in west Tacoma. TPCHD started contacting homeowners and collecting samples last month in area A of Pierce County (map to right).

Vashon-Maury Island

Ecology sent letters to offer soil sampling to 350 homeowners in area A of Vashon-Maury Island. During the first week of October, Ecology's sampling team will begin knocking on the doors of homes that have not responded. They will begin sampling in Area A during the second week of October.

To learn more about Ecology's schedule in your neighborhood, please visit the Yard Program webpage or contact Jill Jacobson, Yard Program Outreach Coordinator at (360) 407-6245 or Jill.Jacobson@ecy.wa.gov.

Soil Sampling Steps

Soil sampling takes about 1-2 hours. The samplers will dig 16-32 small, six inch deep holes and refill them.

Once the lab results are ready, Ecology will send the results to the homeowner with a letter explaining next steps.

If the yard qualifies for cleanup, Ecology will remove the contaminated soil, replace it with new soil and restore the landscaping.

DEPARTMENT OF ECOLOGY
State of Washington

CONSTRUCTION ALERT

Ecology will begin construction this month on a yard in your neighborhood.

The purpose of this construction is to remove **arsenic** and **lead** contaminated soil from the former Asarco smelter in Ruston and north Tacoma. This cleanup is part of the **Tacoma Smelter Plume** Residential Yard Sampling and Cleanup Program.

Work hours: 7:00 a.m. to 5:00 p.m.,
Monday through Friday

Estimated Schedule: October to November, 2013

For more background on the Tacoma Smelter Plume, visit our website:

http://www.ecy.wa.gov/programs/tcp/sites_brochure/tacoma_smelter/2011/ts-hp.htm

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State of Washington

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DEPARTMENT OF ECOLOGY
State of Washington

CONSTRUCTION ALERT

What to Expect…
- Loud construction noise.
- Dump trucks and other equipment coming and going.
- For several months after construction, landscapers will maintain the new lawn.

Please call us if you see…
- Dust in the air.
- Soil on the sidewalk or street.
- Mud or water running off the property.
- Dump trucks without covers.

Sampling and Cleanup on your property...
Ecology plans to contact thousands of properties within the service area, working neighborhood by neighborhood. If you have not heard from us yet, we will contact you when we reach your property in our schedule.

For more information, please contact:

Steve Needles
Field Coordinator
Office Phone: (360) 407-0242
Cell Phone: (360) 742-9405
Email: Steven.Needles@ecy.wa.gov

Amy Hargrove
Cleanup Manager
Office Phone: (360) 407-6262
Email: Amy.Hargrove@ecy.wa.gov

DEPARTMENT OF ECOLOGY
State of Washington

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Email: Steven.Needles@ecy.wa.gov

Amy Hargrove
Cleanup Manager
Office Phone: (360) 407-6262
Email: Amy.Hargrove@ecy.wa.gov

Appendix E
Outreach Materials for the Yard Program

Construction Wrap-Up

Includes*:

- Construction Wrap-Up Site Walk Notifications (postcard, email and call script)
- Cleanup Wrap-Up Paperwork
- Repair Work Walk Through
- Survey and Focus Group For Homeowners

*All items in this section are in production and will be added as they are completed.

Placeholder

- Construction Wrap-Up Site Walk Notifications (postcard, email and call script)

  In development

Placeholder

- Cleanup Wrap-Up Paperwork

  In development

Placeholder

- Repair Work Walk Through

  In development

Placeholder

- Survey and Focus Group for Homeowners

  In development

Appendix E
DRAFT Outreach Materials for the Yard Program

Ongoing Outreach

Includes*:

- History of Tacoma Smelter Plume (photos, maps and fact sheets)
- Sequencing Maps (Vashon, Tacoma and EPA Study Area)
- Sample Cleanup Plan
- Common Weeds
- Gardening Information
    - Hydroseed vs. Sod
    - Native Plants
    - Steps to Success Yard Care Brochure
    - Tree Coupons from the City of Tacoma
    - Master Gardener Contact Information and Handouts

*All items in this section are in production and will be added as they are completed.

Placeholder

- History of Tacoma Smelter Plume (photos, maps and fact sheets)

  In development

Placeholder

- Sequencing Maps (Vashon, Tacoma and EPA Study Area)

  In development

Placeholder

- Sample Cleanup Plan

  In development

Placeholder

- Common Weeds

  In development

Placeholder

- Gardening Information:
    - Hydroseed vs. Sod

  In development

Placeholder

- Gardening Information:
    - Native Plants

  In development

Placeholder

- Gardening Information:
    - Steps to Success Yard Care Brochure

  In development

Placeholder

- Gardening Information:
    - Tree Coupons from the City of Tacoma

  In development

Placeholder

- Gardening Information:
    - Master Gardener Contact Information and Handouts

  In development

Appendix F

Appendix F

Cultural Resources Protocol

Tacoma Smelter Plume Cleanup Cultural Resources Protocol

1.0 Development of the Cultural Resources Protocol

This document reflects Ecology's general understanding of cultural resource issues across the Tacoma Smelter Plume, and specific concerns with the nature of soil disturbance. Sections 2-4 summarize the proposed actions in the Tacoma Smelter Plume (TSP) Interim Action Plan that would disturb soils. The protocol (Section 5) describes cultural resources monitoring and reporting procedures for soil sampling and remediation under the Interim Action Plan.

As part of this plan, Ecology is designing and implementing a sampling and remediation program to identify and clean up arsenic and lead contamination in soils at existing residential properties and continuing sampling and cleanup work through the Soil Safety Program at schools, licensed childcares, parks, and camps. Two types of actions are addressed by this cultural resources protocol:

1. Soil sampling
2. Remediation through excavation, capping, consolidation and capping, or mixing

In January of 2010, Ecology provided the Department of Archaeology and Historic Preservation (DAHP) with an EZ-1 Form to Initiate Consultation. Ecology proposed working with tribes within the TSP—the NisquallyTribe, Puyallup Tribe of Indians, Muckleshoot Indian Tribe, Suquamish Tribe, Squaxin Island Tribe, Tulalip Tribes of Washington, and Snoqualmie Tribe. DAHP supported this approach for writing the cultural resources protocol.

In early 2010, Ecology called and e-mailed natural resources and cultural resources staff with the Nisqually, Puyallup, and Muckleshoot tribes, as well as the Duwamish tribal chairwoman. The staff that did provide feedback recommended drafting a Cultural Resources Protocol in coordination with DAHP. Ecology should then bring that draft, along with the Interim Action Plan, to the appropriate natural resources and cultural resources staff for consultation.

In August 2011, Ecology sent a letter to the tribal chairs of the tribes listed above to inform them about the Interim Action Plan and draft protocols. Ecology provided a briefing opportunity to tribal representatives at a meeting held August 16, 2011, attended by a member of the Puyallup Tribe. The draft protocol is based on feedback Ecology has received from the tribal attendee to-date.

2.0 Tacoma Smelter Plume Background

For almost 100 years, the Asarco Company operated a copper smelter in Tacoma (Ruston), Washington. Air pollution from the smelter settled on the surface soil over the Puget Sound basin, including parts of Pierce, King, Thurston, Kitsap, and Snohomish counties. The extent of

contamination is over 1,000 square miles and is called the Tacoma Smelter Plume (see Figure 1). Arsenic, lead, and other heavy metals are still in the soil as a result of this pollution.

Ecology has finalized the Interim Action Plan for partial cleanup of the Asarco Tacoma Smelter site. The Interim Action Plan identifies the actions Ecology will take to manage and address arsenic and lead soil contamination from aerial deposition from the former smelter. Because the site contains thousands of parcels of potentially contaminated developed and undeveloped property, cleanup needs to be implemented in stages over many years. All work depends on availability of funds from the state's recent settlement with Asarco.

3.0 Existing project site conditions:

The extent of contamination covers more than 1,000 square miles and reaches areas more than 30 miles from the former smelter location in Ruston. Ecology has conducted a series of studies of undisturbed soils, child use areas, and an extended footprint study. Based on these studies and other evidence gathered, the TSP has the following characteristics:

- Arsenic is the primary contaminant; therefore, the spatial extent of the TSP Site is defined by soil arsenic concentrations.
- Properties closer to the smelter tend to have higher contamination.
- Contamination generally follows wind patterns.
- Topography affects contamination; hilltops or ridges can be more contaminated.
- Contamination is highly variable within small areas.
- Contamination is mostly found in the top six inches of soil.
- The highest contamination tends to be found in areas where the ground has not been recently disturbed (forested areas, properties with homes built prior to 1970).

4.0 Proposed ground disturbing activities

4.1 Residential Yard Sampling and Cleanup Program

Ecology will use funds from the Asarco settlement to manage and pay for a sampling and cleanup program. EPA may provide funding for sites where arsenic in soil exceeds EPA's action level of 230 ppm. Although the plume is 1,000 square miles, Ecology-funded work for the Residential Yard Sampling and Cleanup Program (Yard Program) will focus on a much smaller geographic area, labeled as the "Service Area". The "Service Area" (Figure 2) currently includes southern Vashon-Maury Island, Ruston, and areas of northwest Tacoma to Highway 16. Outside of the Service Area, Ecology is mainly offering education & outreach, and guidance & technical assistance for property owners doing their own remediation.

The program will cover most residential properties within the Service Area (Figure 2). Based on the number of properties that may need to be remediated, this part of the Interim Action Plan will take over 10 years to implement.

The total number of properties that can be sampled and remediated and the number of years the program will run, depends on the Cleanup Settlement Account return on investment and the change in cost of remediation over time. Ecology currently estimates that 4,600 properties will need sampling and 1,200 will need remediation within the Service Area.

4.2 Soil Safety Program Sampling and Remediation

Ecology will use funds from the Asarco settlement to continue to manage and pay for the sampling and cleanup program for schools, licensed childcares, parks, and camps that are located within the Soil Safety Program Service Area (Figure 3). Ecology plans to continue this part of the Interim Action Plan over the next 10 years. Ecology estimates approximately 50 facilities will be sampled each year and approximately 10 properties will need remediation.

4.3 Sampling and remediation protocols

Ecology will further evaluate the number of properties in the program and prioritize action by land use and location. As part of the program design, the agency will develop a soil sampling design and Quality Assurance Project Plan. Most samples will come from the top 0-6" of soils, with some samples taken from a 12" depth and possibly from 18".

One sample contains only one half cut cup of soil and is easily inspected. If remediation is needed, the depth of soil disturbance (excavation and removal) will often not exceed 12". The Tribes and DAHP will also have the opportunity to review and comment on the Sampling and Remediation Design.

5.0 Proposed Cultural Resources Process

5.1 Ecology Managed Programs

This section addresses cultural resource procedures to be followed prior to and during the implementation of the Tacoma Smelter Plume Interim Action Plan. During ground-disturbing activities, Ecology may inadvertently encounter archaeological, cultural, or historical objects, such as ruins, sites, buildings, artifacts, dumps, or other objects of antiquity that may have cultural, historical, or scientific significance.

Typical examples of artifacts may include: bone and bone tools, shells, wood or plant fiber objects, projectile points and other stone tools, flakes from stone tool production, and thermally altered rocks. Historic-era artifacts may include cans, bottles, remnants of logging or agricultural implements, outhouse pits, and trail-road-railroad alignments or features.

Ecology will do sampling and remediation on residential properties that have already been developed, but may retain undisturbed cultural deposits. Grading, excavating, or mixing of sediments may cause subsurface effects to cultural resources. Ecology's programs will cover areas known to have historic grave sites associated with tribal villages, or areas of higher probability for the presence of other cultural resources. Therefore, there is some potential for discovering cultural resources during program activities within these communities.

Ecology may sample over 4,600 properties over a ten year period. Therefore, it is not practical for a Tribal representative or professional archaeologist to be present at every site during sampling and remediation. In addition, DAHP has made a determination that archaeological review of sampling sites is not needed due to the minimal potential disturbance that sampling activities represent.

Ecology project managers, field staff, and contractors will participate in early action steps and follow the protocols in section 5.3 below. In the event of a conflict between the protocols and any applicable law, the applicable law shall govern.

5.2 Ecology action steps–prior to program implementation

1. Ecology will contract with (or hire) an archaeologist for consultation, training, and to assist in implementing the protocol (section 5.3), including determining and documenting any significant discoveries.

2. Ecology will also work with the Tribes, DAHP, and the archaeologist to provide training to Ecology staff and contractors on how to recognize artifacts of potential cultural significance when conducting sampling and remediation at TSP contaminated properties. Ecology staff and contractors will also be trained on the Cultural Resources Protocol (section 5.3).

3. Ecology will notify the archaeologist and DAHP (and Tribes, if requested) when it selects specific neighborhoods for remediation activities that have the potential to disturb soils. Ecology's archaeologist will conduct a Washington Information System for Architectural and Archaeological Records Data (WISAARD) record search and historic map research—such as General Land Office (GLO) maps and Sanborns—to determine if recorded cultural resources are located on the selected properties.

   DAHP and the Tribes can alert Ecology and the archaeologist if there is a known or suspected archaeological site in the area of the properties. Ecology will also consult with property owners to determine if the specific property is a known archaeological site.

5.3 Cultural Resources Protocol–during program implementation

The following procedures will be followed:

1. **Sampling:** Ecology sampling staff, contractors, or subcontractors will visually scan the sampling location for evidence of historic and prehistoric archaeological materials prior to excavating. They will examine excavated soil samples for the presence of artifacts, bones, or features.

   In the event of an inadvertent discovery of such items, the Ecology staff person on site (Remediation Manager or Field Coordinator) will contact the Ecology archaeologist and the property owner as soon as feasible.

If an Ecology staff person is not on-site, the contractor will contact both the Ecology archaeologist and the Ecology Remediation Manager. The archaeologist will visit the property to verify the identification and potential significance of the find and implement the applicable steps in this protocol. Ecology will obtain a permit to dig from DAHP, if required.

2. **Remediation:** If Ecology chooses to do excavation or mixing within the High and Moderate Risk archaeological sensitivity zones identified by DAHP's model on WISAARD, Ecology will consult with DAHP and tribal staff regarding the appropriateness of the planned remediation activities, and the requirements for providing for an archaeologist to be on site during the time soil will be disturbed. On any properties where remediation is funded by EPA, Ecology will consult with EPA and the tribes to address the requirements of Section 106 of the National Historic Preservation Act.

   DAHP's sensitivity model only applies to prehistoric archaeological materials. Therefore, for these locations, Ecology will also conduct appropriate background research on the potential presence of historic archaeological deposits (such as GLO records and Sanborn maps). Ecology will share the results with DAHP and the tribes. Ecology may sometimes cap soils in place, which has no subsurface impacts because it does not involve excavation.

3. **Human remains:** In the unlikely discovery of human remains, Ecology staff or contractors will treat the remains with dignity and respect at all times. Ecology or contractors will not handle the remains, they will cover the remains, and they will secure the area of the find and protect it from further disturbance.

   In addition, Ecology will report the finding of human skeletal remains to the King County or Pierce County Medical Examiner (ME) and local law enforcement as quickly as possible to satisfy the requirements of RCW 27.44. The ME will assume jurisdiction over the human skeletal remains, and make a determination of whether those remains are forensic or non-forensic. If the ME determines the remains are non-forensic, they will report that finding to the DAHP. DAHP will then take jurisdiction over those remains and report them to the appropriate cemeteries and affected tribes.

   The State Physical Anthropologist will make a determination of whether the remains are Native American or non-Native American, and report that finding to any appropriate cemeteries and the affected tribes. The DAHP will then handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains.

4. **Artifact discovery:** If Ecology discovers potential artifacts or archaeological deposits during sampling or cleanup work, such activities will cease within 30 feet of the find. Work will stop until the Ecology archaeologist has verified that the find is cultural and whether it is an isolated item or part of a surface site or buried deposit. The archaeologist will document the find using photographs, drawings, and written descriptions adequate to prepare a Washington Archaeological Site Inventory form or Isolated Find form.

   If the find is determined to be a historic site, or prehistoric isolated find or site, the archaeologist will contact the Tribe, DAHP, and the Ecology Project Manager regarding

avoidance or additional work, as appropriate, to determine significance and minimize further impacts.

5. **Artifact storage:** Samples or artifacts collected will be prepared for long term storage or curation and held in secure storage until such time as they can be analyzed or conveyed to an agreed upon repository, or returned to the property owner. With the property owner's permission, Ecology's archaeologist, the Tribe, or DAHP may temporarily take the samples and artifacts for identification or analysis.

   Ecology encourages property owners to donate cultural materials discovered as the result of the project activities or to have them curated at tribal museums. If the artifact is exhibited in a tribe's museum, the display information will include the property owner's name if they request it.

5.4 Contacts

5.4.1 Tribal Contacts

Muckleshoot Tribe

- Preservation department 253-939-3311 - Laura Murphy, Archaeologist, laura.murphy@muckleshoot.nsn.us

Nisqually Tribe

- Joe Kalama, Cultural Resources 360-456-5221 x1139, kalama.joe@nisqually-nsn.gov

Puyallup Tribe

- Brandon Reynon, Cultural Regulatory Specialist 253-573-7986, brandon.reynon@puyalluptribe.com

Snoqualmie Tribe of Indians

- Steven Mullen-Moses, Director of Archaeology & Historic Preservation 425-495-6097 steven@snoqualmienation.com

Squaxin Island Tribe

- Rhonda Foster, Cultural Resources Director 360-432-3850, rfoster@squaxin.nsn.us

Suquamish

- Dennis Lewarch, Tribal Historic Preservation Officer 360-598-3311, dlewarch@Suquamish.nsn.us

Tulalip Tribes

- Henry Gobin, Cultural Resources Manager 360-716-2636**,** hgobin@tulaliptribes-nsn.gov

5.4.2 Washington State Contacts

Washington Department of Ecology

- Amy Hargrove, Soil Safety Program Coordinator 360-407-6262, amy.hargrove@ecy.wa.gov
- Marian Abbett, Project Manager 360-407-6257, marian.abbett@ecy.wa.gov

Washington Department of Archeology & Historic Preservation

- Rob Whitlam, Ph.D., State Archeologist 360-586-3080, Rob.Whitlam@dahp.wa.gov
- Guy Tasa, Ph.D., State Physical Anthropologist, 360-586-3534, Guy.Tasa@dahp.wa.gov
- Stephanie Kramer, Assistant State Archeologist 360-586-3083, Stephanie.Kramer@dahp.wa.gov
- Gretchen Kaehler, Local Government Archeologist 360-586-3088, Gretchen.Kaehler@dahp.wa.gov

5.4.3 County Contacts

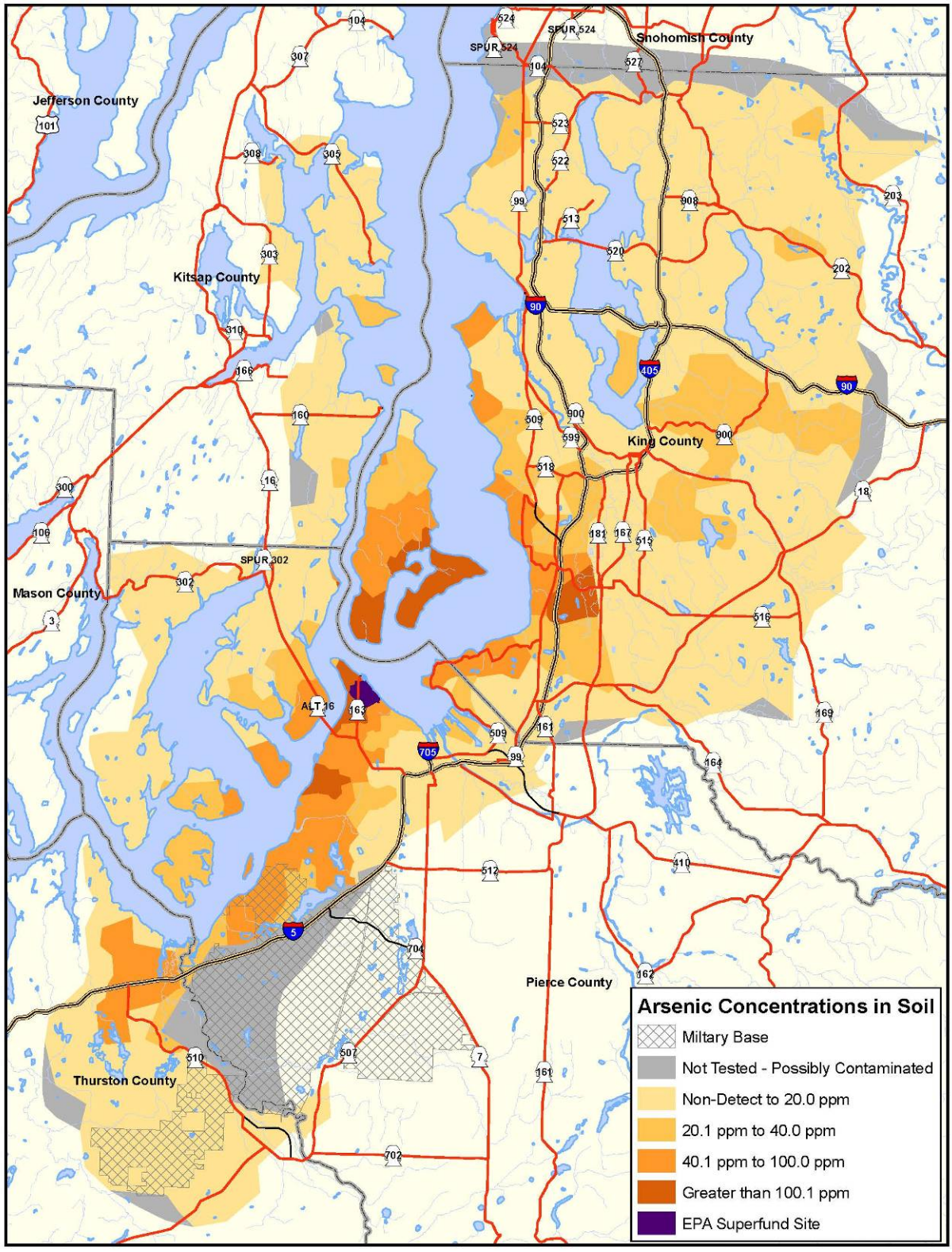
Pierce County

- Sheriff 253-798-7530, pcsheriff@co.pierce.wa.us
- Non Emergency 253-798-4721 (#1)
- Medical Examiner 253-798-6494

King County

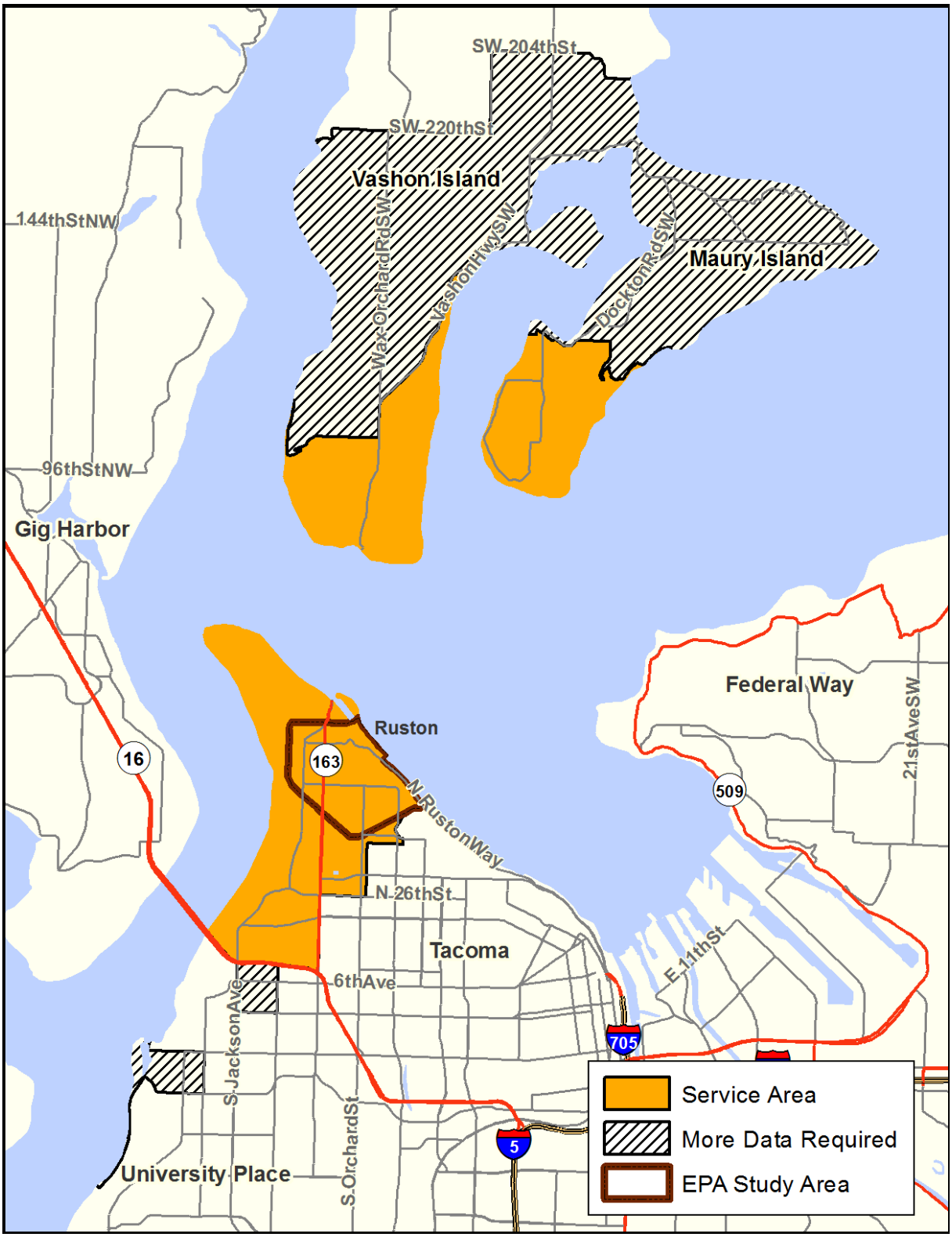
- Sheriff West Precinct, Burien Station 206-296-3333
- Sheriff West Precinct, SeaTac Station 206-973-4900
- Non Emergency 206-296-3311
- Medical Examiner 206-731-3232

Figure 1. Tacoma Smelter Plume Map



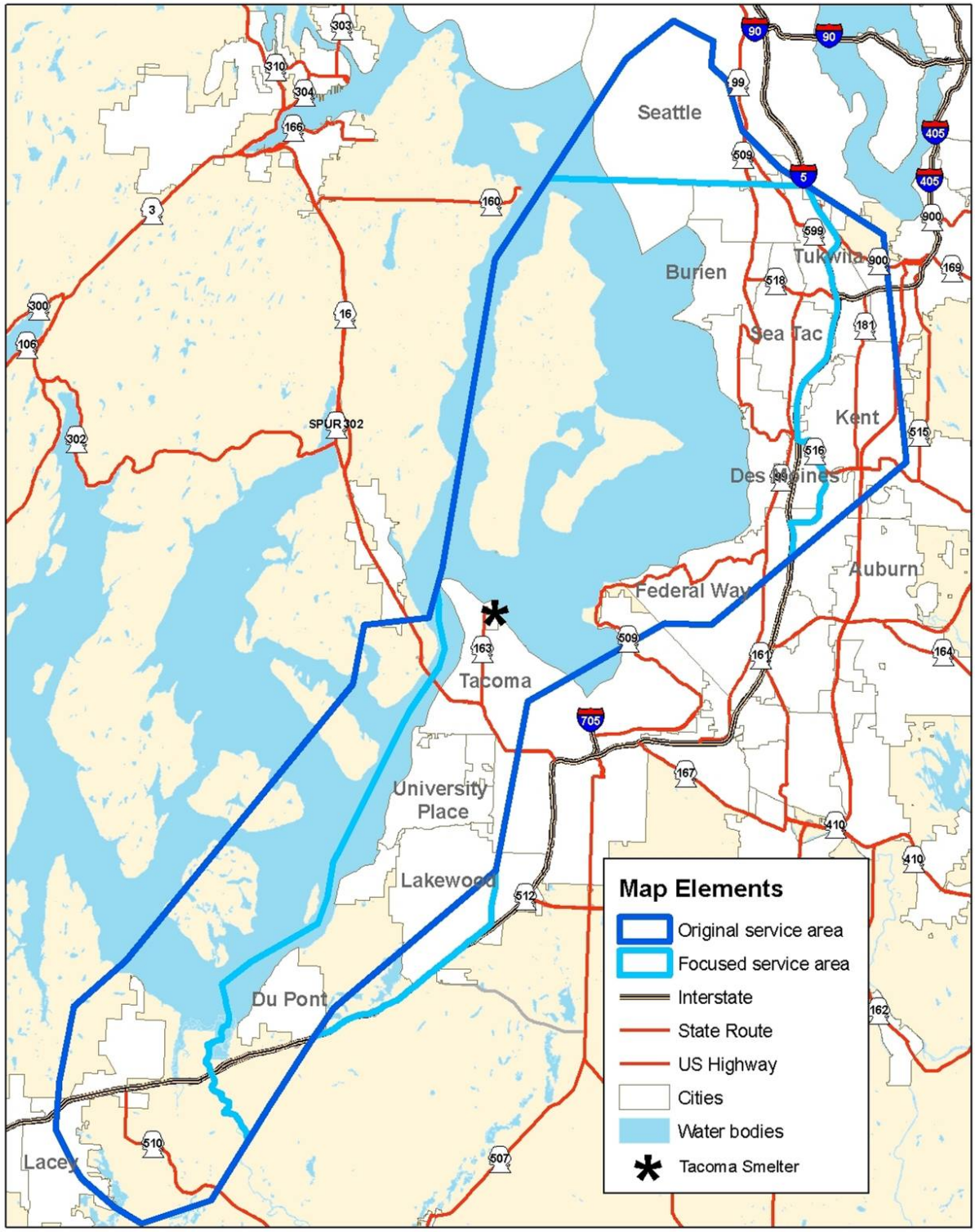
This map shows estimated concentrations of arsenic in the top six inches of soil. It is based on a relatively small number of soil samples, given the large area that is affected. Property-specific sampling is needed to determine the actual amount of arsenic on a given property.

Figure 2. Tacoma Smelter Plume Yard Program "Service Area"



This map shows the Service Area of the Tacoma Smelter Plume Yard Program. The Service Area is the area of the Tacoma Smelter Plume where arsenic levels are most likely to exceed 100 ppm. This area encompasses southern Vashon-Maury Island, Ruston, and areas of northwest Tacoma to Highway 16.

Figure 3. Soil Safety Program Service Area



The original Soil Safety Program service area (darker blue) was around 315 sq miles. Ecology set the boundary based on limited data to estimate where maximum arsenic levels were likely to be over 100 parts per million (ppm). After three years of sampling schools and childcares, Ecology re-evaluated the service area (lighter blue), which is around 253 square miles.

Appendix G

Appendix G

Regulatory and Permitting Requirements

Program Design and Implementation Plan

Appendix G: Regulatory and Permitting Requirements

Tacoma Smelter Plume Residential Yard Program

June 2013

Toxics Cleanup Program
Washington State Department of Ecology
Olympia, Washington

Appendix G. Permitting Requirements

The State of Washington Model Toxics Control Act (MTCA) requires that all cleanup actions comply with applicable local, state, and federal law. It states that "applicable state and federal laws" shall include legally applicable requirements and those that Ecology deems "relevant and appropriate" (Washington Administrative Code [WAC] 173-340-710(1)). This appendix discusses the legally applicable or relevant and appropriate requirements (ARARs) for the Tacoma Smelter Plume Residential Yard Sampling and Cleanup Program (Yard Program).

This appendix also describes the factors Ecology must take into account when choosing a cleanup approach. WAC 173-340-710(4) presents guidelines for deciding whether certain requirements are relevant and right for a cleanup. If conflicts appear between this chapter and the language of the regulation, the regulation shall govern. If new requirements arise in the future, Ecology will include them.

Chapter 1 of the Yard Program Residential Yard Sampling and Cleanup Program Design and Implementation Plan (Program Design) presents the objectives of the Yard Program. Ecology will make cleanup decisions by comparing arsenic and lead levels to the Tacoma Smelter Plume (TSP) action levels for residential properties (see Table 1-1 of the Program Design). Ecology will then conduct property reviews to assess local permitting requirements during implementation of cleanup actions.

Property reviews will be conducted during formulation of the cleanup plans as described in Chapter 6 of the Program Design. These property reviews are anticipated to include the following activities:

- Review and if necessary mapping of critical and sensitive areas using Pierce County and King County geographic information system (GIS) mapping tools.
- Review of local agency permitting requirements and contacts with permitting officials.
- Review of cultural resource requirements as described in Appendix F of the Program Design.

The Yard Program will address areas within the TSP where arsenic levels are expected to be highest. Ecology terms this area the Service Area (see Figure 1-2 of the Program Design). As of February 2013, the current projections of the Service Area included parts of Pierce County (including the United States Environmental Protection Agency [EPA] Ruston/North Tacoma Study Area, part of the EPA Superfund site, as well as portions of Tacoma) and southern Vashon-Maury Island of King County.

This review of regulatory and permit requirements begins in Section G.1 with the State Environmental Policy Act (SEPA) because SEPA requires impacts analysis of the project as it relates to most federal, state, and local environmental protection regulations. In addition, the Yard Program is not exempt from SEPA. Additional federal, state, and local regulatory programs, are discussed in Section G.2, including an approach to meeting the substantive requirements of city and county local permitting, which is the mechanism for complying with local code and management plans.

G.1 State Environmental Policy Act

The proposed actions under the Yard Program are subject to SEPA, RCW 43.21 C. Ecology issued a mitigated determination of non-significance (MDNS) for the Tacoma Smelter Plume Interim Action Plan in October 2011, which describes the Yard Program, meeting the requirements of SEPA. The Yard Program, as outlined in the Program Design is consistent with the activities that are described in the Interim Action Plan. However, the mitigation measures in the SEPA checklist are fairly general. This appendix provides additional details on implementation of the general mitigation measures listed in the MDNS. Because the scope, impacts, and mitigation measures of the Yard Program identified in the SEPA checklist has not changed and the Program Design is a follow-on document that provides further details on implementing the program, there is no need for an additional review under SEPA per WAC 197-11-600(4)(c) and 625. Ecology will be evaluating their program in terms of SEPA and if necessary will issue an addendum to "update" mitigation measures and implementations if warranted. Per SEPA guidance, the Program Design should be distributed to the affected agencies and interested persons involved with the Yard Program.

In the following section, the Mitigation Measures from the SEPA checklist in the Interim Action Plan are restated *in italics*, followed by additional details on how the Mitigation Measure will be implemented.

G.1.1 Erosion and Sediment Control

Mitigation Measure: *Contamination in steeply-sloped areas and bluffs will typically not be addressed using physical soil cleanup methods (excavation and removal, capping, or mixing). These methods could cause damage to the sensitive ecosystems, outweighing the benefits of reducing arsenic and lead concentrations. These are also areas where human exposure is less likely*.

Implementation: Use existing Critical Areas Ordinance (CAO) mapping from affected communities to identify steep slopes and other areas of geological hazard. In general, these areas will not be cleaned up due to physical hazards and the high cost of mitigation. Instead, human health will be protected using institutional controls, such as signage or educating residents about reducing exposure to soil contaminants. In the rare instance that soil removal is necessary in an area designated in the CAO as a steep slope or geologic hazard, Ecology or its Architectural and Engineering contractor must provide additional restoration details including:

- A sub-basin map showing the location of the project and its relation to nearby natural and constructed drainage features.
- Erosion-sedimentation controls and revegetation plans, including topography at 5-foot maximum contour intervals, and extending 100 feet beyond project boundaries. The plan must include an inventory and locations of pre-existing, existing, and proposed overstory and understory vegetation.
- A plan identifying all critical areas and buffers having clearing limitations: erosion hazards, wetlands, aquatic areas, steep slopes, and landslide hazards.

Mitigation Measure: *Best Management Practices (BMPs) will be used during each cleanup, to minimize erosion and sediment. Any stockpiled soils will be covered during wet weather and surrounded by berms. Fill and remaining soils will be graded to minimize erosion and sediment*

and covered with stabilizing materials such as sod, plantings, permeable surfaces, or paving. Establish construction entrances and wheel washes to reduce the amount of track-out of soil.

Implementation: Develop a generalized Stormwater Pollution Prevention Plan (SWPPP) for contractors to follow that includes specific minimum erosion and sediment control measures (e.g., use of silt fences or other practices identified in Ecology's Stormwater Management Manual for Western Washington: Volume II -- Construction Stormwater Pollution Prevention, Volume II, Chapter 4.1). Contractors will also be required to meet specific jurisdictional construction stormwater BMPs where applicable. These additional requirements are summarized on the table below.

Summary of Jurisdictional Construction Stormwater BMPs

Jurisdiction	Requirements	Reference/Link
King County	Erosion control measures must include: Clearing limits, cover measures, perimeter protection, traffic area stabilization, sediment retention surface water collection, dewatering control, dust control, and flow control.	King County Surface Water Design Manual, Appendix D
Pierce County	Meet minimum requirements including: Marked clearing limits, establish construction access, flow control, sediment controls, stabilize soils, protect slopes, protect drain inlets, stabilize channels and outlets, control pollutants, control dewatering, maintain BMPs, manage project.	2012 Stormwater and Site Development Manual, Section 2.4 .2
Ruston	No apparent special requirements, follow Pierce County and Ecology construction stormwater requirements	Town Ordinance
Tacoma	Meet 12 elements: Mark clearing limits, establish construction access, control flow rates, install sediment controls, stabilize soil, protect slopes, stabilize channels and outlets, control pollutants, control dewatering, maintain BMPs, manage project.	City of Tacoma Stormwater Management Manual, Volume 2

Require contractors to develop a specific Erosion and Sediment Control Plan (one-page figure and checklist form from general SWPPP) for its work and provide a Certified Erosion and Sediment Control Lead (CESCL) to monitor construction activities. The plan will identify construction entrances and exits to each property and, if necessary and practical, track off plates or wheel washes may be used to reduce the amount of track-out of soil.

G.1.2 Surface Water Runoff Impacts

Mitigation Measure: *Follow construction BMPs, including covering soil stockpiles, building berms around stockpiles and sloped areas. Avoid steep slopes (as defined by local jurisdiction). Include interceptor dikes and swales where there is stormwater runoff. Protect storm drains.*

Use mulching or other erosion control practices to reduce erosion. Wash vehicles and equipment before leaving the cleanup project area.

Implementation: Include specifications for contractors to provide erosion control for each cleanup. Include requirement for temporary mulching in areas where runoff could occur while restored vegetation grows in. Require contractor to provide sediment control structures to prevent runoff from work sites and unimproved access roads in accordance with Ecology's *Stormwater Erosion and Sediment Control for Small Parcel Construction*. Control measures would include:

- Limiting site access to one route when possible.
- Stabilizing denuded areas as soon as possible by mulching or covering.
- Keeping sediment on-site using vegetative buffers or sediment barriers (silt fences or waddles).
- Maintaining and regularly inspecting erosion control BMPs.
- Installing sediment control structures such as mulch barriers.
- Other BMPs such as secondary protection of storm catch basins and ditches.

Require contractor to develop plans for managing vehicle wash water that includes minimal requirements for onsite containment and drying, or settling and disposal. Wash water **cannot** be discharged to surface water under construction stormwater permit.

G.1.3 Air Emissions

Mitigation Measure: *Fugitive dust will be controlled by watering down soils during the cleanup process. Ecology has found this method to be effective during past soil cleanup projects in the TSP.*

Implementation: Require contractor to submit a general dust emissions control plan as required for the Arsenic Rule (WAC 296-848) and Lead Rule (WAC 296-62-07521) that includes use by the contractor of water for dust control to prevent creation of visible dust beyond the boundary of the work area. Calculations using maximum anticipated soil metal concentrations and conservative estimates of the amount of dust needed to become visible to the naked eye indicate that exposures to metals and silica dust will be below applicable occupational standards if visible dust is not generated. Therefore, visual monitoring for dust emissions will meet the monitoring requirements of the lead and arsenic rule. However, this assessment does not release the contractor from the requirement to meet all federal Occupational Safety and Health Administration (OSHA) and Washington Department of Labor and Industries Division of Occupational Safety and Health (DOSH) implementation of the Washington Industrial Safety and Health Act (WISHA) requirements for employee safety. Ecology will require contractors to submit their employee personal air monitoring data. Implement a "no visible dust outside of work area" standard for the work. Provide an Ecology contact for residents and neighbors to report dust complaints. Spot-check earthwork to visually assess dust emissions. Cover loads that are to be exported from the property.

Mitigation Measure: *Control vehicle exhaust and greenhouse gas emissions by limiting truck trips. Vehicle exhaust and greenhouse gas impacts can be reduced by minimizing truck trips. Routes can be planned to minimize the miles that need to be driven. Excavators and other soil moving vehicles will not be idled unnecessarily.*

Implementation: Require contractors to submit transportation plans that demonstrate efficient use of trucks and truck routes/timing that will reduce overall fuel usage (mileage and idling in traffic). Contractor must obtain Right-of-Way Use permit from the local jurisdiction, if required. Require contractors to limit truck and equipment idling to less than 10 minutes.

G.1.4 Environmental Health Hazards

Mitigation Measure: *Water soils to limit dust.*

Implementation: Include requirement in contractor specifications with "no visible dust outside of work area" standard. Limit water use to the amount sufficient to dampen soil without creating runoff. Require contractor to curtail activities that create dust during high wind conditions (defined as more than 40 miles per hour [mph] sustained wind for the Yard Program). Contractor will be required to check and log hourly wind predictions for the city closest to the project area using Weather.com or other resource at the beginning of each work day and curtail excavation work when wind is predicted to have sustained speed of greater than 40 mph.

Visible airborne dust can be used as the action level for protection monitoring. Dust is generally considered visible at levels of roughly 2 to 10 milligrams per cubic meter of air (mg/m^3) (Pilat and Ensor 1969[1]). The Washington permissible level for total dust is 10 mg/m^3 (WAC 296-841-20025), which is greater than the visible dust level. The Washington action and permissible levels for arsenic are 0.005 and 0.01 mg/m^3, respectively (WAC 296-848-500). The Washington permissible level for lead is 0.05 mg/m^3 (WAC 296-841-20025). Based on the expected soil levels of arsenic and lead at the properties undergoing cleanup, a visible dust level of 10 mg/m^3 is not anticipated to trigger exceedance of these Washington action and permissible levels.

If dust is visible from any excavation area, immediately initiate engineering controls or alternative dust control methods. Dust suppression primarily consists of using water to dampen an area of dust generation. Covering stock piles with tarps and/or dampening the stockpile with water are effective dust suppression methods.

Mitigation Measure: *Educating workers about limiting their exposure by using gloves, washing hands, and wearing protective clothing, and dust masks, if necessary*.

Implementation: Require contractor to use employees that have completed, at a minimum, 24-hour hazardous waste operations (HAZWOPER) training and at least one supervisor who has both 40-hour HAZWOPER and 8-hour supervisor training per 29 CFR 1910.120. Require contractors to comply with all OSHA and DOSH regulations. Implementation includes demonstrating that workers are not exposed above Washington action and permissible air levels (WAC 296-848-500 and WAC 296-841-20025), and through previous similar work practices such as exposure assessment or exposure monitoring during project. Alternatively, contractors can limit worker exposure to visible dust. Require contractor to meet all OSHA/DOSH requirements for worker hygiene, including providing personal wash stations and containment/cleaning of personal protective equipment including boots.

Mitigation Measure: *Wash truck wheels before leaving contaminated property*.

[1] Plume opacity and particulate mass concentration, Michael J. Pilat, David S. Ensor, Department of Civil Engineering, University of Washington, Seattle, Washington USA, 1969.

Implementation: Require contractor to develop a plan for washing vehicles operated within disturbed contaminated areas. This could include brushing equipment off at the property and transporting equipment on trailers to a designated wash down area. Encourage contractors to minimize vehicle use within disturbed areas. Encourage contractors to minimize wash water by physically removing soil prior to washing. Where necessary to prevent tracking material off site, require contractor to establish construction entrance with quarry spawls placed over geotextile fabric.

Mitigation Measure: *Cover contaminated soils being removed from property.*

Implementation: Require contractors to securely tarp or cover all loads before leaving the property. Require that any excavated soil stockpiled onsite to be covered at the end of each work day.

G.1.5 Noise Impacts

Mitigation Measure: *Work only during normal business hours; provide community contact (e.g., hotline number) to assist with community concerns.*

Implementation: Require contractor to work only during designated hours. Review and comply with local noise ordinances, the minimum allowing construction noise only between seven A.M. and ten P.M. on weekdays and between nine A.M. and ten P.M. on weekends and federal holidays per local noise ordinances. Use of truck compression brakes within city limits will be prohibited. Provide contact information for residents to report noise impacts in outreach materials provided to residents within the neighborhood where cleanup is occurring and within the Yard Program Service Area in general. The following is a summary of sources for local noise ordinances:

Summary of Local Noise Ordinances

Jurisdiction	Ordinance
King County	http://www.kingcounty.gov/council/legislation/kc_code/15_Title_12.aspx
Pierce County	http://www.co.pierce.wa.us/DocumentCenter/View/1144
Tacoma	http://www.cityoftacoma.org/page.aspx?cid=8852
Ruston (draft)	https://docs.google.com/viewer?a=v&pid=sites&srcid=cnVzdG9ud2Eub3JnfHJ1c3RvbndlYnNpdGV8Z3g6Nzg4NjlhMjFhYmUwODVkOA

G.1.6 Transportation Impacts

Mitigation Measure: *Traffic impacts during soil cleanup will be mitigated by carefully planning truck routes to minimize miles driven, and informing residents through outreach materials in the neighborhood where cleanup is occurring when work is occurring and what roads may be impacted. Load out areas may be used to transfer soils from smaller trucks to truck-trailer combinations for long-haul transport to disposal facilities. An Ecology project manager will be available to assist with community concerns and needs throughout the cleanup process.*

Implementation: Require contractors to submit a transportation plan that demonstrates efficient use of trucks and truck routes/timing and identifies proposed transfer areas. Require contractor to identify major transportation routes and mitigate public safety, traffic, and road infrastructure impacts to the extent reasonable. If required, the contractor will submit the plan to local jurisdiction

as part of Right of Way Use Permit. The general transportation routes could be discussed with local transportation agencies. Provide flaggers, traffic control, and traffic warning signs (e.g. "Trucks Entering Roadway" signs) to the extent required under the Manual of Uniform Traffic Control Devices (MUTCD 2009) Part 6, Temporary Traffic Controls[2]. At load out or staging areas, require contractor to establish construction entrances with quarry spawls covering geotextile fabric or track off plates/mats.

Contractors will be required to obtain necessary Right of Way Use Permits when a cleanup includes a public right of way. Contractors will be required to obtain any necessary state Department of Transportation trip permits and meet weigh and size limits described in R.C.W. 46.44.090, or will have to obtain a local or state permit. Ecology may use photographs and notes to document the condition of unimproved roadways and alleys used by contractors to access yards, as appropriate, prior to start of excavation work in the project area. The contractor will be required to restore unimproved roads to pre-project condition, including obtaining permits from the appropriate jurisdiction for any in-road work.

G.2 Other Regulations and Local Permitting

G.2.1 Applicable or Relevant and Appropriate Requirements

In addition to SEPA, the following laws and regulations are considered the ARARs for the Yard Program. Many regulations such as the Clean Water Act and Clean Air Act are established based on Federal law, but are delegated to the state level for implementation. Likewise, some state law is implemented at the local level. Regulations and permitting requirements are organized below based on the implementing agency level.

Federal

- Executive Order 05-05, Archeological and Cultural Resources (A&CR) and National Historic Preservation Act (16 USC 470)
- Chapter 43.21 C RCW, State Environmental Policy Act (SEPA)
- Chapter 70.94 RCW, *Washington Clean Air Act* (WCAA)*
- Chapter 70.95 RCW, *Solid Waste Management, Reduction, and Recycling* (SWMRR)*
- Chapter 70.105 RCW, *Hazardous Waste Management* (HMW)*
- Chapter 90.48 RCW, *Water Pollution Control* (WPC)*
- Chapter 90.58 RCW, *Shoreline Management Act of 1971* (SMA)*
- Chapter 296-848 WAC, Inorganic Arsenic Rule, Department of Labor and Industries (IAR).

Local

- Local regulations for Shoreline Management Act, Critical Areas Ordinance, Growth Management Act and grading and stormwater management (LOCAL). These regulations are typically implemented through the permitting and planning review process at the county or city level.*

[2] Manual of Uniform Traffic Control Devices 2009 with Revisions 1 and 2. U.S. Department of Transportation, 2012. http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/pdf_index.htm. The latest edition should be reviewed for requirements prior to conducting work.

- Local regulations pertaining to Low Impact Development (LID).*
- Local Regulations protecting urban trees/forestry (UF).*

** MTCA exempts Ecology from the procedural requirements of certain State laws (noted above). It also exempts Ecology from laws authorizing local permits or approvals for cleanup actions conducted by Ecology (RCW 70.105D.090). However, Ecology must ensure compliance with the substantive requirements of these local laws and regulations. In addition, Ecology must obtain permits when the State program is required under federal law, regulation, or permit, such as a National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit under the Clean Water Act.*

Methods to meet the substantive requirements of these ARARs are summarized below. The requirements below are based on a review of local construction clearing and grading permits, stormwater permits, Shoreline Management Act (SMA), and Growth Management Act.

Summary of ARAR Substantive Requirements

ARAR Description (ARAR Abbreviation)	**Method to Meet Substantive Requirement of ARAR**
Executive Order 05-05, Archeological and Cultural Resources and requirements of National Historic Preservation Act (16 USC 470). (A&CR)	Follow Cultural Resources Protocol (See Appendix F of Program Design).
RCW 43.21 C, State Environmental Policy Act. MDNS dated 10/20/11. (SEPA)	Adhere to the descriptions and follow mitigation measures in the SEPA Checklist.
Chapter 70.94 RCW, Washington Clean Air Act. (WCAA)	Requirements for air quality permits are not anticipated for the project. Follow dust and vehicle emission mitigation measures.
Chapter 70.95 RCW, Solid Waste Management, Reduction, and Recycling. (SWMRR)	Dispose of excavated soil at Subtitle D permitted facilities.
Chapter 70.105 RCW, Hazardous Waste Management. (HWM)	Soil failing the Toxicity Characteristic Leaching Procedure (TCLP) test is federally designated hazardous waste and state dangerous waste under WAC 173-303-070(3). These soils are subject to state and federal disposal and tracking requirements for dangerous and hazardous wastes. Based on previously tested arsenic and lead concentrations, it is not anticipated that excavated soil will be classified as a hazardous or dangerous waste (See Section 9.3.4 and Appendix I of the June 2012 Interim Action Plan). No hazardous waste management or reporting is anticipated. Landfills may still require TCLP tests before disposal.

ARAR Description (ARAR Abbreviation)	Method to Meet Substantive Requirement of ARAR
Chapter 90.48 RCW, Water Pollution Control. (WPC)	All construction projects are subject to erosion and sediment control requirements. Larger properties or conglomerations of properties may require a NPDES Construction Stormwater General Permit because the construction stormwater permit threshold is based on the total project area, rather than each individual cleanup area. Erosion and sediment controls must be inspected by a Certified Erosion and Sediment Control Lead. Special monitoring and practices are required for work near sediment, pH, and phosphorus-impaired water bodies. These water bodies must be mapped within the project area.
Chapter 90.58 RCW, Shoreline Management Act of 1971. (SMA)	The SMA includes an exemption (RCW 90.58.355) for hazardous substance remedial actions. However, substantive requirements of Shoreline Master Programs will be met.
Chapter 296-848 WAC, Inorganic Arsenic Rule, Department of Labor and Industries Chapter 296-62-07521, Lead Rule, General Occupational Health Standards. (IAR/LR)	Contractor must follow these rules, including preventing employee exposure, providing training, conducting exposure assessment during work practices, and supplying medical monitoring.
Chapter 36.70a RCW, Growth Management Act and local CAOs. (GMA)	Obtain GIS maps of critical areas from local jurisdictions and avoid work in areas restricted from development.
Local regulations for shoreline management, grading and stormwater management. (LOCAL)	Shoreline protection is part of the construction permit review process.
Local regulations for Low Impact Development code requirements (LID)	No new development will occur as result of the Yard Program, therefore the cleanup work is not subject to city or county Low Impact Development code requirements.
Local regulations for Urban Forestry. (UF)	The Yard Program specifically excludes removal of trees or large shrubs and therefore is compliant with local tree protection/urban forestry regulations.

G.2.2 Shoreline Management Act

The measures below summarize the substantive requirements of the SMA-required management plans from jurisdictions within the Yard Program Service Area. These requirements are limited to those relevant to the cleanup project.

Because no new development is anticipated as part of the project, the Yard Program will ensure compliance with the substantive requirements of the SMA through the clearing and grading management strategies described in Section G.2.4, with the additional requirements described below within SMA areas:

- When appropriate, preserve or restore natural flora and fauna.

- Do not substantively alter natural topography in shoreline areas.
- Protect, improve, and if appropriate, increase wildlife and aquatic habitats, including spawning grounds.
- Make every reasonable effort to retain natural shoreline vegetation and other natural features of the landscape during property development and construction.
- Design developments to protect the water and shoreline aesthetic characteristics.
- Minimize disturbance of shoreline vegetation.

To meet these additional requirements and assure that restoration does not occur in areas that were originally not permitted, the property review will include mapping of the boundaries of the SMA, developed by each jurisdiction.

G.2.3 Critical Areas Ordinance

Ecology plans to ensure compliance with the substantive requirements of local CAOs by complying with the clearing and grading reviews typically required by the jurisdictional permit process and the SMA review process described above. Ecology will obtain CAO maps from the appropriate jurisdictions and overlay these maps onto planned cleanup areas to identify properties in sensitive or hazardous areas.

As with steep slopes (which may be identified on CAO maps), cleanup is not anticipated in CAO areas because these areas are not expected to be high-use areas and cleanup costs would be prohibitive. Cleanup will not be performed on that portion of a property subject to a CAO if previous development was conducted but had not been permitted (e.g., unpermitted projects constructed within wetland buffers, on steep slopes, or in critical habitat areas).

G.2.4 Clearing and Grading Permits

Locally issued clearing and grading permits are the means for planning agencies to implement regulatory controls during the plan review, including compliance with the CAO, the SMA, and construction stormwater permitting and erosion and sediment controls. Because no new development will occur in connection with the Yard Program, Development Permits are not required; however, substantive requirements of CAO ordinances that rely on development review will be included in the CAO review for each project property. As of February 2013, Ecology has identified the following jurisdictions that may be within the Yard Program Service Area:

- Unincorporated King County (Vashon Maury Island)
- City of Tacoma
- City of Ruston
- Unincorporated portions of Pierce County

Ecology will work with the local permitting jurisdiction to develop a programmatic approach to addressing substantive requirements, where possible. If such an approach can be developed, Ecology will develop a general plan to review each proposed cleanup against the substantive requirements. Ecology will share these general plans with the jurisdictions and invite comments; however, Ecology anticipates that the local jurisdictions will not review individual property cleanup plans. If unusual circumstances arise, Ecology will consult with the local jurisdiction for guidance, if appropriate.

Ecology will work with each permitting agency to determine the substantive requirements of local permits. The local authority may require compensation for these reviews based on permitting agency review rate schedules for a single large project.

The general planning process should include a GIS CAO Review. As warranted this may include the development of GIS CAO maps. These maps will include wetlands, sensitive habitats of special status species, flood hazards, and geological hazards, as well as the SMA requirements described below.

The plans should include information that is common to the permit applications of the Service Area jurisdictions. The following information is typically required on permit applications:

- Legal description of the property, including tax parcel number(s).
- A North arrow.
- A vicinity map drawn to a scale of approximately 1" = 2,000' in sufficient detail to clearly locate the project in relation to arterial streets, natural features, landmarks, and municipal boundaries.
- A sub-basin map showing the project location and its relation to nearby natural and constructed drainage features.
- Size and location of all existing improvements within 50 feet of the project.
- Property boundaries, easements, covenants, setback requirements, and clearing limits.
- Erosion-sedimentation controls and revegetation plans, including topography at 5-foot maximum contour intervals. Contours should extend 100 feet beyond the project boundaries.
- All critical areas and buffers with clearing limitations: erosion hazards, wetlands, aquatic areas, steep slopes, and landslide hazards.
- Clearing and/or restoration plans that include an inventory and locations of pre-existing, existing, and proposed overstory and understory vegetation.
- Total earthwork (cut and fill).
- Design of any soil retention structures (retaining walls).

These requirements will be fulfilled by requiring construction contractors to submit individual site plans. For some common requirements, Ecology could address the requirements generically in an overall programmatic document for the project or for each jurisdiction. Where jurisdictions require property-specific information, Ecology will provide a property cleanup sketch to the contractor, who would mark the locations of those features on each property. The plan will use checklists and standardized symbols for plan features. With approval from the agencies, Ecology will act as their agent and review contractor submittals against the substantive requirements of the permit review process.

G.2.5 Construction Stormwater Permit

Ecology's Water Quality Program administers the Construction Stormwater General Permit. Ecology's Toxic Cleanup Program is working with Ecology's Water Quality Program personnel to evaluate whether project-wide coverage under the Washington Construction Stormwater General

Permit will be sufficient for the entire project. This permit would include a generic SWPPP that references individual property erosion and sediment control plans prepared and submitted by the cleanup contractor(s).

Ecology will use the Water Quality Assessment 303(d) list to identify properties where runoff could discharge to any 303(d) listed or Total Maximum Daily Load (TMDL) water bodies impaired by fine solids, phosphorus, and pH. Specific limitations and/or practices to reduce pollutant runoff would be implemented for these areas, including monitoring. In cases where stormwater discharges to a water body with a TMDL that prohibits construction stormwater discharge loads, the contractor will be required to use other stormwater management options such as limiting work to the dry season, or containing and infiltrating all stormwater on site.

The Construction Stormwater General Permit includes the following monitoring requirements:

S4. MONITORING REQUIREMENTS, BENCHMARKS AND REPORTING TRIGGERS

Table 3. Summary of Primary Monitoring Requirements

Size of Soil Disturbance[1]	Weekly Site Inspections	Weekly Sampling w/ Turbidity Meter	Weekly Sampling w/ Transparency Tube	Weekly pH Sampling[2]	Requires CESCL Certification?
Sites that disturb less than 1 acre, but are part of a larger Common Plan of Development	Required	Not Required	Not Required	Not Required	No
Sites that disturb 1 acre or more, but fewer than 5 acres	Required	Sampling Required – either method[3]		Required	Yes
Sites that disturb 5 acres or more	Required	Required	Not Required[4]	Required	Yes

Additional monitoring requirements apply for discharges to impaired water bodies. If a programmatic permit can be developed, monitoring and reporting requirements will consider the large scale of the project, including work in multiple locations by many different contractors. Contractors or Ecology will provide CESCLs for routine stormwater inspections. Wheel wash water discharge is generally prohibited; therefore, contractors must manage vehicle and wheel wash water separately. Ecology will utilize current BMPS as well as best available technology, such as the use of track off plates.

Appendix H

Appendix H

AREIS Database Manual

Areawide Remediation Environmental Information Systems (AREIS) – Phase 2

Tacoma Smelter Plume User Manual

Table of Contents

Login

External users must login through SecureAccess Washington (SAW) in order to access the Areawide Remediation Environmental Information Systems (AREIS) database. Click this link (https://secureaccess.wa.gov/) or type the URL onto the address bar on an internet browser.

New Users

1) Click on "Do not have an account? Create one" on the main SAW page.

2) Complete the steps to obtain user access.

3) Once access to SAW is granted, choose "Department of Ecology" from the list of available agencies.

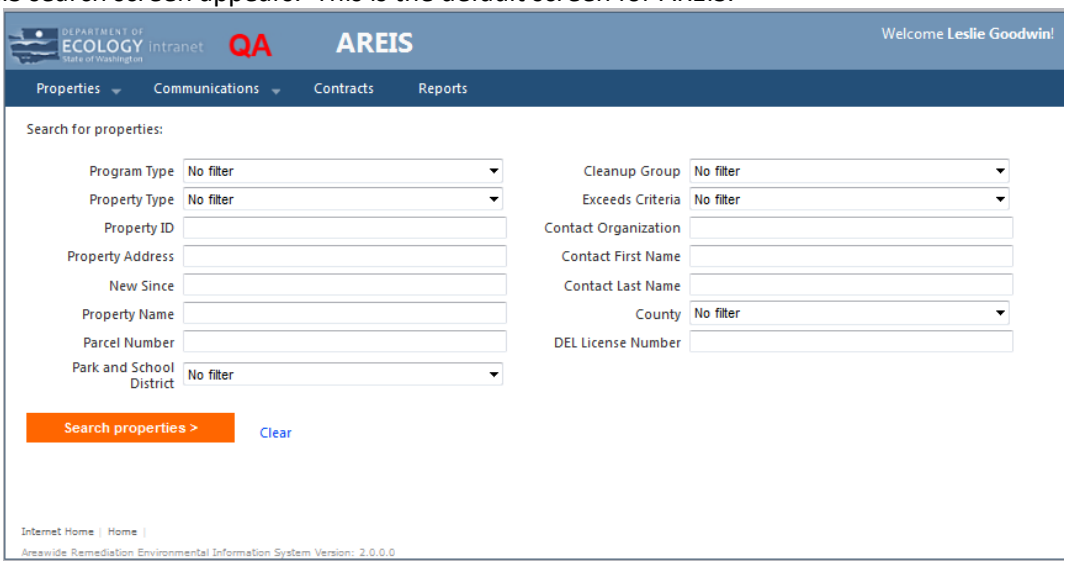
4) Choose “AREIS” from the list of services available from the Department of Ecology.

5) An email will be sent to you once access is granted. This usually takes several hours, but may take several days. Once you receive your email, you can login to SAW as shown below.

Existing Users

6) Enter User ID and Password and click ‘login’

7) The AREIS search screen appears. This is the default screen for AREIS.



User Types and Access

AREIS contains data for the Tacoma Smelter Plume (TSP) Soil Safety Program (SSP), Residential Yard Sampling and Cleanup Program (RES), and Environmental Protection Agency Data (EPA).

AREIS user types:

- General users –have read-only rights to the database. None of the screens will be editable. EPA users fall into this category and have the same rights.
- Local agency users - can add and edit all screens.
- County agency users – can only add/edit data for their respective counties. Cannot add/edit contracts or associate properties with contracts.
- System Administrators – have all permissions of local agency users, and can delete properties and manage lookup tables.

This manual differentiates between the user types as needed.

General AREIS Conventions

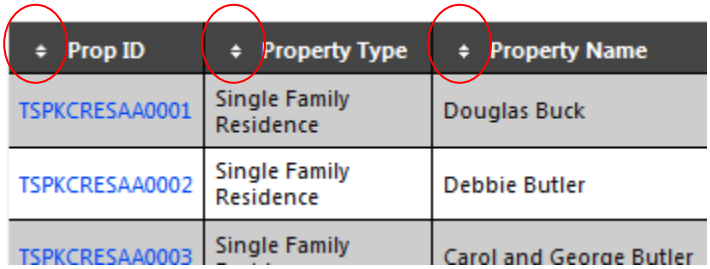
- **Export to Excel** – most grids have an Export to Excel icon at their upper left corner. When clicked, AREIS exports the contents of the grid to a Microsoft Excel spreadsheet where it can be edited and saved as you choose.

  A message will ask, “Do you want to open or save <filename> …?” Select open or save.

  Another message may warn, “The file you are trying to open is in a different format than specified by the file extension. Verify that the file is not corrupted and is from a trusted source before opening the file. Do you want to open the file now?” Click “Yes”.

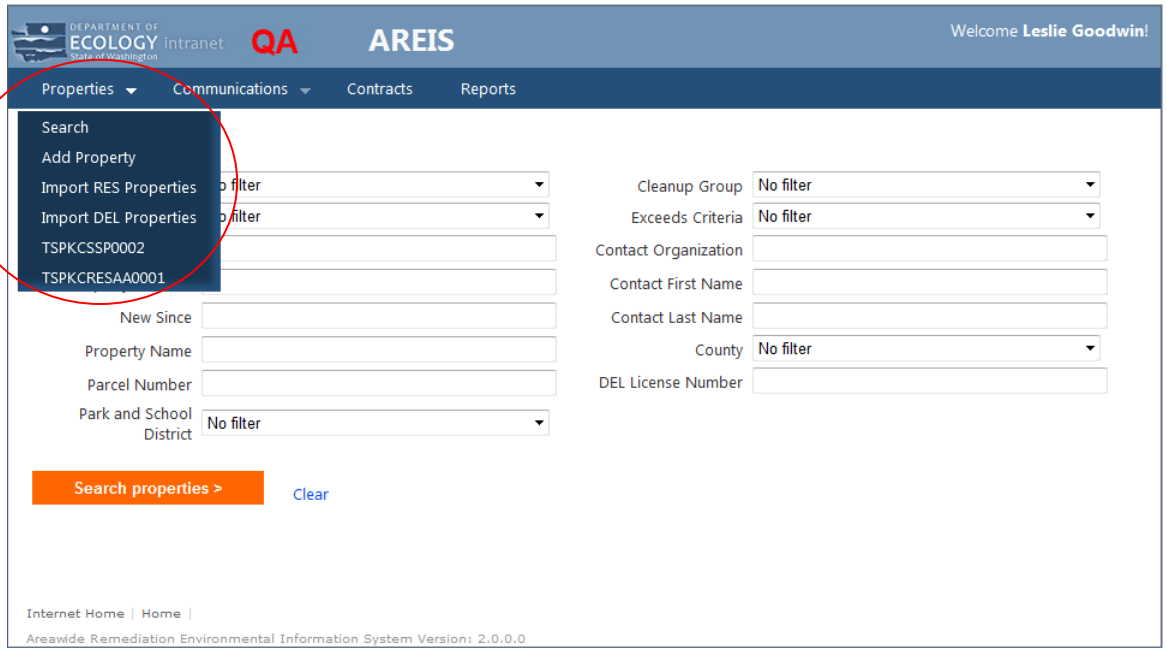
- **Sorting Grids** – whenever grids have little up/down arrows to the left of the column headings, you can click the column heading to sort by that column. Clicking again will reverse the sort order.



Properties Menu

The Properties Menu is where you search for, view, and edit information about specific properties. The Properties Menu offers several dropdown options:

- Search
- Add Property
- Import RES Properties (only available to certain users)
- Import DEL Properties (only available to certain users)
- A list of the last few properties you have viewed. These can be clicked for quick access to those properties.

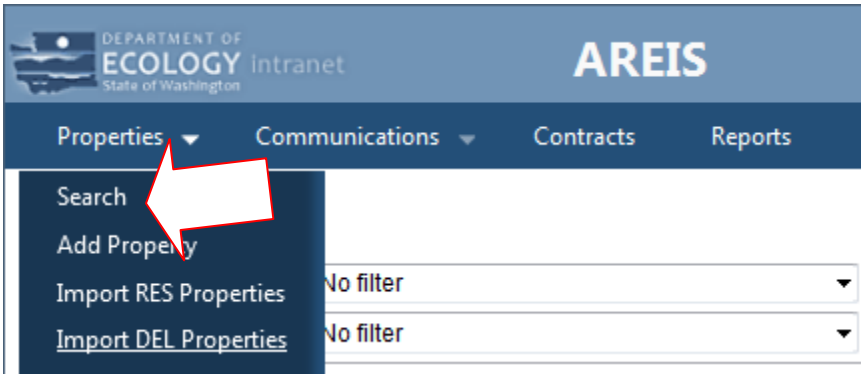


1. Search

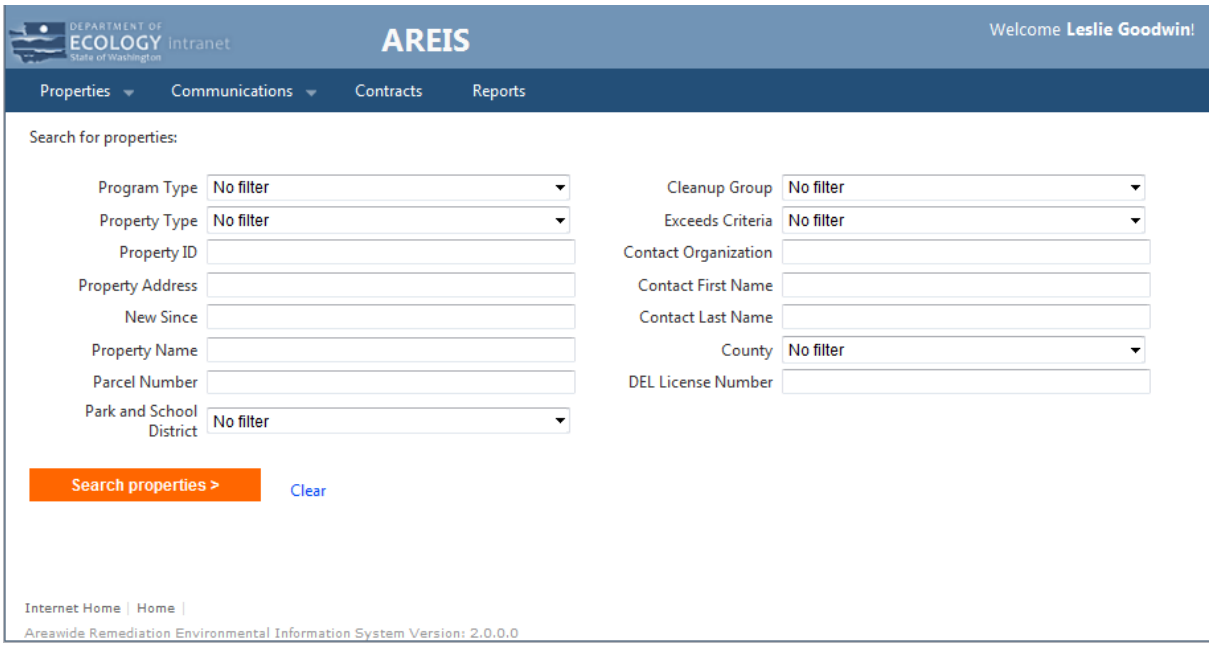
Before you can view or edit an existing property's information, you need to find it in the Search screen.

Using the Search Screen

1) The search screen is the default AREIS screen. If you are not already on the Search screen, go there by selecting "Properties" from the main menu, then "Search" from the dropdown menu.



2) The AREIS search screen displays.



The search criteria are as follows:

- Program Type
- Property Type
- Property ID
- Property Address
- New Since
- Property Name
- Parcel Number
- Park and School District
- Cleanup Group
- Exceeds criteria
- Contact Organization
- Contact First Name
- Contact Last Name
- County - dropdown
- DEL License Number

Definitions for search criteria:

- Program Type – There are three programs within the AREIS database.
    - SSP – Soil Safety Program – contains information on play areas at schools, childcares, parks, camps, and public multifamily housing facilities.
    - RES – Yard Program – contains information on single and multifamily residential properties within the service area of the program.
    - EPA – Environmental Protection Agency – holds historical data from properties located within the EPA Study Area, The single and multifamily residential properties located within this area are also included in the Yard Program.
    - Hint: There may be some childcares that have duplicate information because they are located in both the Soil Safety Program service area and the Yard Program service area or in the EPA Study Area.
- Property Type – There are multiple property types to choose from. The table below indicates the property types for each program. Please note not every property type can be used for each program.

SSP	RES	EPA
Public School	Single Family Residence	Single Family Residence
Private School	Private Condo	Unknown
Family Home Childcare	Private Apartment	Right of Way
Childcare Center		Non-Residential
Preschool		Multifamily Private Housing
ECEAP		Public School
Headstart		Private School
Park		Childcare Center
Camp		Park
Public Multifamily Housing		

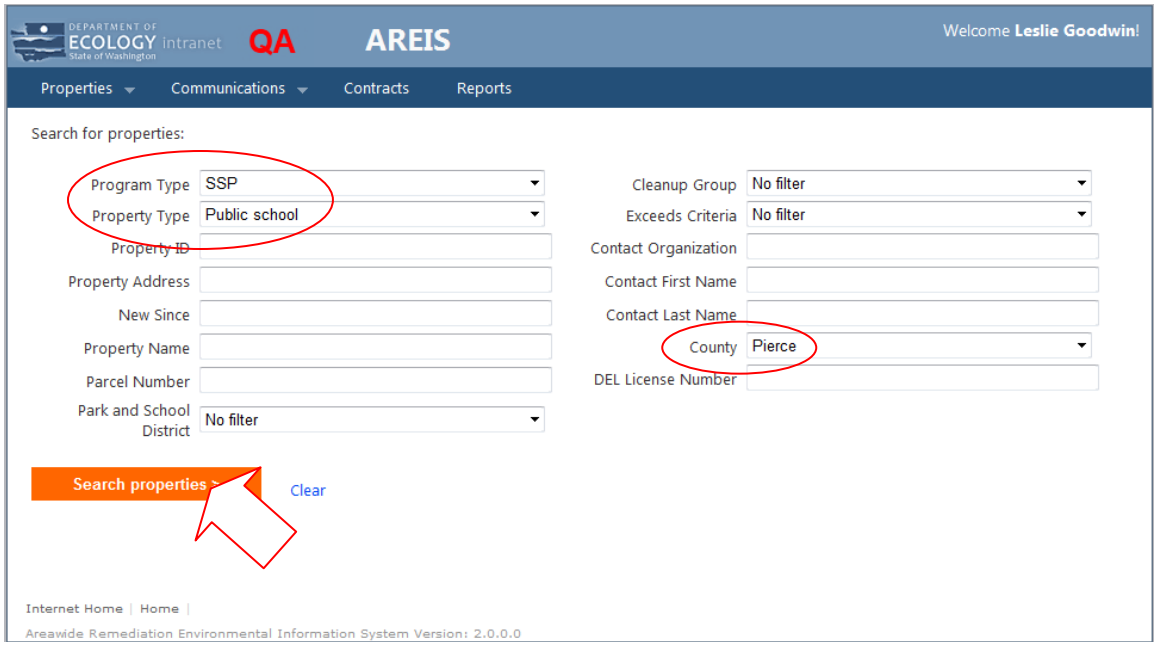
- Property ID – This is the unique identifier for each property in the database. It is generated by the system.
- New Since – If you are looking for newly created facilities you can use this date field. This is most useful for Soil Safety Program facilties.
- Property Name – may be equal to the owners name, the name of the facility, or the EPA identifier depending on the program type
- Park and School District – If you are only looking for SSP schools or parks located in a specific district
- Cleanup Group – This will be assigned as we meet with properties and try to plan for the next cleanup group.

- Contact Organization – This is if you are searching for properties that are affliated with an organization like a property management company or an Home Owners Association.
- Contact First Name and Last Name – the name of someone affliated with one of the properties in the system.
- County – the county the property is located within
- DEL License Number – Childcares are all assigned a license number from the Department of Early Learning. This is imported in during upload.

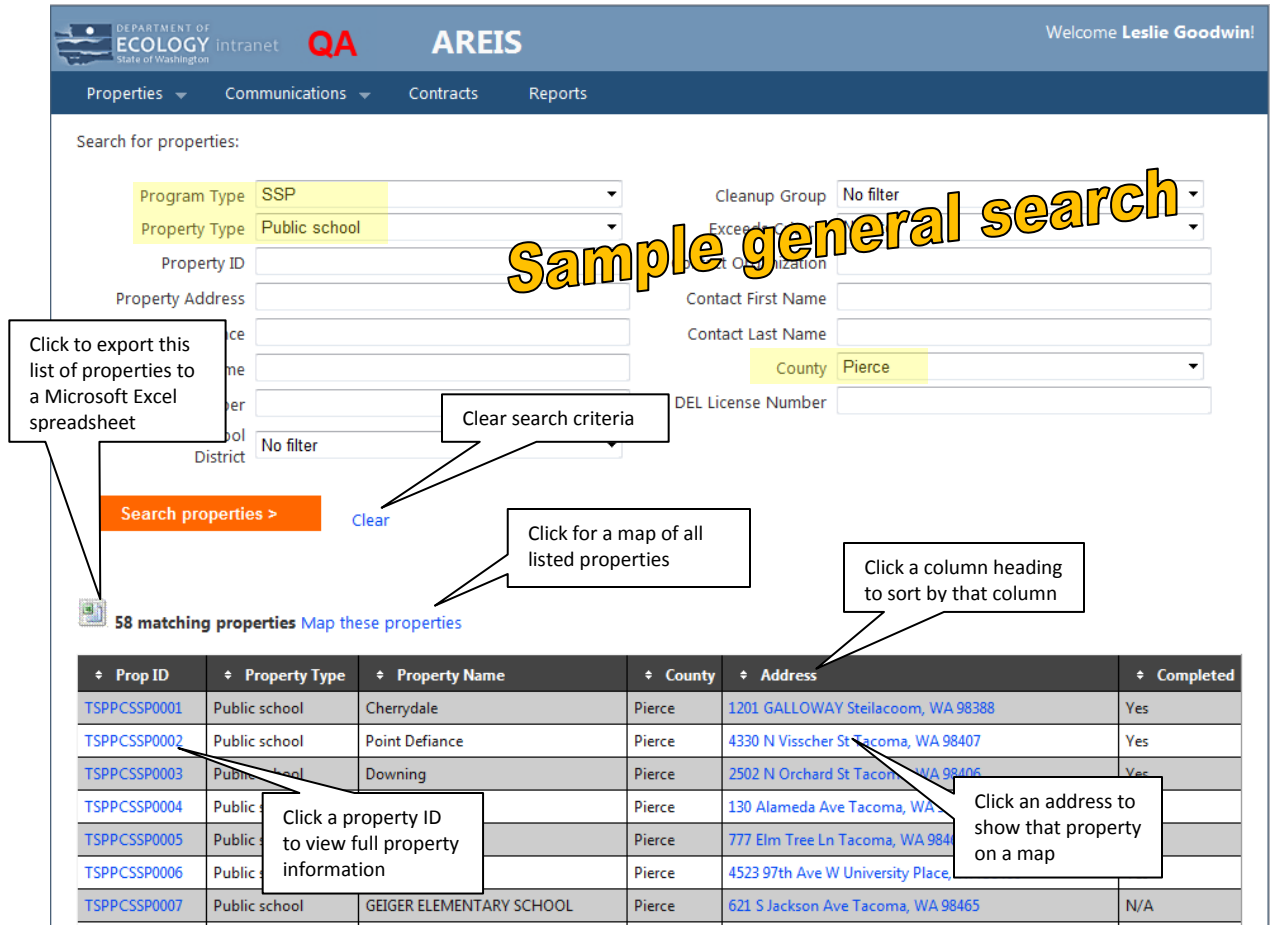
AREIS searches for any properties containing your search criteria. You must enter at least one search criteria. Additional criteria will narrow your search. For example:

- Entering program type "RES" and county "Pierce" will search for all RES properties in Pierce County. This would be a very general search, and would return many properties.
- Entering property address "Frace" will return all properties on Frace Street.
- Entering Property ID "TSPPCRESAA" will return all Tacoma Smelter Plume, Pierce County, Residential Properties in Access Group AA
- *HINTS:*
  - *Address Search: When searching by property address, the best way to get the address you want is to enter the house number. If you type the exact address but spell out "Street" or "Avenue" you may get no return on your results. The convention for entering addresses into the system is to abbreviate "Street (St)", "Avenue (Ave)", "North (N)" or "South (S)", and no periods after the abbreviations.*
  - *Property ID search: You do not have to type the entire property ID into this field, you may type the last four digits or any portion of the property ID.*

3) Enter at least one search criteria. The more specific you are, the narrower your search will be. Click "Search propertie" to execute your search.

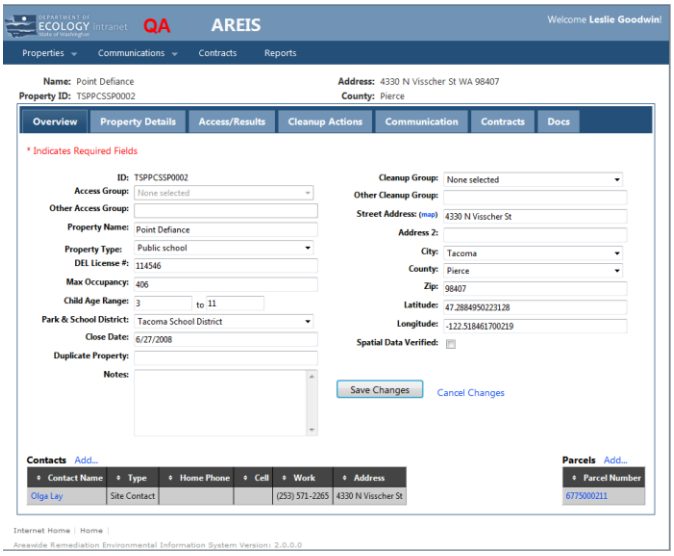


AREIS returns a list of properties matching your search criteria.

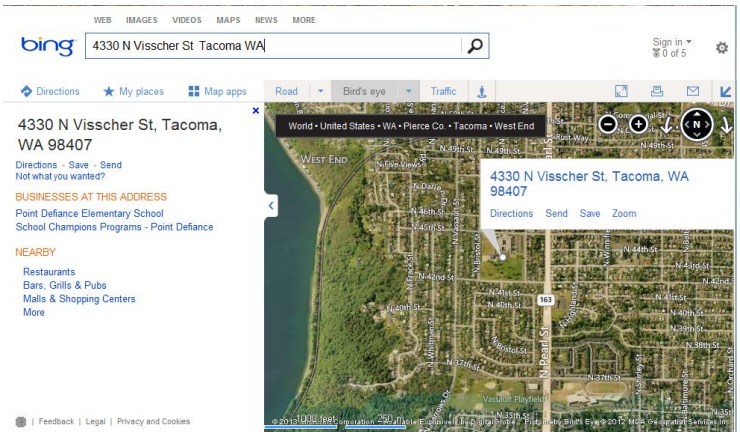


From here, you can:

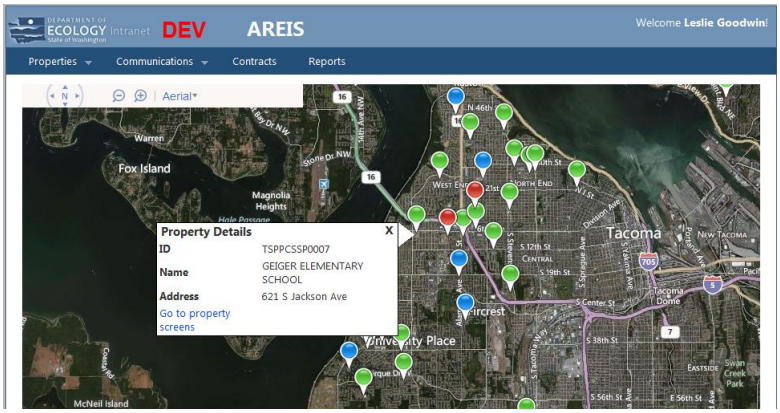
a) Click a Property ID. AREIS opens the property overview page:



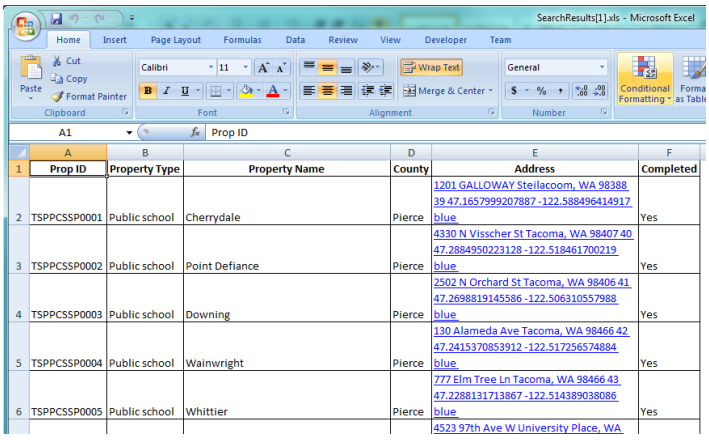
b) Click a Property Address. AREIS opens a map of the property:



c) Click "Map these properties." AREIS opens a map with push pins showing all listed properties. If you click one of the push-pins, a popup gives general property information and allows you to click to go to the property screen.



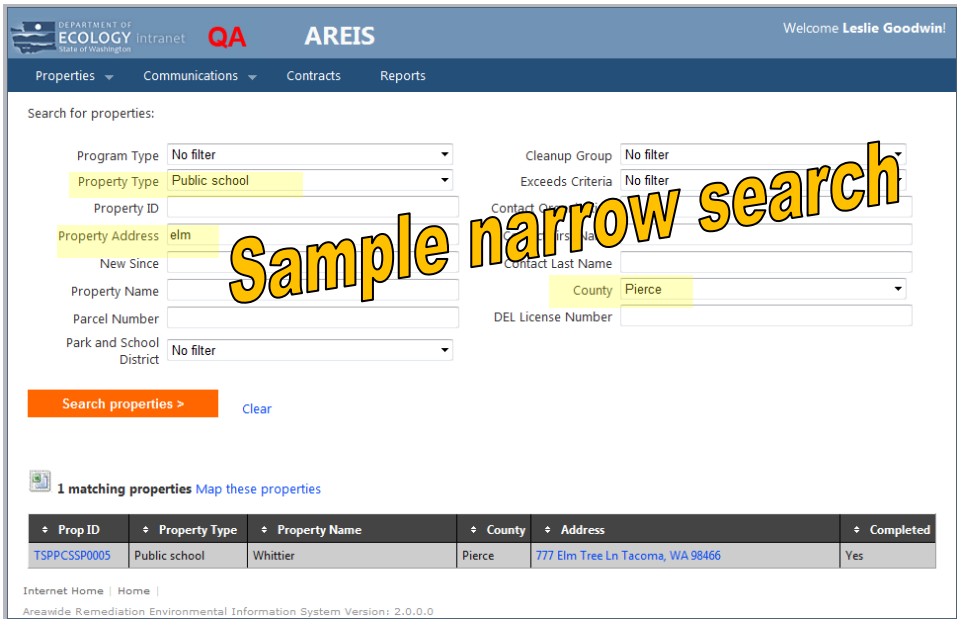
d) Click the "Export to Excel" icon. AREIS exports the list of properties to a Microsoft Excel spreadsheet, which can be opened (if Microsoft Excel is installed on your computer) or saved. If you get a message warning that the file is a different format than specified by the extension, click "Yes" to open it.



	A	B	C	D	E	F
1	Prop ID	Property Type	Property Name	County	Address	Completed
2	TSPPCSSP0001	Public school	Cherrydale	Pierce	1201 GALLOWAY Steilacoom, WA 98388 39 47.1657999207887 -122.588496414917 blue	Yes
3	TSPPCSSP0002	Public school	Point Defiance	Pierce	4330 N Visscher St Tacoma, WA 98407 40 47.2884950223128 -122.518461700219 blue	Yes
4	TSPPCSSP0003	Public school	Downing	Pierce	2502 N Orchard St Tacoma, WA 98406 41 47.2698819145586 -122.506310557988 blue	Yes
5	TSPPCSSP0004	Public school	Wainwright	Pierce	130 Alameda Ave Tacoma, WA 98466 42 47.2415370853912 -122.517256574884 blue	Yes
6	TSPPCSSP0005	Public school	Whittier	Pierce	777 Elm Tree Ln Tacoma, WA 98466 43 47.2288131713867 -122.514389038086 blue	Yes
					4523 97th Ave W University Place, WA	

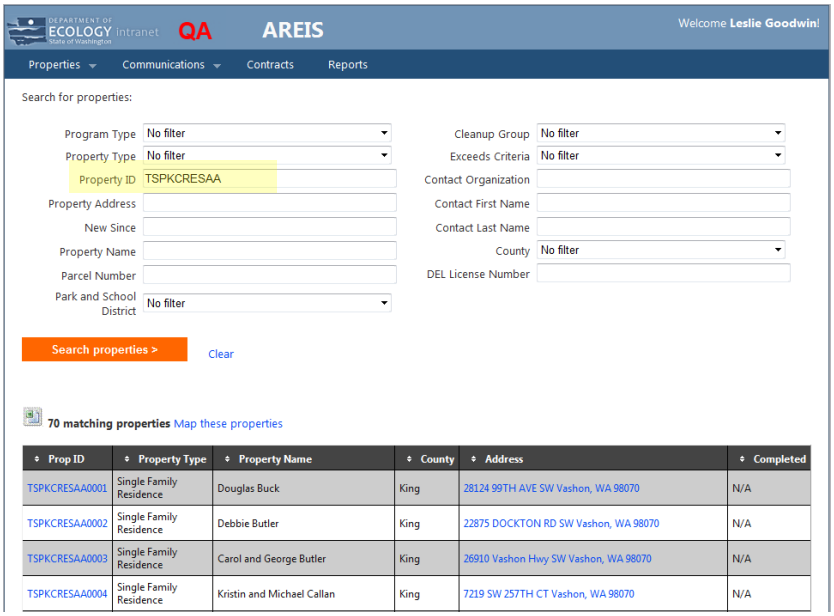
e) Click a column heading to sort by that column. AREIS will re-order the search results by that column. Click again to reverse the order.
f) Add more search criteria to narrow your search, then press "Search properties" again.
g) Click "Clear" to erase all search criteria, then enter new criteria to search again.

Below is a narrow search that returned only one property. This searched for a public school in Pierce County with "Elm" in the address.



Sample narrow search

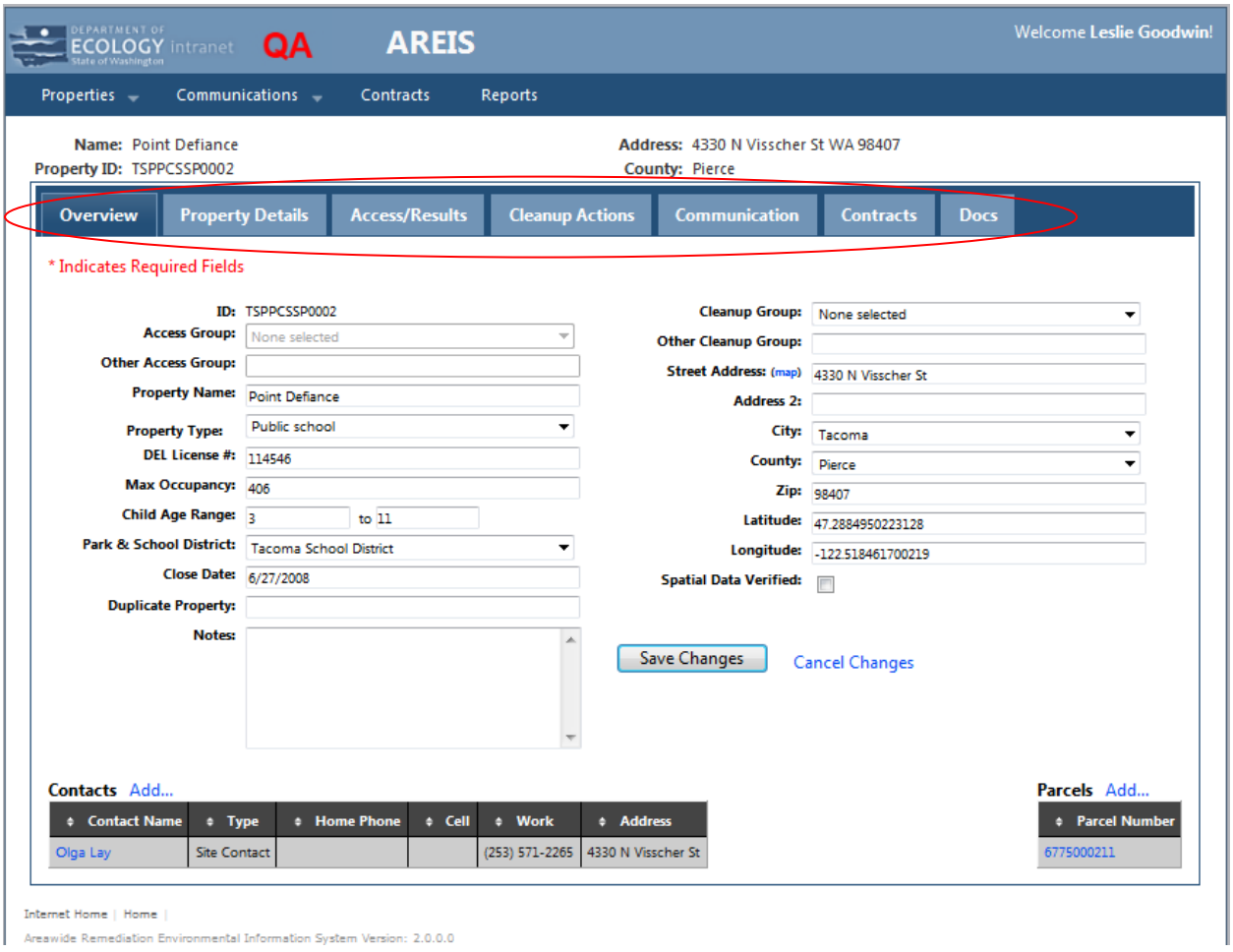
Below is a search for all Tacoma Smelter Plume RES properties in King County in the "AA" access group. We used a search shortcut -- entering a partial Property ID (TSPKCRESAA) -- and AREIS found all properties with that string in the property ID.



2. Property Tabs

When you click a property ID from the search screen, AREIS opens that property record. The property screen has seven tabs:

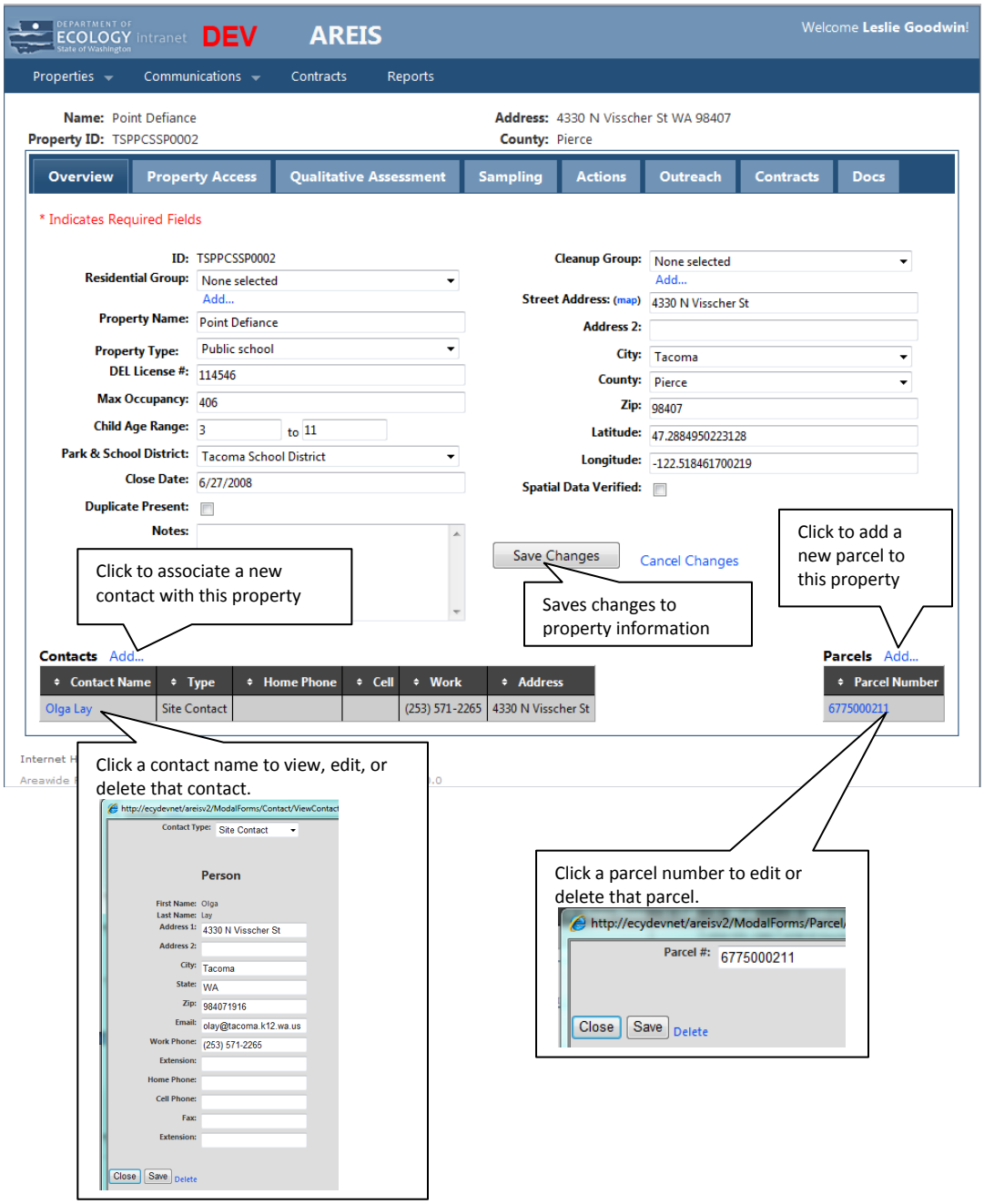
1. Overview - the default, opening screen for the property
2. Property Details
3. Access/Results
4. Cleanup Actions
5. Communications
6. Contracts
7. Docs



A. Overview Tab

The Overview tab is divided into three sections:

1. Property information - general information regarding the property that can be viewed and edited.
2. Contacts - lists all contacts associated with this property and allows users to add, edit, or delete contacts.
3. Parcels - lists all parcels associated with this property and allows users to add, update, or delete parcels.

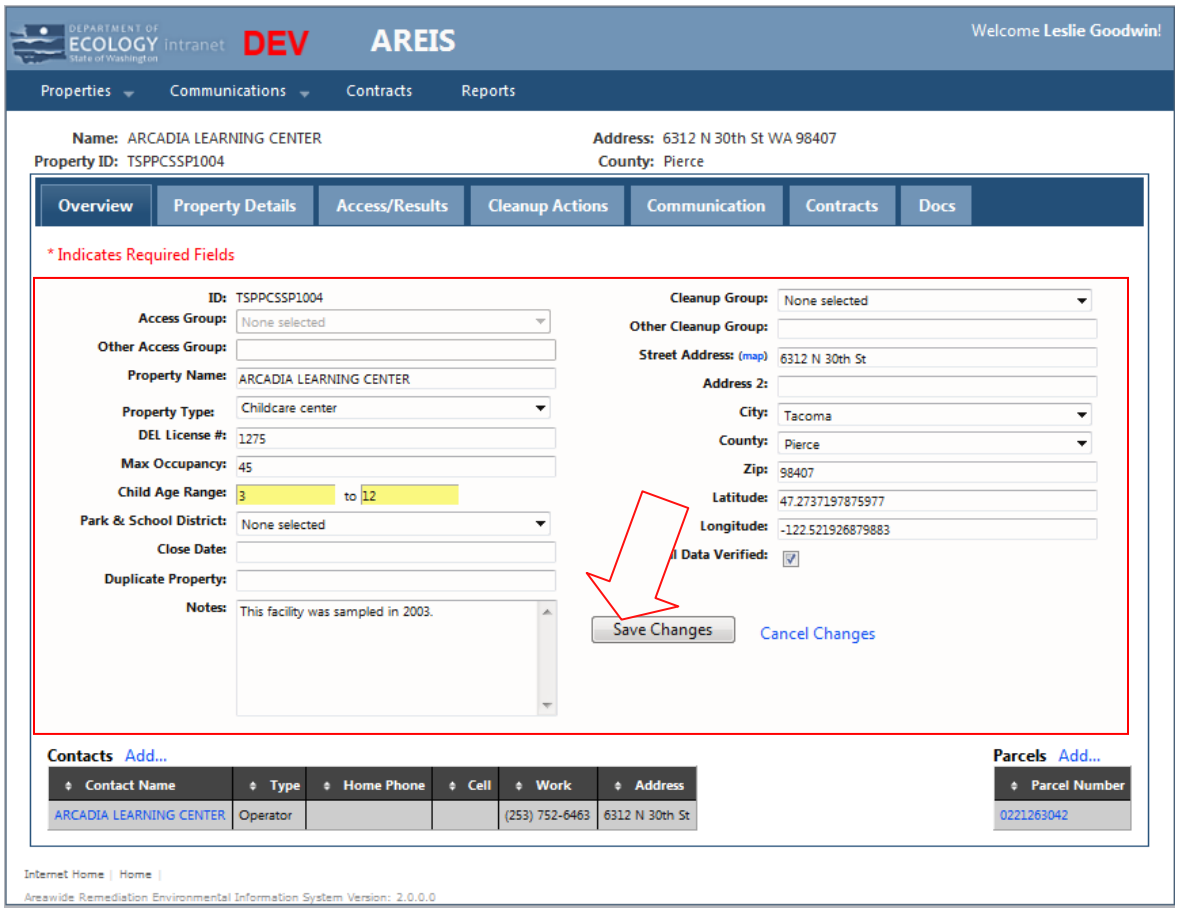


Property Information Section

This section contains general property information. The fields vary based upon the program.

Required fields are marked with a red asterisk (*).

Edited fields turn yellow to reflect pending changes.



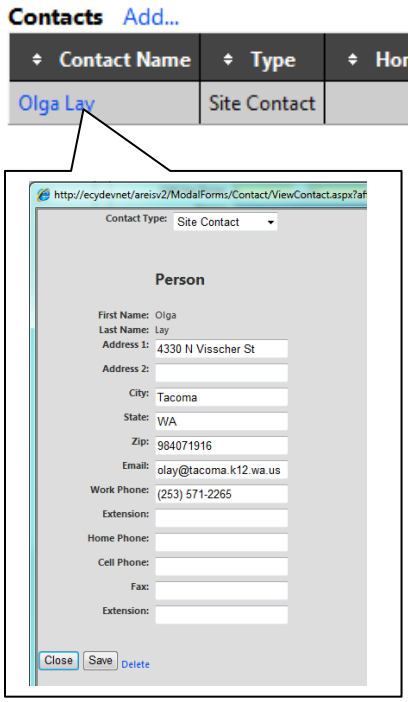
- **Save Change**s - saves all changes made
- **Cancel Changes** - will undo any changes that have not been saved.

Contacts Section

Lists contacts and/or organizations associated with this property.

1. View a Contact

Click on an existing contact's name. A pop-up window with detailed information returns.

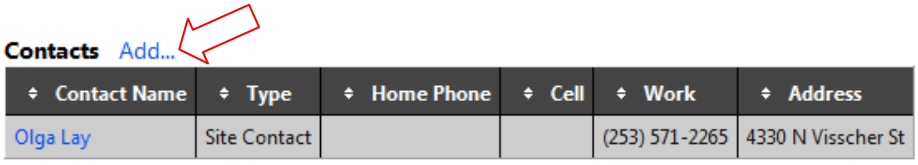


- You can edit the contact's information and click "Save".
- NOTE: Edits to the contact's information are reflected throughout the database, wherever this contact is affiliated with a property.
- Changing the "contact type" only affects the contact's affiliation with this property.
- Deleting the contact disassociates the contact from this property.
- "Close" doesn't save any changes.

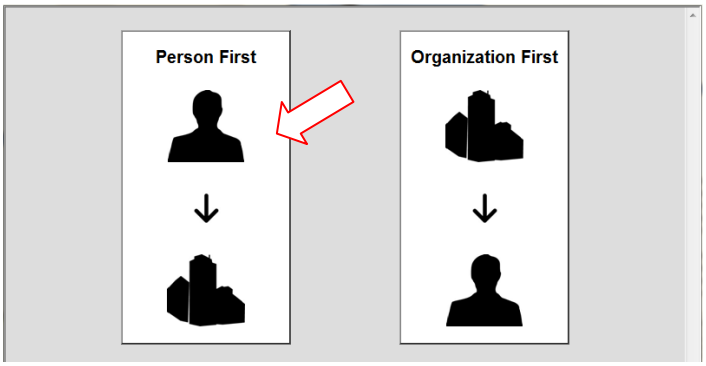
2. Add a Contact

AREIS uses a popup wizard to guide you through the process of finding your contact in the database, then affiliating your contact with this property. Contacts can take two forms: person or organization. Often you'll have a person who is affiliated with an organization; AREIS will guide you to find the person and their organization. Sometimes your contact won't exist yet in the database, so AREIS will help you add your contact, then affiliate that contact with the property.

a. Click on "Contact **Add …"**



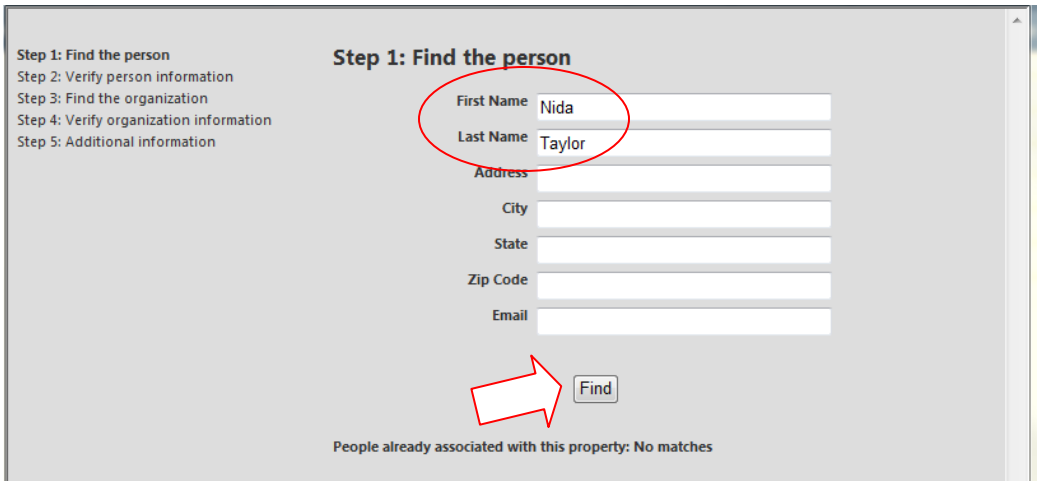
b. A popup appears to guide you through the Add a Contact process. Usually you know the person's name and want to add by "Person First". Click on "**Person First**"



c. **Step 1: Find the Person** – Here, you enter search criteria to find the person, if he/she already exists in the Ecology database.

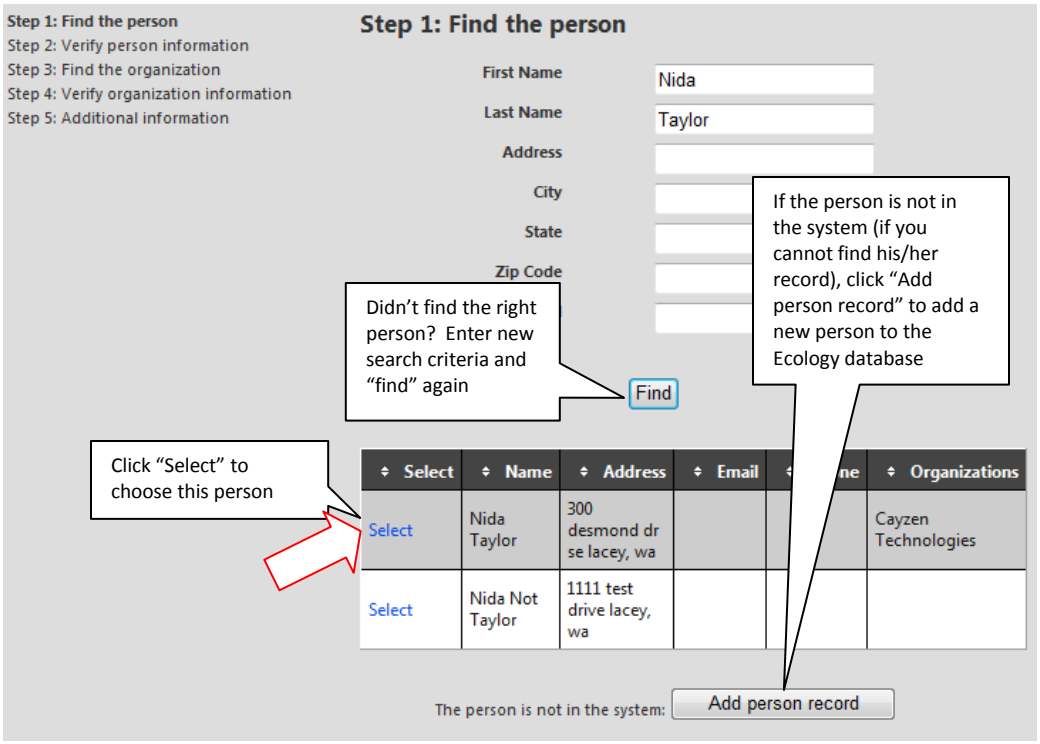
Enter your search criteria to find the person. You must enter at least two characters of the first name and at least 3 characters of the last name. It is not necessary to enter complete information, only enough to find the person in the database. AREIS will search for persons whose names/addresses/email addresses contain your search criteria.

Then click "**Find**"



d. AREIS searches and returns a list of all persons matching your criteria in the database.

In the sample below, AREIS found two records with first name containing “Nida” and last name containing “Taylor”.



From this screen, you have three choices:

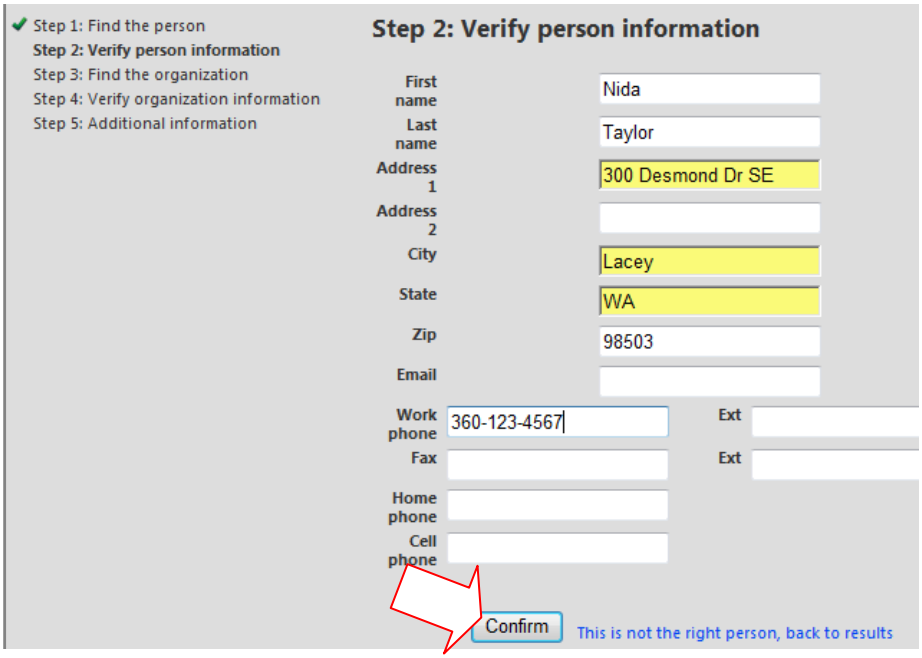
1. If the correct person is listed, click “**Select”** for that person.
2. If the person is not listed, or the list is too long, you can try to enter other/additional search criteria, and “Find” again (then repeat this step)
3. If the person is not listed and you are certain he/she is not in the database, you can “Add person record” to add him/her to the Ecology database

In this example, Nida Taylor with Cayzen Technologies is the correct person, so click “Select” for that record.

e. **Step 2: Verify Person Information** –

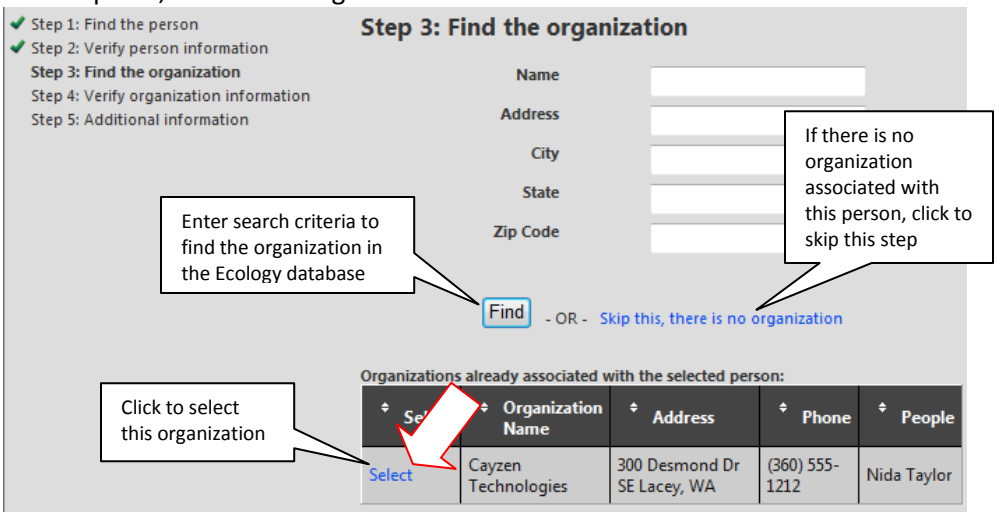
- If you're adding a new contact, enter all information in this form.
- If choosing an existing contact, verify all information is correct, editing information as needed.

Click "**Confirm**".



f. **Step 3: Find the Organization** –Find the organization (if any) associated with this person for this property. You can:

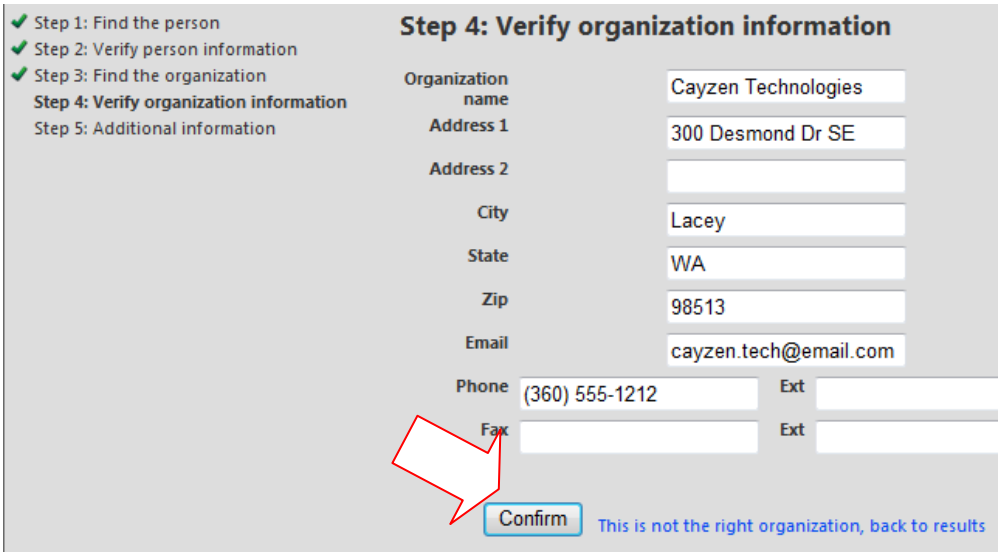
- "Select" from the list of organizations already associated with this person.
- Enter search criteria and "Find" the organization in the Ecology database. Once found, you'll be returned to this screen. If you cannot find the organization, you will be prompted later to "Add organization record."
- "Skip this, there is no organization"



In this example, Cayzen Technologies is correct, so "Select" it.

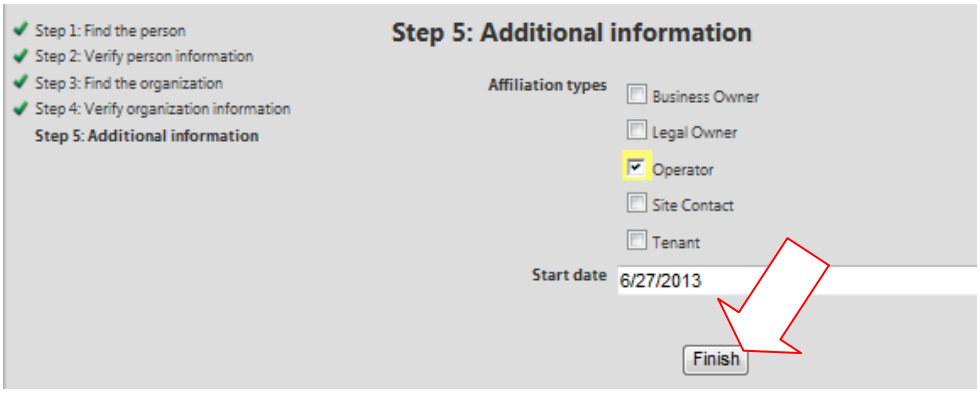
g. **Step 4: Verify organization information** –

- If you're adding a new organization, enter all information.
- If choosing an existing organization, verify all information is correct, editing information as needed.
- Click "**Confirm**".



h. **Step 5: Additional Information** –

- Choose the Affiliation Types applicable to the person. Multiple types can be selected.
- Enter a starting date for this contact (defaults today).
- Click "**Finish**".



i. AREIS returns to the Property Overview tab. Your new contact is listed in the Contacts section.

Contacts Add...

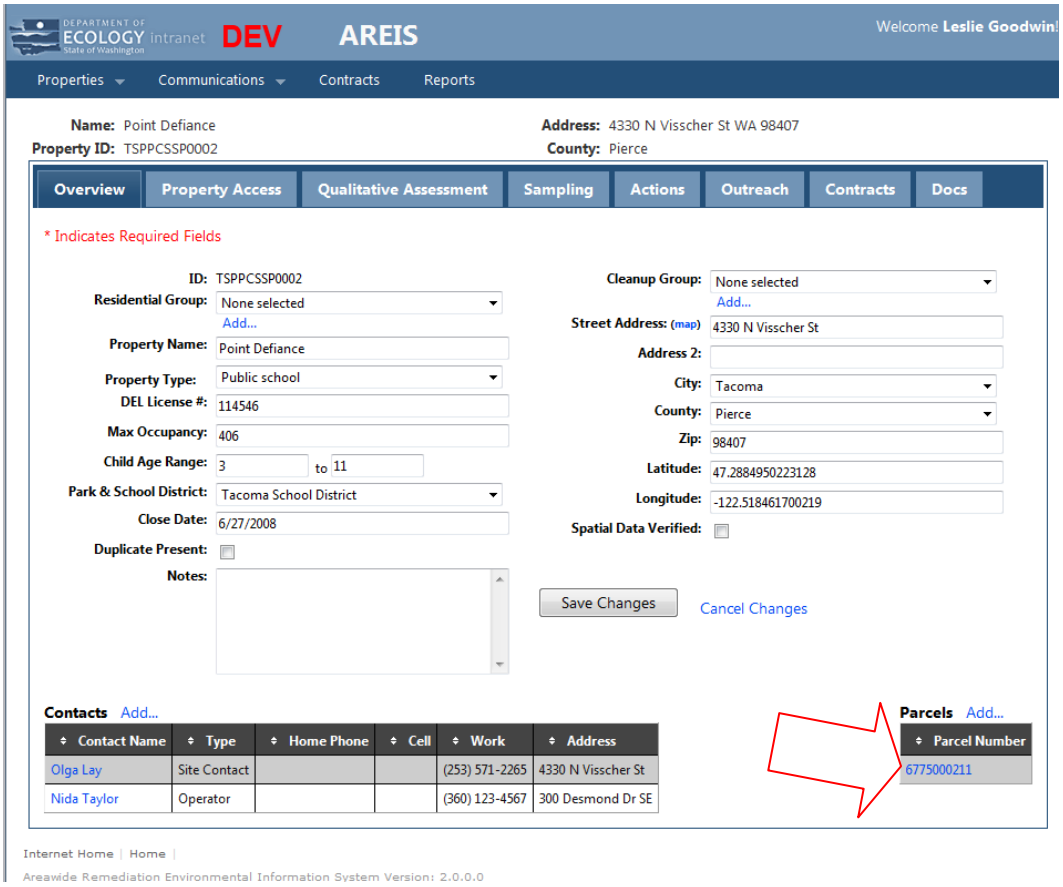
Contact Name	Type	Home Phone	Cell	Work	Address
Olga Lay	Site Contact			(253) 571-2265	4330 N Visscher St
Nida Taylor	Operator			(360) 123-4567	300 Desmond Dr SE

Parcels Section

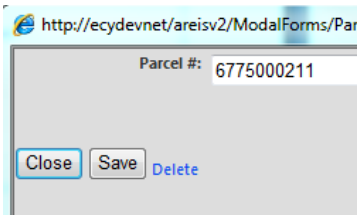
Lists all parcels associated with this property.

1. View/Edit/Delete a Parcel

a. From the property overview screen, click on an existing parcel number.



b. A popup appears:



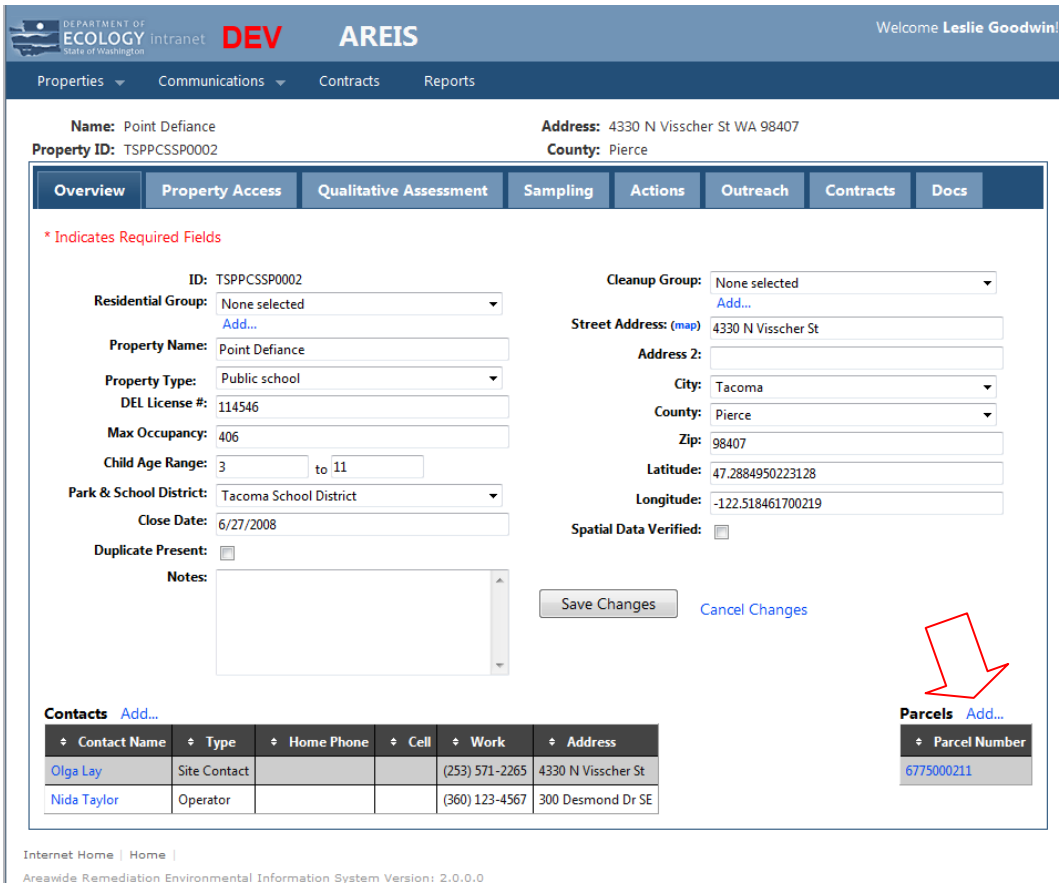
From here, you can:

- Edit the parcel number and click “Save”.
- Delete the parcel.
- Close doesn’t save any changes.

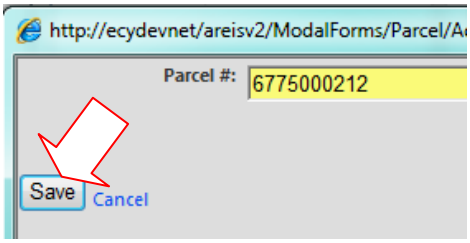
For this example, click “**Close**”. AREIS returns to the property overview screen.

2. Add a Parcel –

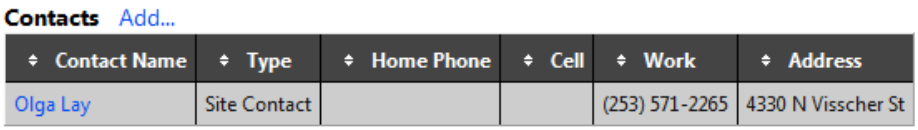
a. From the property overview screen, click Parcels "**Add** …"



b. A popup appears. Enter the new parcel number and click "**Save**".



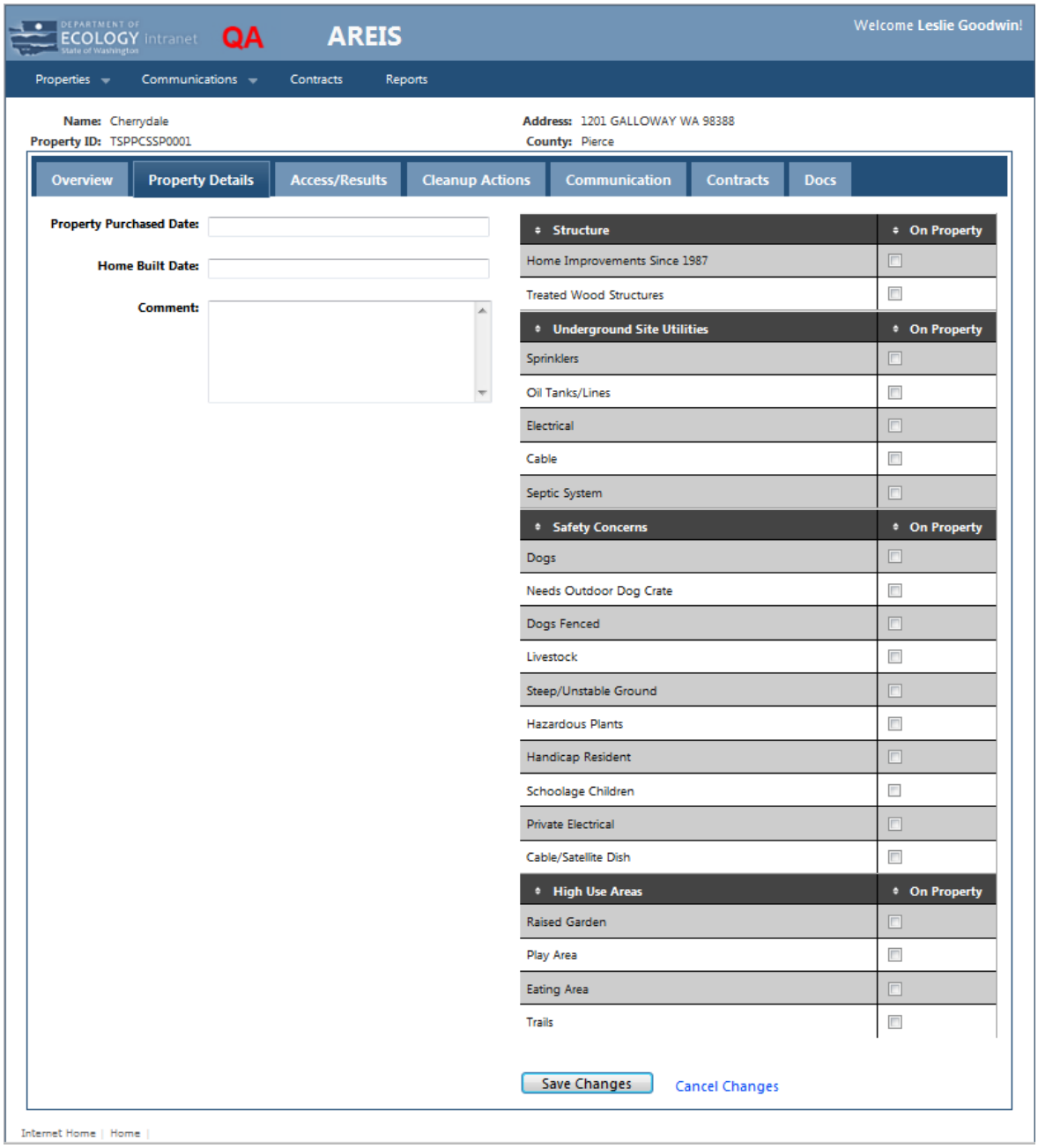
c. AREIS returns to the property overview screen. The new parcel is listed in the parcels section.



B. Property Details Tab

The property details tab stores property purchased and building dates and structural, utility, safety, and usage information.

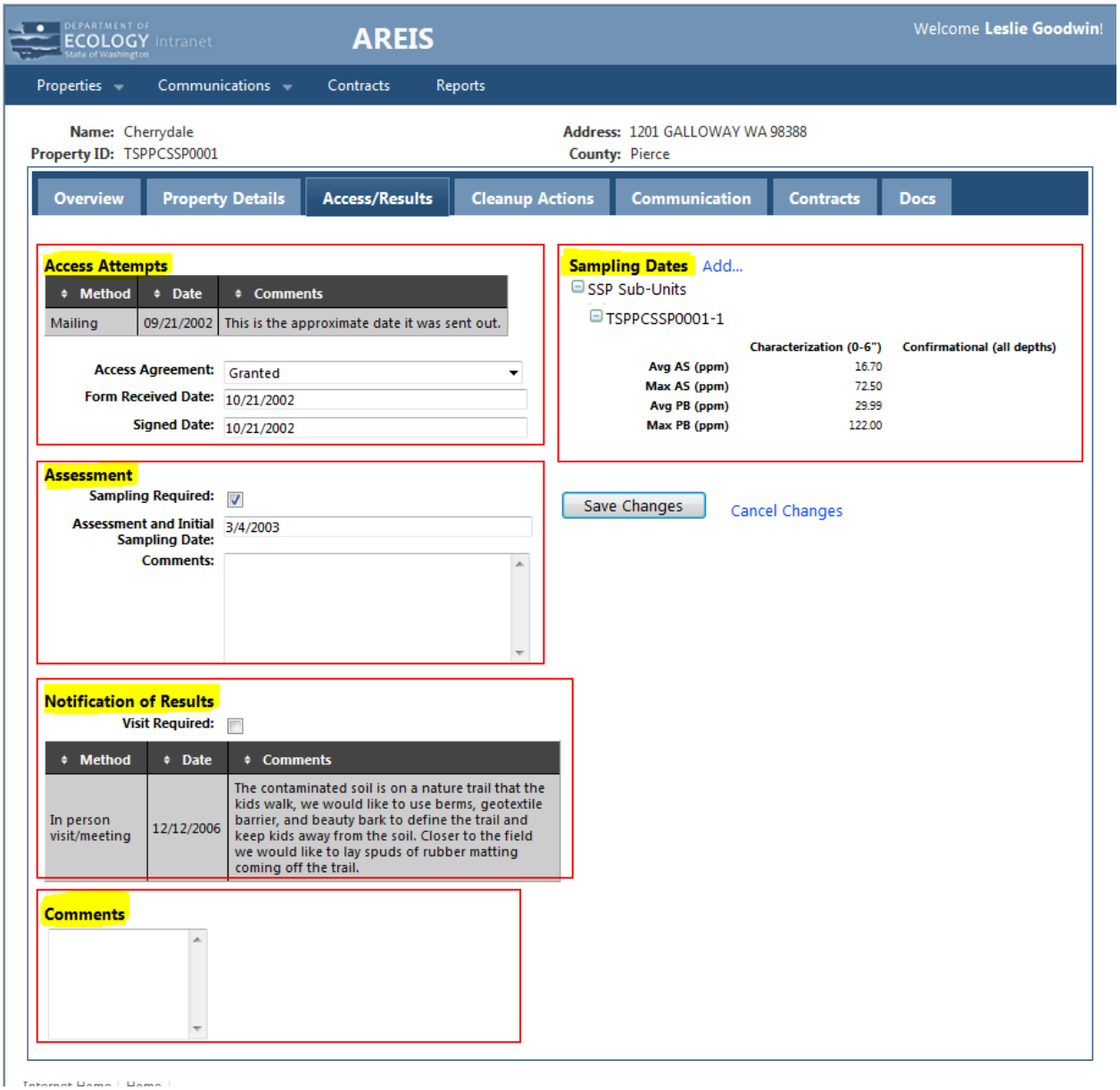
- **Save Change**s - saves all changes
- **Cancel Changes** - will undo any changes that have not been saved



C. Access/Results Tab

The property's Access/Results tab is divided into 5 sections:

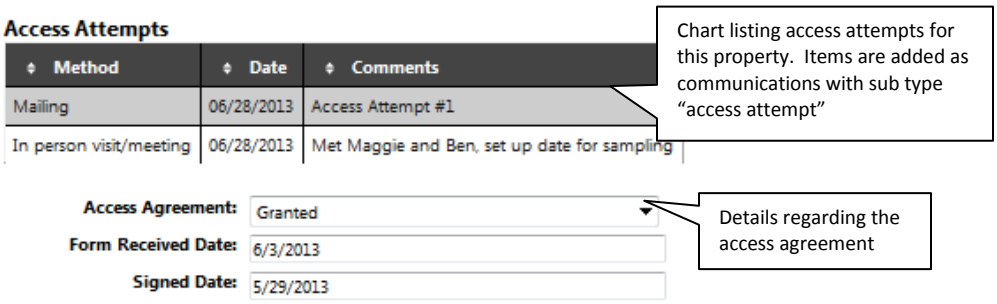
1) Access Attempts
2) Assessment
3) Notification of Results
4) Additional Sampling/Sampling Results
5) Comments



Access Attempts Section

The Access Attempts section contains:

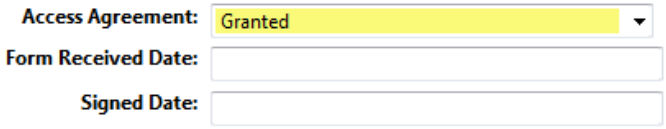
- A chart listing access attempts that have been made for this property
- This property's access agreement status and dates



Access Attempt Chart: To add an access attempt to the chart, create a new communication with the sub type "Access Attempt". (See the Communications section for details.)

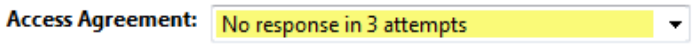
Access Agreement Status: This data is entered directly from this screen. Once you select an access agreement status, additional fields will appear below it. The fields vary depending upon the status. Press "Save Changes" to save or "Cancel Changes" to cancel unsaved changes.

- Granted:



- Denied:

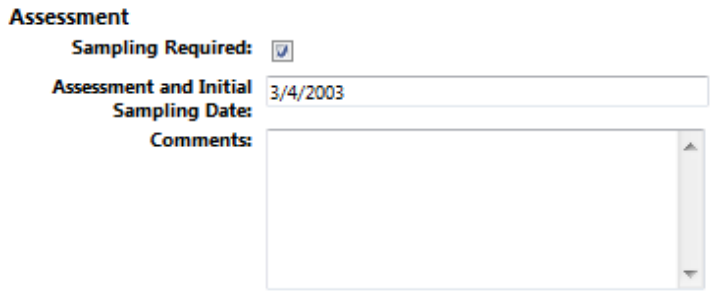
- No response in 3 attempts: (no other fields appear)



Assessment Section

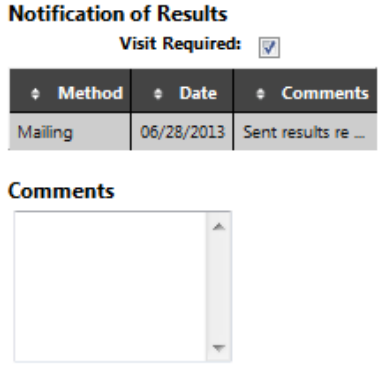
The assessment data is entered directly from this screen. Press “Save Changes” to save or “Cancel Changes” to cancel unsaved changes.

“Sampling Required” indicates that sampling has taken place.



Notification of Results Section

Notifications of results are added through communications.



To add a Notification of Result for this property, create a new communication with the sub type “Notification of Results”. (See the Communication section for details.)

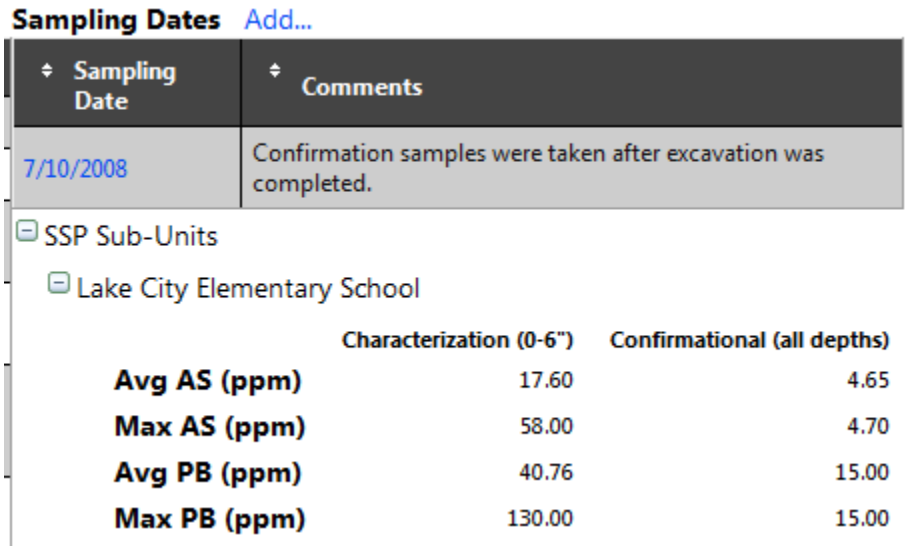
Visit Required checkbox – is directly editable from this page.

- EPA Properties – this box should be checked upon reviewing the old EPA results and finding that the property qualifies for cleanup.
- RES Properties – this box will be checked automatically if results are above criteria for the yard program.

Click “Save Changes” to save or “Cancel Changes” to cancel unsaved changes.

Additional Sampling and Sampling Results Section

This section lists additional sampling dates and displays sampling results that have been entered through EIM.



To Add Sampling Dates:

1) Click "**Add …**" next to Sampling Dates

2) The additional sampling popup appears. Enter a date and comments, then click "**Save**".

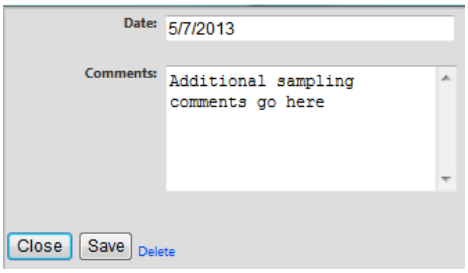
Comments Section

Enter any access/results/sampling comments here.

To Edit or Delete an Additional Sampling

1) Click an existing Sampling Date

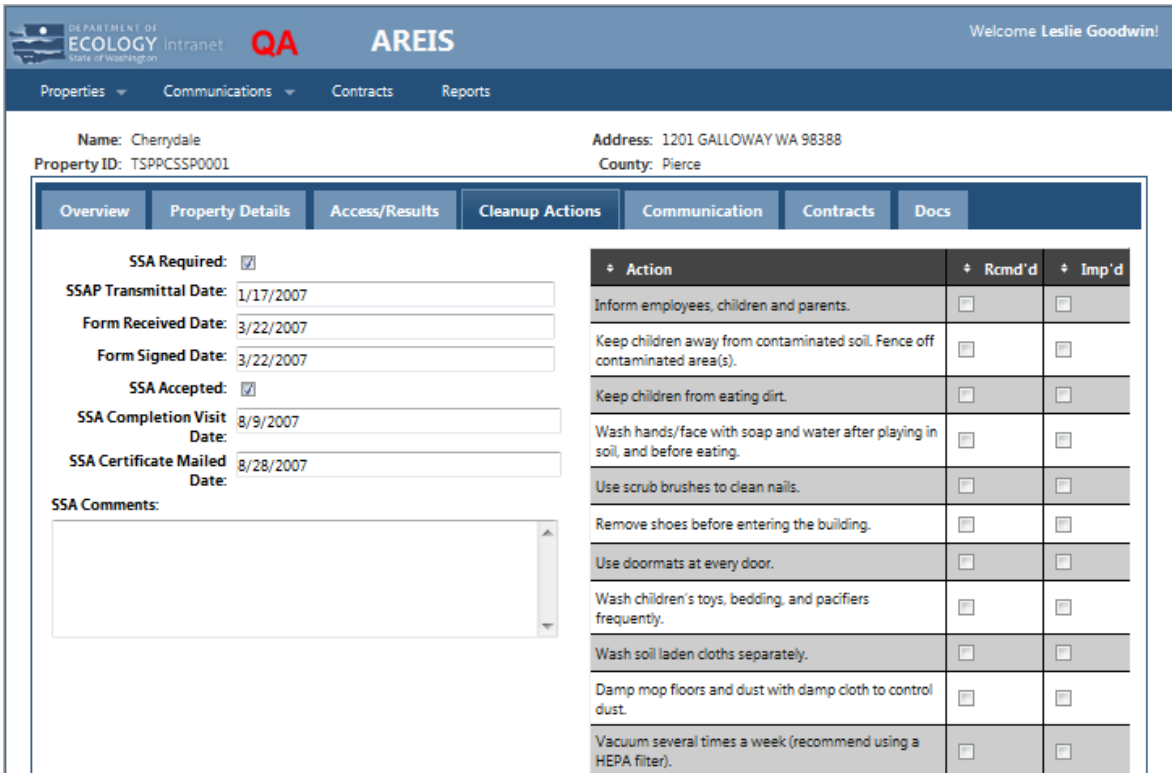
2) The Sampling Date popup appears. You can edit and "Save" changes, "Delete" the sampling date, or "Close" without saving changes.



D. Cleanup Actions Tab

The Cleanup Actions tab contains details concerning the cleanup agreement and any cleanup actions taken for this property. This information varies depending upon the program.

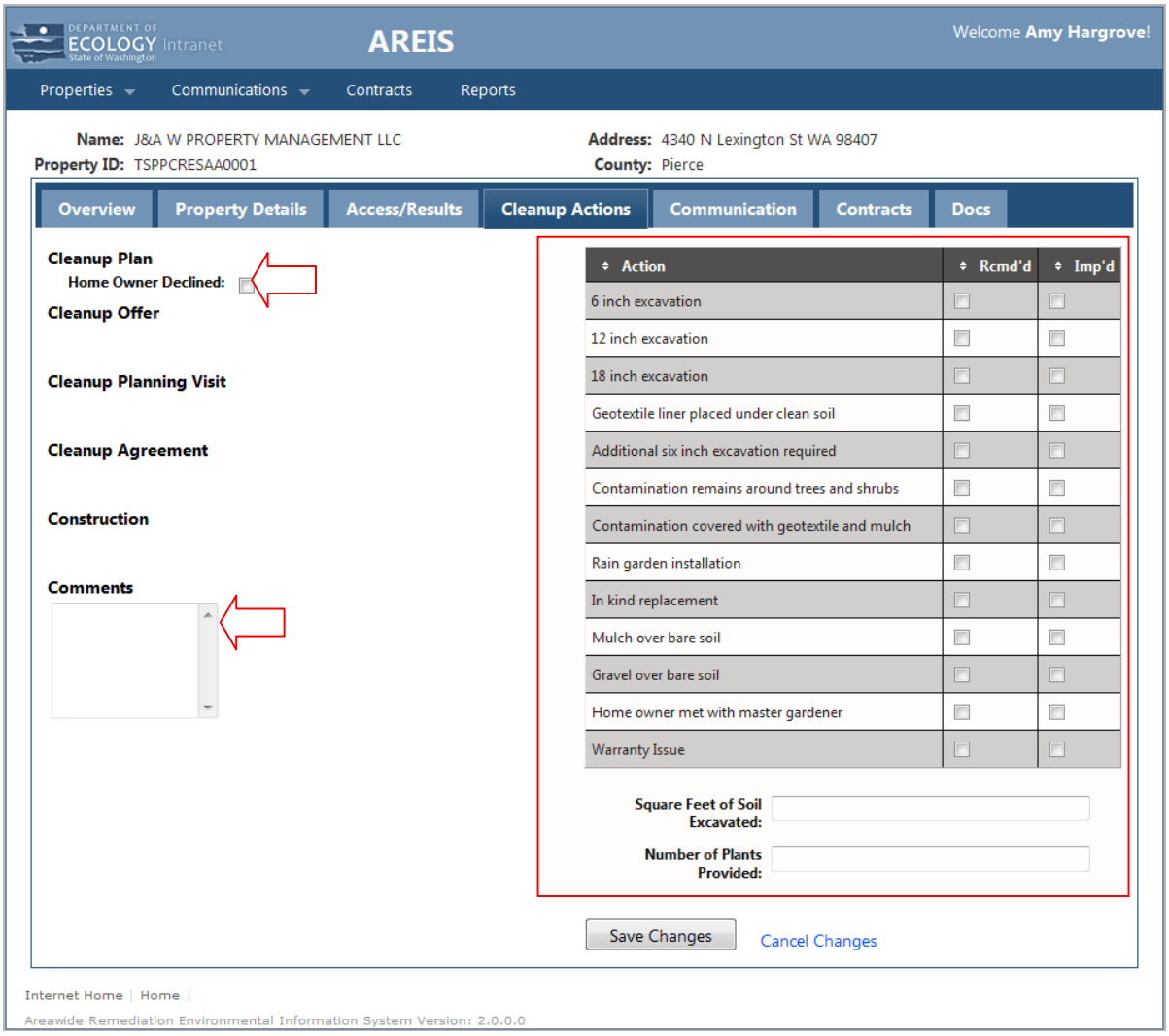
SSP properties: all fields are directly editable from this screen:



Field Definitions for Soil Safety Program Cleanup Actions Screen

- **SSA Required** – means that a soil safety action is required on this property
- **SSAP Transmittal Date** – this is the date that the Soil Safety Action Plan was sent to the property
- **Form Received Date** – the date when the SSAP was received by Ecology after the property owner signed
- **Form Signed Date** – the date the property owner signed the SSAP
- **SSA Accepted** – this box is checked if the property owner agreed to the soil safety actions
- **SSA Completion Visit Date** – the date when the action plan work was completed
- **SSA Certificate Mailed Date** – this is the date the Soil Safety Program completion certificate was mailed.
- **Action List** – this list has the actions that were recommended to the property checked and if the work was completed there is also a list of the actions that were implemented.

RES and EPA properties: the fields in the left column are created as communications with subtypes Cleanup Offer, Cleanup Planning Visit, Cleanup Agreement, and Construction. (See the Communications section for details.) The fields indicated by the red arrows and red box are directly editable from this screen. If changes have been made to the editable sections, click on, "Save Changes" to save, or "Cancel Changes" to cancel pending changes.



Field Definitions for RES and EPA Cleanup Actions Screen

- **Homeowner Declined Checkbox** – If a homeowner declines cleanup at anytime check this box
- **Cleanup Offer** – This subtype would be chosen during a communication when trying to offer a property a cleanup planning meeting.
- **Cleanup Planning Visit** – This subtype would be chosen during a communication when trying visiting a property to plan for cleanup.
- **Cleanup Agreement** – This subtype would be chosen during a communication when an agreement has been sent, received, or signed.
- **Construction** - This subtype would be chosen when performing a construction walkthrough before or after construction and when the cleanup completed package is sent.

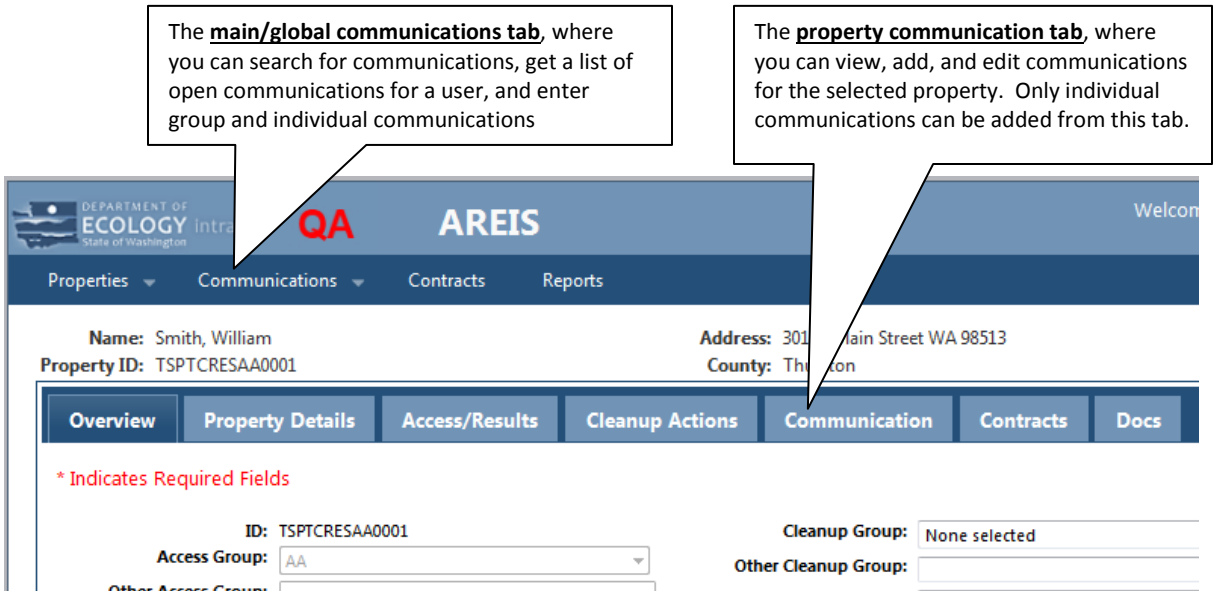
- **Action List** – Check the boxes that were recommended to the homeowner and after construction those that were actually implemented. Record the square footage of soil excavated and the number of plants provided.

E. Communications Tab

AREIS manages individual and group communications:

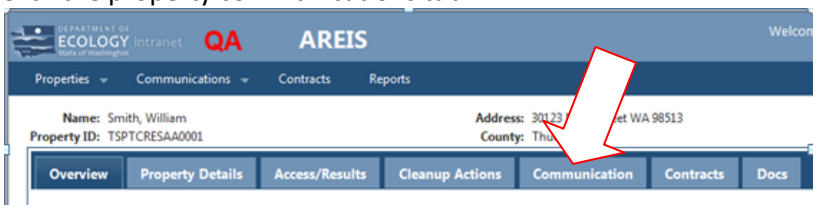
- **Individual communications** – involve only one property. The communication may involve several contacts for that property, i.e., the tenant and the property owner, but only one property is involved.
- **Group communications** – involve more than one property. Multiple contacts for multiple properties can be involved.

There are two communications tabs in AREIS:

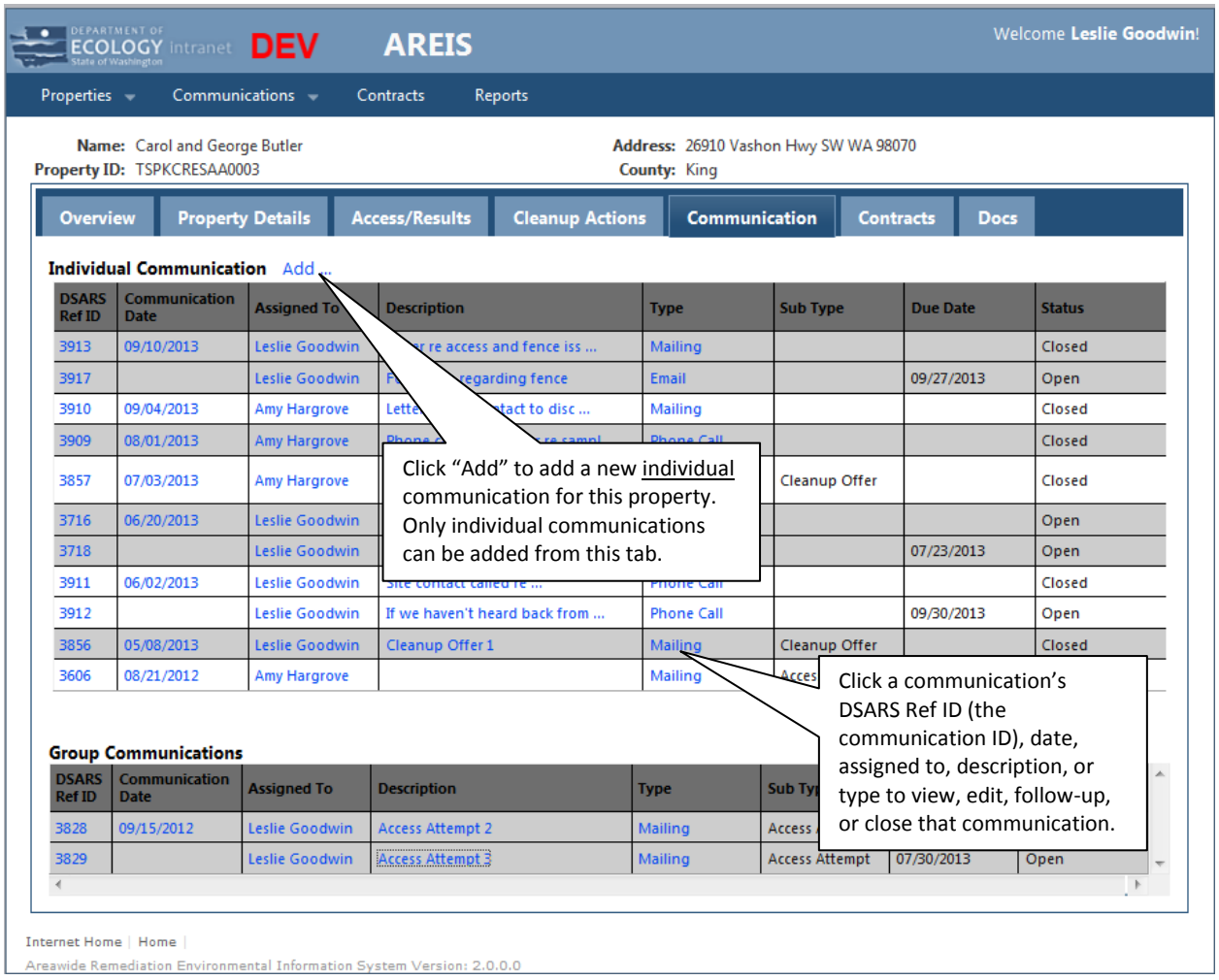


View Communications for an Individual Property

1) Search for that property
2) Click the property ID to open its overview tab
3) Click the property communications tab:



The property communications tab displays all communications for this individual property:



Threads: The communications are grouped by thread, and the threads are banded in alternating colors. In the example below, you can see three color bands representing three different threads. In the first thread, the originating/parent communication, a 9/10 mailing, is closed. Its follow-up, due 9/27, is still open. The second thread is dated 9/4 and the third is dated 8/1 – neither has a follow-up.

Individual Communication Add ...

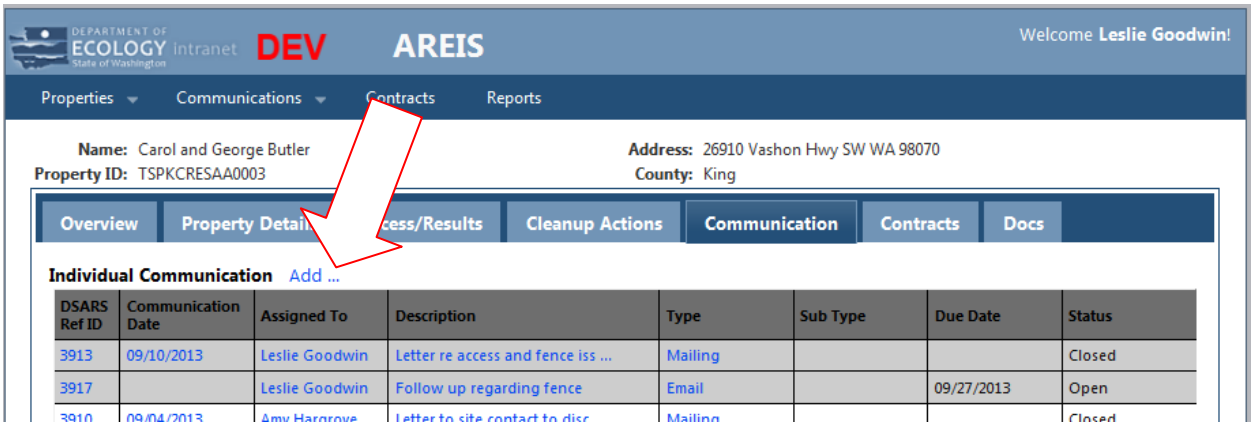
DSARS Ref ID	Communication Date	Assigned To	Description	Type	Sub Type	Due Date	Status
3913	09/10/2013	Leslie Goodwin	Letter re access and fence iss ...	Mailing			Closed
3917		Leslie Goodwin	Follow up regarding fence	Email		09/27/2013	Open
3910	09/04/2013	Amy Hargrove	Letter to site contact to disc ...	Mailing			Closed
3909	08/01/2013	Amy Hargrove	Phone call from owner re sampl ...	Phone Call			Closed

Add an Individual Communication

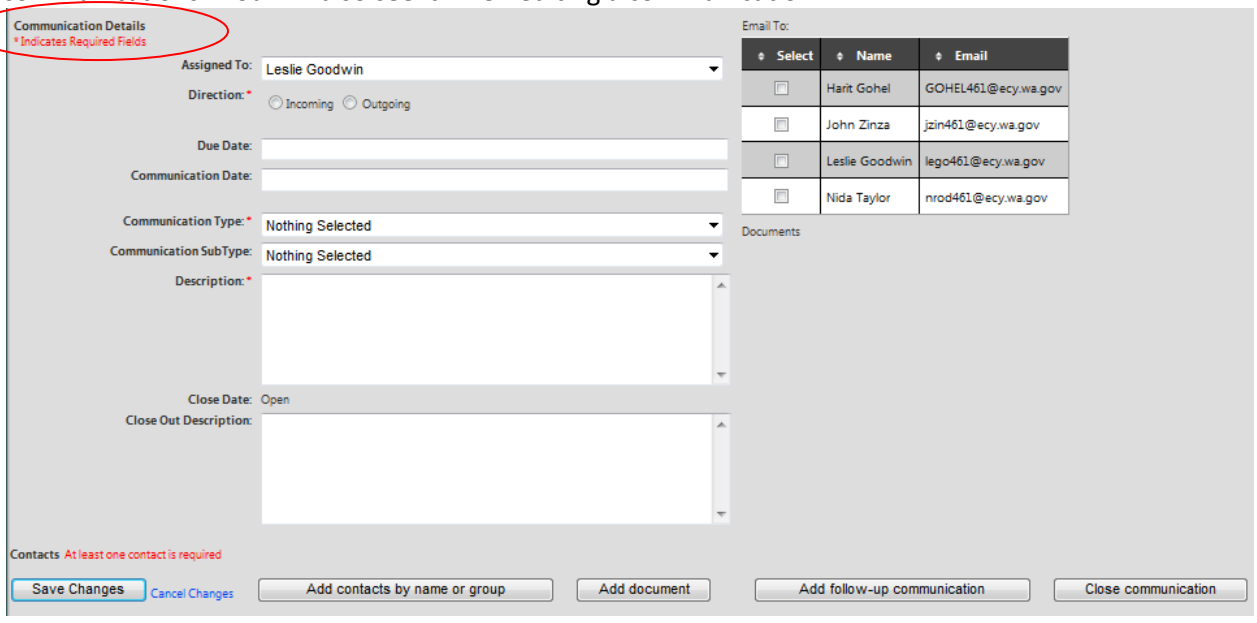
It is easiest to add an individual communication from the property communication tab, because the contacts for that property will be listed by default, so you don't have to search for them.
Note: Be sure to check the contacts list on the property overview screen to confirm that your contact is listed. If not, you will need add your contact(s) there before adding the communication.

To add an individual communication from the property communication page:

1) Click "Add" individual communication



The Communication Details popup appears. This popup is the same for individual and group communications. You will also see it when editing a communication.



Assigned To: This should be the person the task is assigned to or the person who received the communication. This field defaults to the current user of AREISRequired.

Direction: Select either incoming or outgoing. Incoming means that someone contacted you while outgoing is a communication initiated by you. Required.

Due Date: If you are assigning someone a task enter the date by which it should be performed. Either a due date or a communication date is required.

Communication Date: The date the communication took place, i.e., the date the phone call or visit took place, the letter was mailed. Either a due date or a communication date is required.

Communication Type: The action that took place. Required. The Communication types are listed below with a brief description of when to use them.

- Mailing – a letter or packet was mailed to property owner or a letter was recieved
- Phone Call
- Email
- Knock and Talk –when trying to gain access for sampling or cleanup
- In Person Visit/Meeting –when meeting in person or onsite
- Hotline –if someone has called in through the hotline phone number
- Yard Visit –when conducting a visit for cleanup planning
- Homeowner Declined – when a homeowner has communicated that they have declined cleanup
- Cleanup Draft Sent – when the draft cleanup plan is sent to the property owner
- Cleanup Owner Signed – when the owner has signed the agreement and plan
- Cleanup Final Sent – when a final cleanup plan is sent
- Cleanup Agreement Revised – when an agreement needs to be revised
- Cleanup Owner Signed Revised – a revised agreement is signed
- Cleanup Revised Sent -
- Cleanup Completed Package Sent -
- Cleanup Action Plan Signed -
- Construction Walkthrough -
- Public Meeting – when property owners
- Training – when property owners attend training events
- Outreach Visit – when a property requires further outreach
- Master Gardner Visit – when a master gardner has been referred to a property
- DSHS licensure
- Ecology Staff
- SSP presentation

Communication Sub Type: If this communication should be categorized as an access attempt, notification of results, or cleanup action, it needs to be set here. Primary sub-types are:

- Access Attempt – displays in the Access Attempts section of the Access/Results tab.
- Notification of Results – displays in the Notification of Results section of the Access/Results tab.
- Cleanup Offer, Cleanup Planning Visit, Cleanup Agreement, and Construction – displays on theCleanup Actions tab for RES, and EPA properties.
-

Description: Description of the communication or assignment. Required.

Close Date: Set when this communication is closed. If "open", then this communication is open and can be edited.

Close Out Description: Closing comments, inserted when this communication is closed.

Email To: If you'd like to email this communication/assignment to one of these persons when you save it, click their name here.

Contacts: The property contacts involved in this communication. To select contacts, click "Add contacts by name or group". Required.

Logs and Assignments:

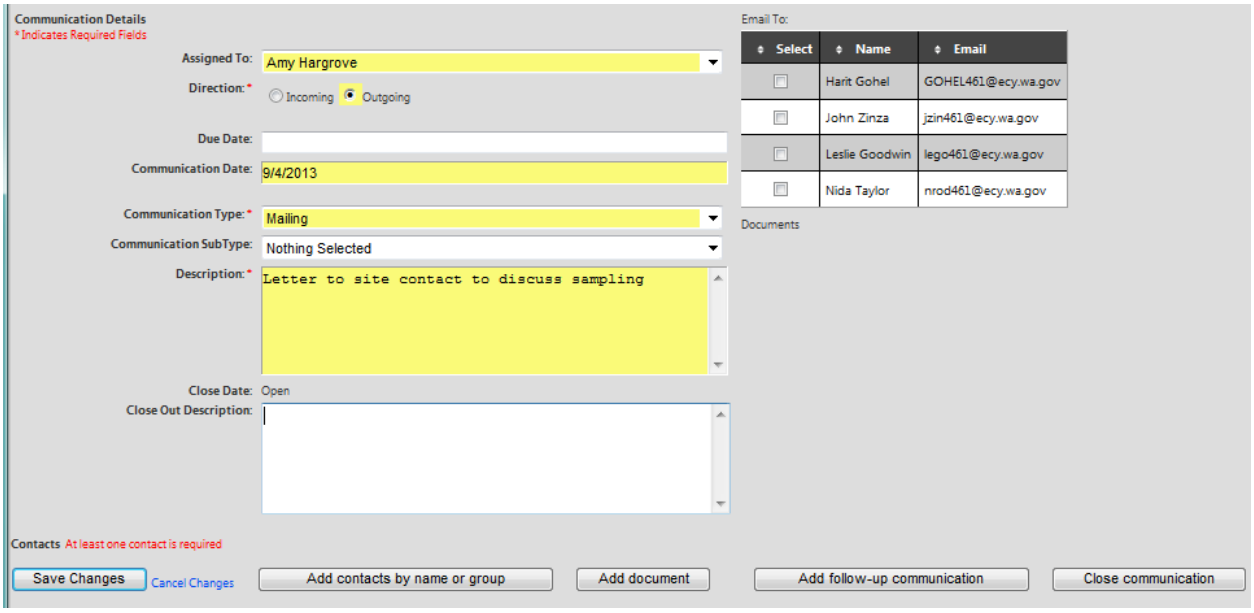
New communications are usually "logs" or "assignments":

Logs: Record an incoming or outgoing communication, i.e., you received a phone call or sent a letter. For logs, you'll enter the communication date (the date the phone call/letter/site visit took place) and leave the due date blank. You'll usually set the status to "closed".

Assignments: These are tasks or follow-ups. For an assignment, you'll enter a due date and leave the communication date blank, and you'll leave the communication in "open" status. When you complete the assignment, you'll insert the communication date (the date the assigned communication was made) and close the assignment.

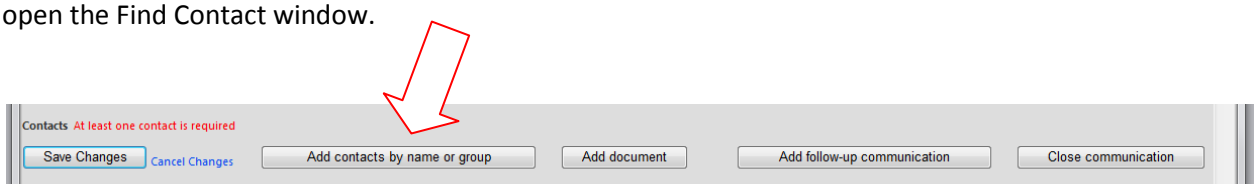
2) Fill in the communication details.

The fields turn yellow to indicate pending changes.

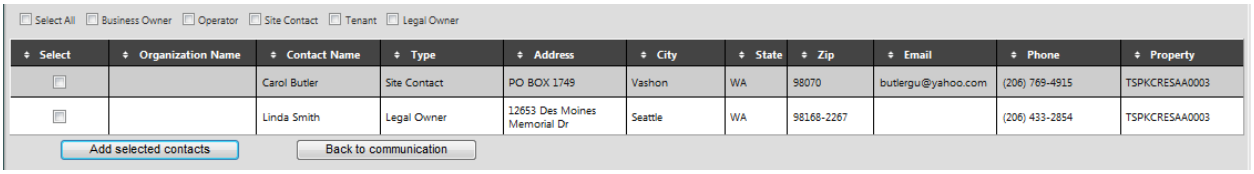


3) Select your contacts.

At least one contact is required for every communication. Click "Add contacts by name or group" to open the Find Contact window.



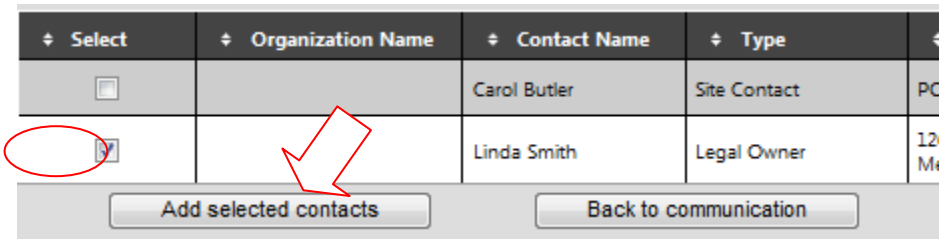
A popup appears. The persons currently associated with this property are listed.



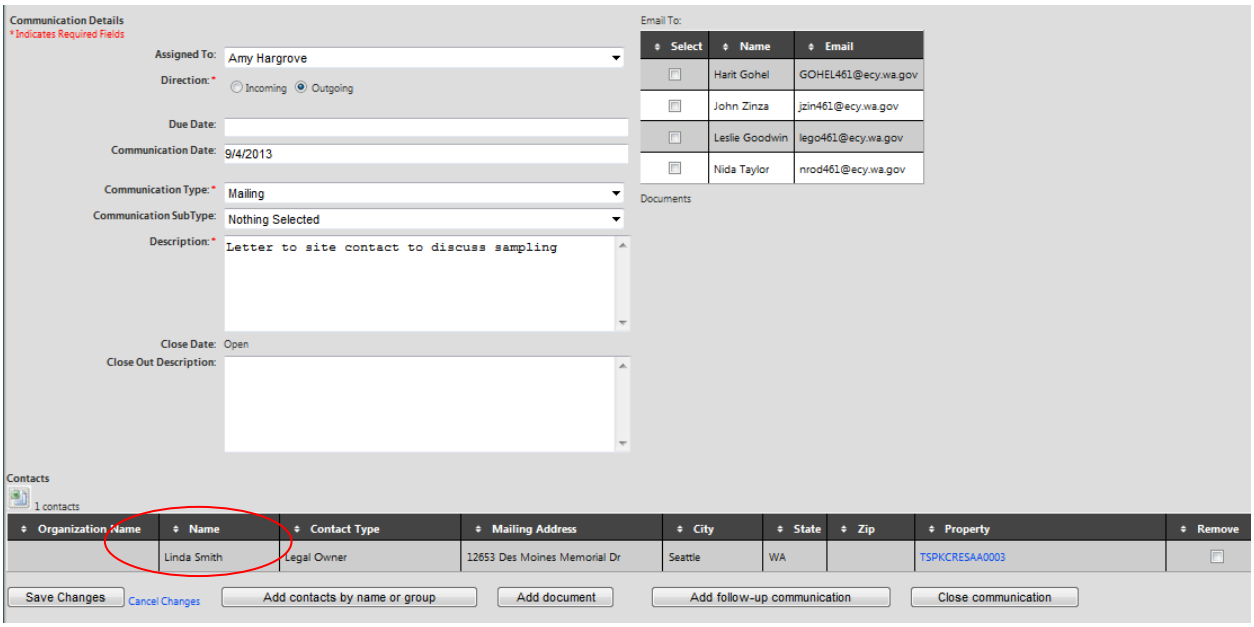
- Check the select box(es) of the contact(s) that are associated with this communication. In this case, the phone call came from the site contact, William Smith, so check William Smith.

- Alternatively, you can click one of the selection boxes at the top to select all contacts of this type, i.e., select all site contacts, or select all.

- Click “Add Selected Contacts”.



4) AREIS returns to the Communication Details popup. Your contacts are listed at the bottom.

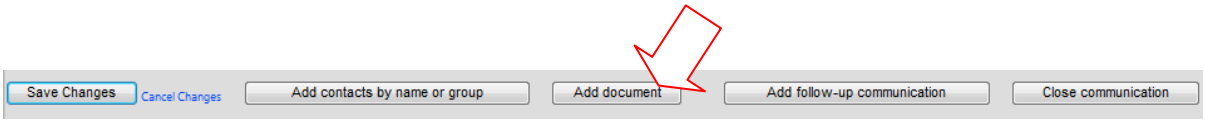


To add additional contacts, click “Add contacts by name or group” again.

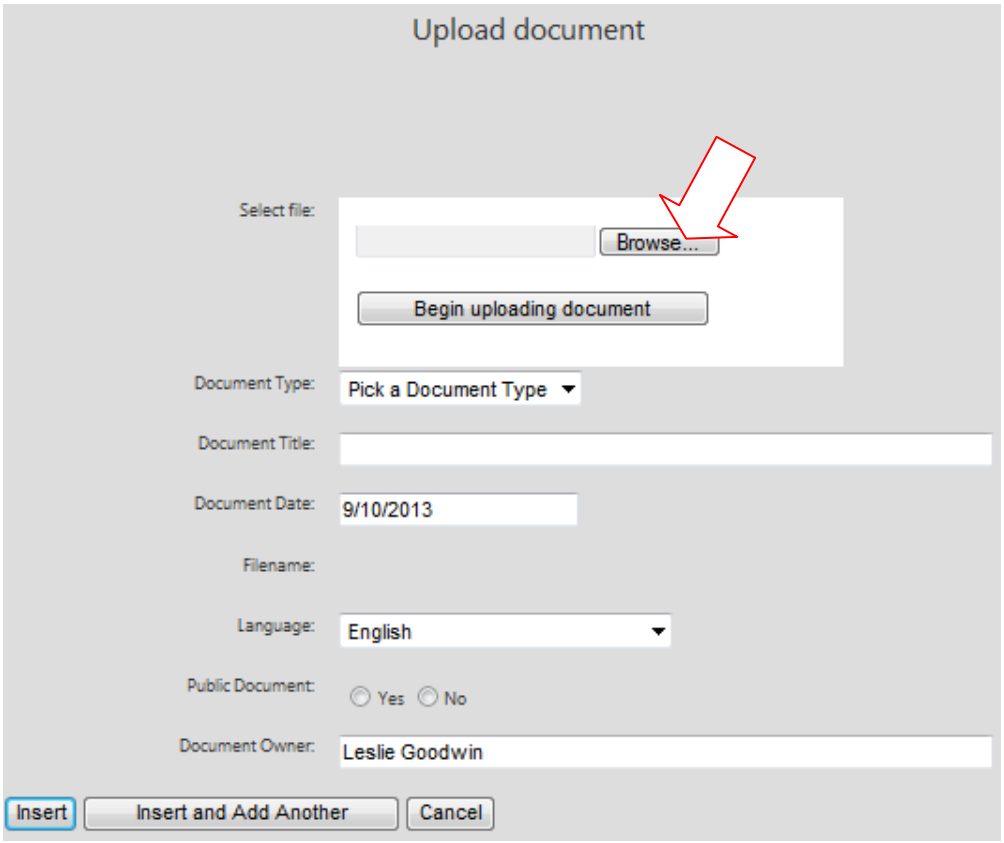
To remove a contact from this communication, click the “Remove” checkbox for that contact.

5) Add/attach any documents that apply to this communication, as needed.

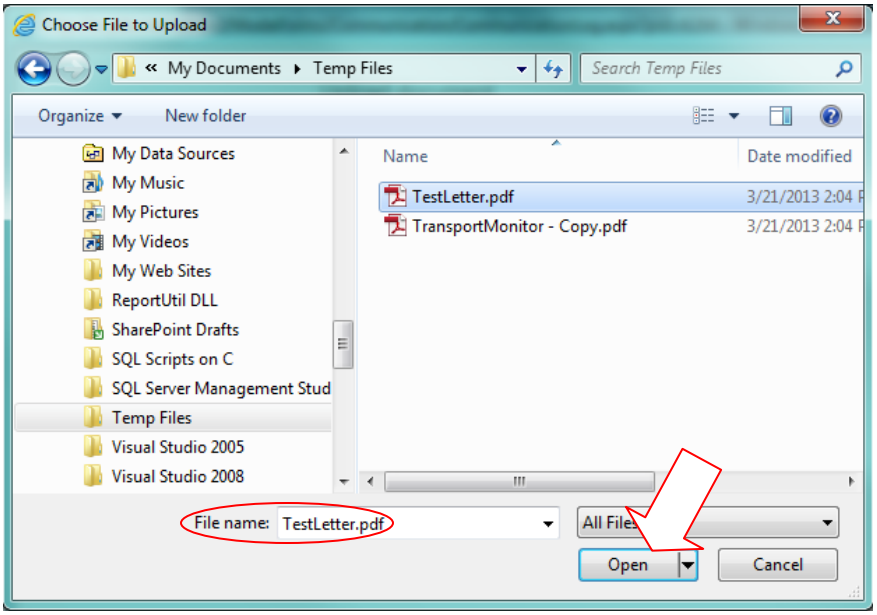
To attach copies of documents, click the “Add Document” button:



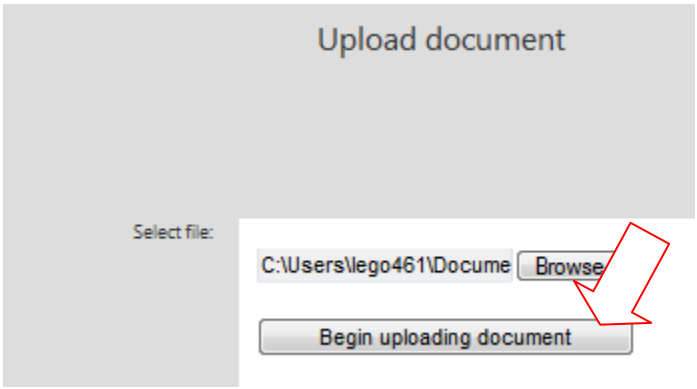
The Upload Document screen appears. First, select the document to be uploaded by clicking "Browse".



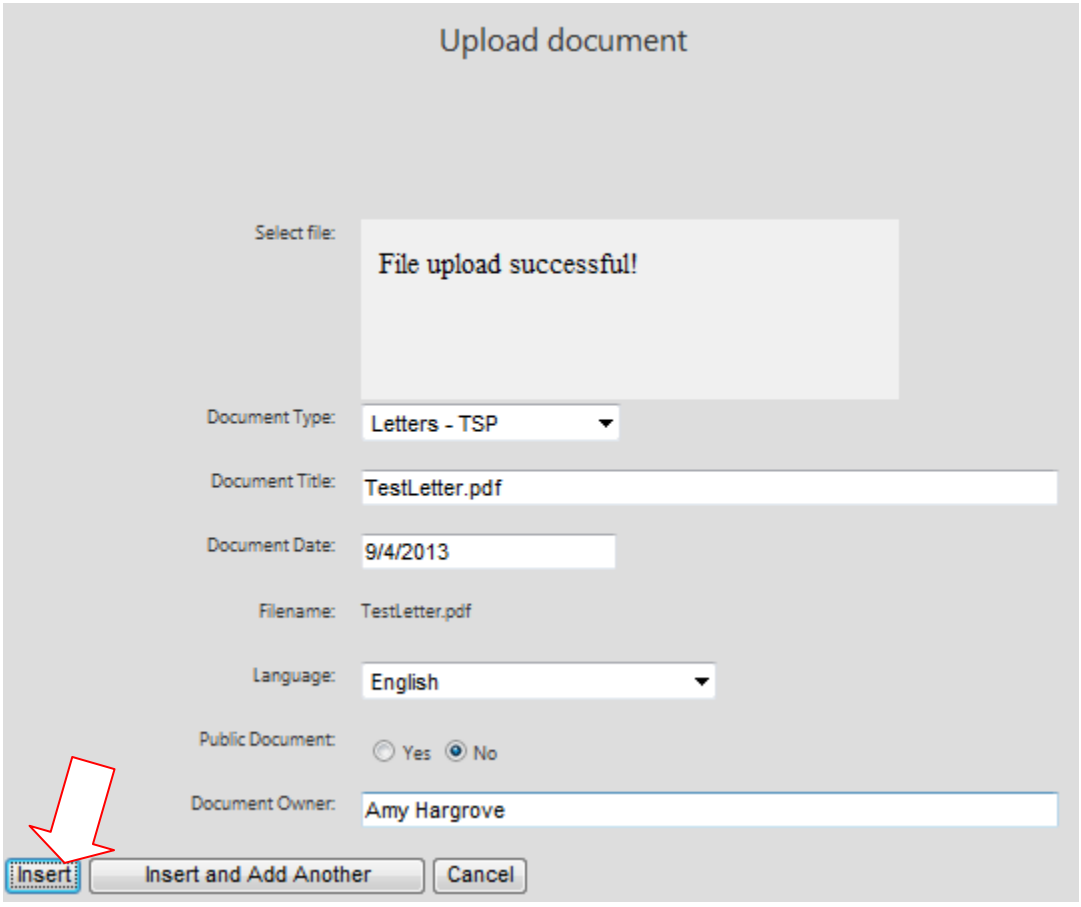
A window opens for you to navigate to thefile to be uploaded. Select the file and click "Open".



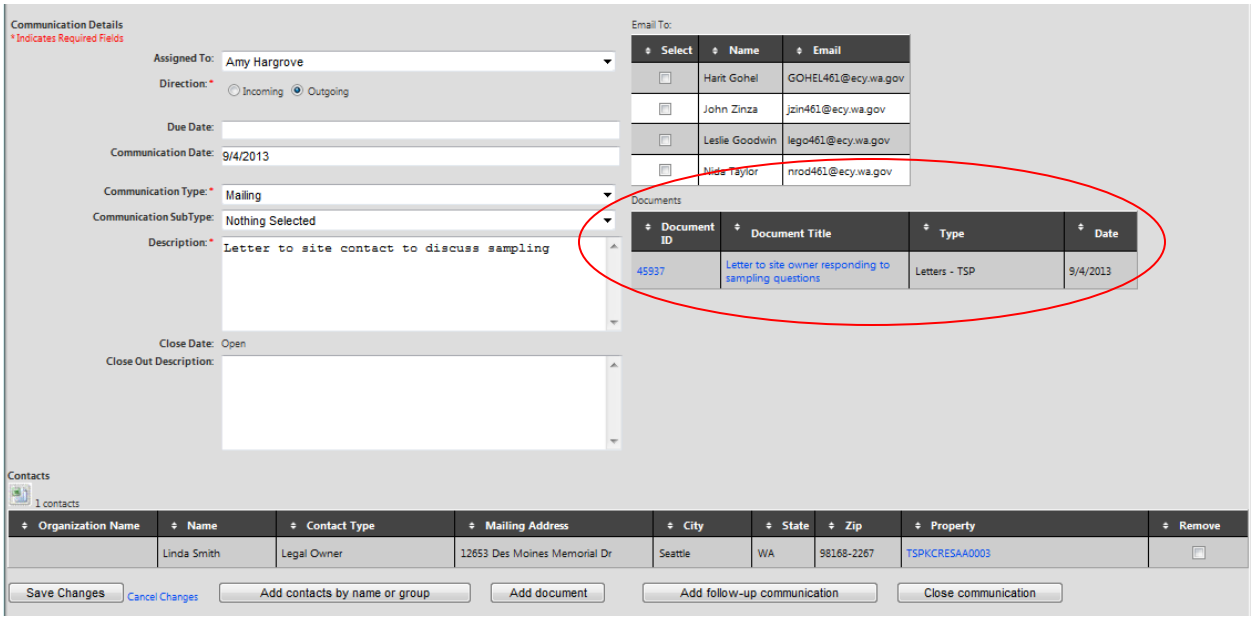
Click the “Begin uploading document” button.



The screen refreshes and displays “File upload successful!”. Now fill in the rest of the fields, then click “Insert” or “Insert and Add Another”. (NOTE: Your document is not successfully uploaded and attached to the communication until you click “Insert” or “Insert and Add Another”.)



AREIS returns you to your communication. Your documents are listed.



6) <u>Select your save/follow-up/close option.</u>

You can:

Save Changes: Saves all pending changes and closes this popup. This closes the window. It doesn't set the communication status to "closed".

Cancel Changes: Cancel all changes to this communication. If you haven't saved, nothing will be saved.

Add Contacts by Name or Group: opens the Find Contact popup, where you can find and select the contacts for this communication, i.e., the site contact, owner, operator, etc.

Add Follow-Up Communication: Click to add a follow-up.

Close Communication: Set this communication status to "closed". This does NOT mean to close this popup window.

Hints on Closing Communications:

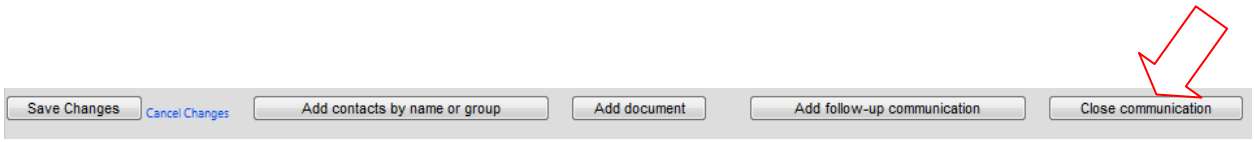
<u>When should you leave a communication open?</u>

- If you'll want to edit it in the future. (Closed communications can't be edited.)
- If you're going to create a follow-up. (You can't create a follow-up on a closed communication. After you create the follow-up, you can go back and close the parent communication.)
- So it will be listed on your "Open Communications" screen.
- Assignments and follow-ups should be "open" until you complete and "close" them.

<u>When should you close a communication?</u>

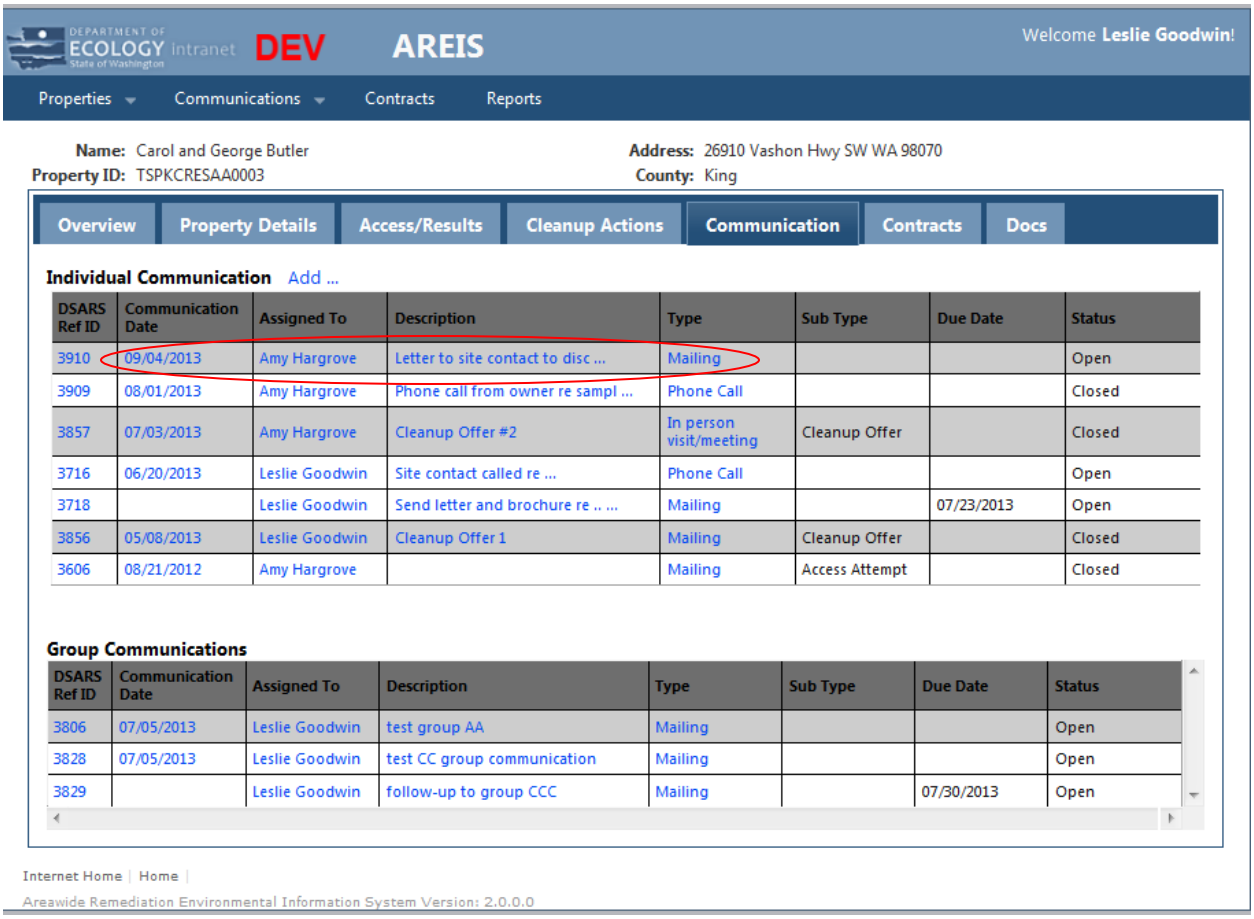
- If it is complete, and you won't need to edit or change it.
- So it doesn't clutter your "Open Communications" screen.

Since you are finished with this communication and don't expect to edit it or create a follow-up, and you don't want it to appear on the "Open Communications" screen, click "Close Communication".



7) AREIS returns to the Property Communications tab.

The popup closes and AREIS returns to the Property Communications tab. Your new communication is listed in the Individual Communications section. .

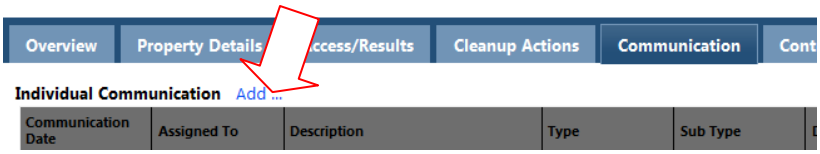


NOTE: The "DSARS Ref ID" is the communication ID you can use in mail merge reports.

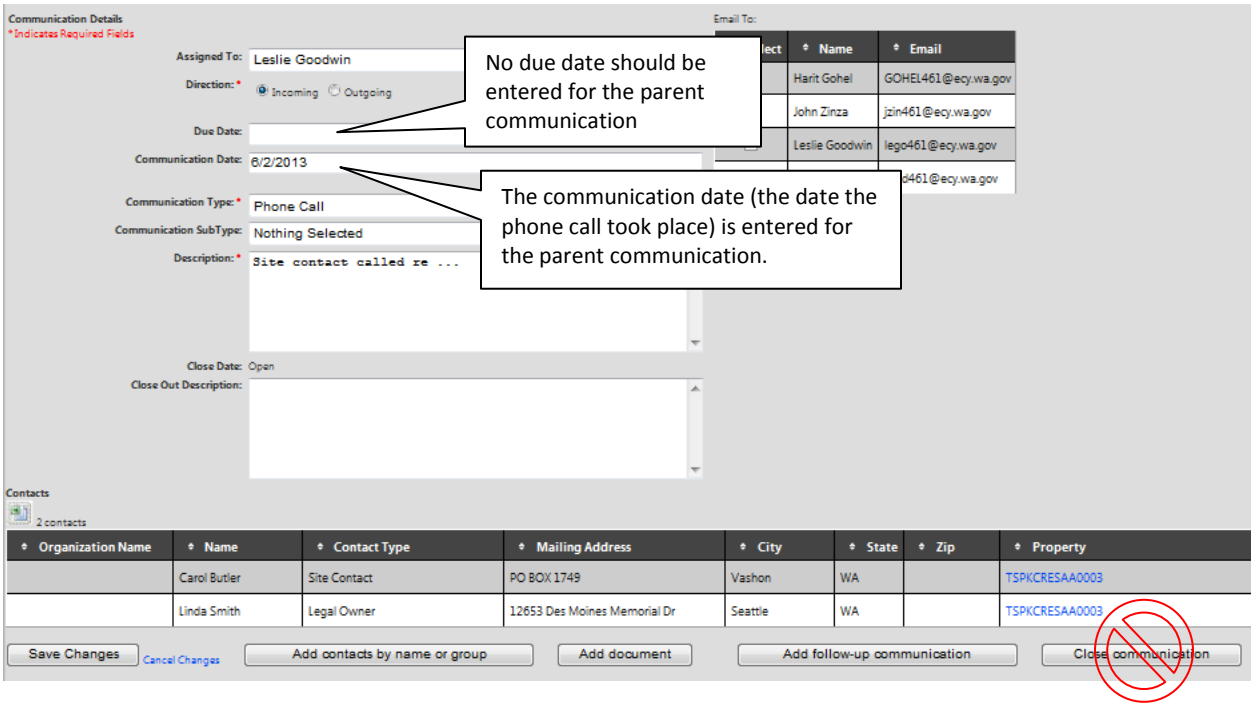
Add a Communication with a Follow-Up

Suppose you receive a phone call from a site contact, and you want to log that call and assign yourself a task to send a follow-up letter a week later. You could create two communications; one to log the phone call, one to assign yourself the task. Or, you could add a communication with a follow-up.

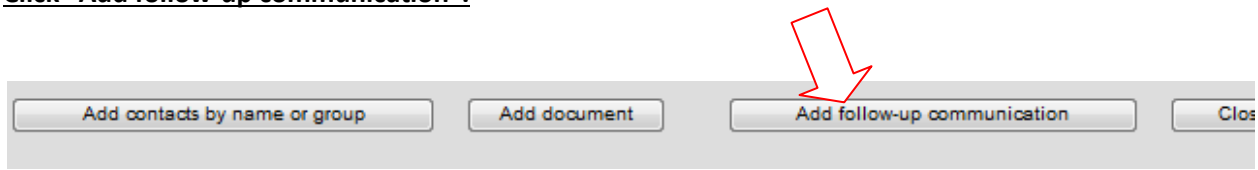
1) **First, create the parent/originating communication** – the phone call. From the property communication tab or global/main communications menu, click to add a communication.



2) **The Communication Details popup appears. Fill in the communication details and select your contact(s) for the parent communication** – the phone call. Include the communication date (the date we received the call) but not the due date – that will be part of the follow-up. DO NOT close the parent communication yet! You can't add a follow-up once it's closed. After you add the follow-up, you'll come back and close it.

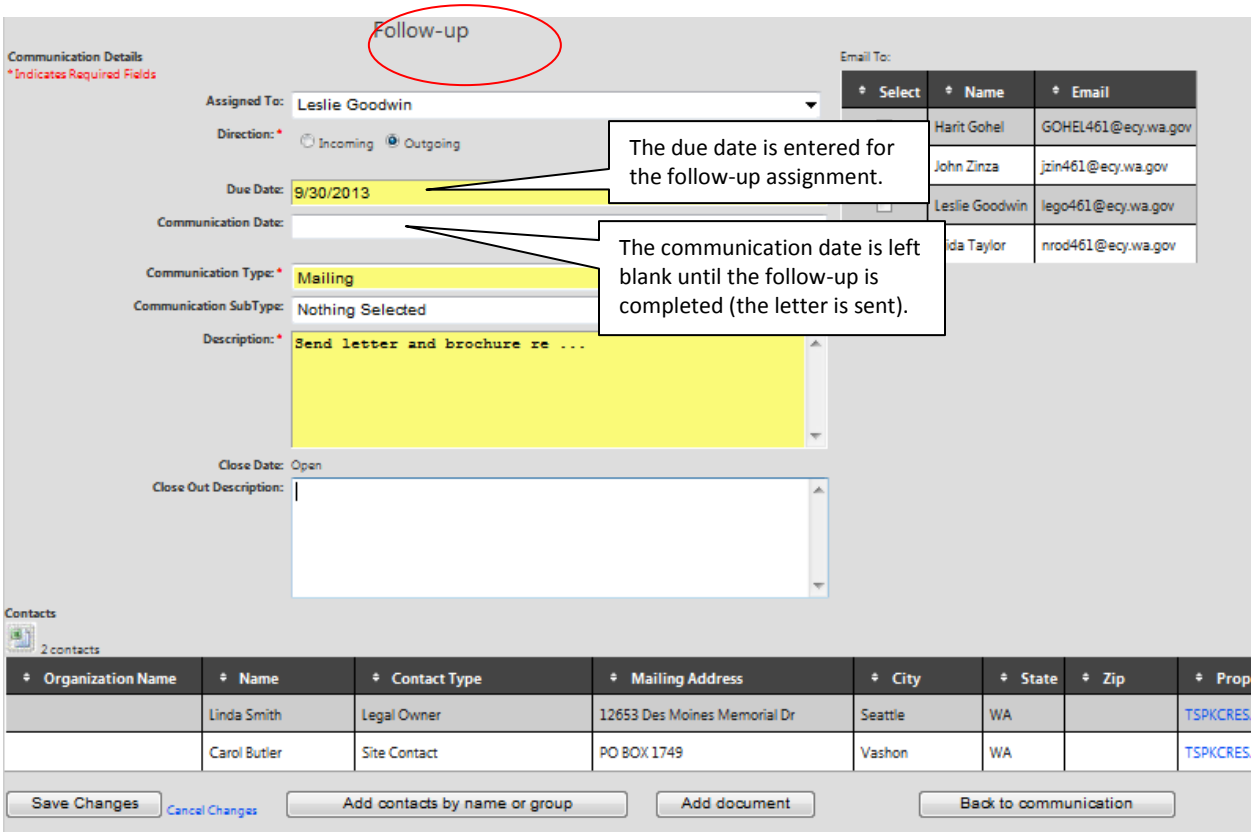


3) **Click "Add follow-up communication".**

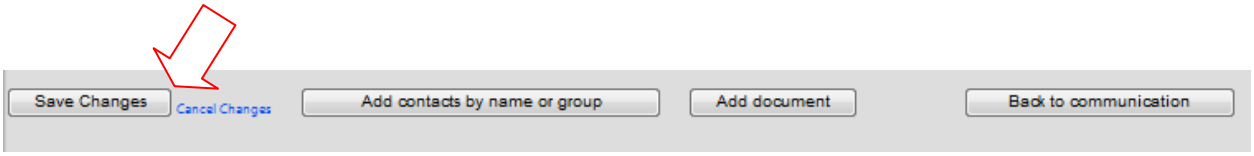


4) **<u>The follow-up popup appears. Fill in the communication details for the follow-up assignment.</u>**
Include a due date but no communication date – the communication date will be entered after you send your follow-up letter, when you come back to log the letter and "close" the follow-up.

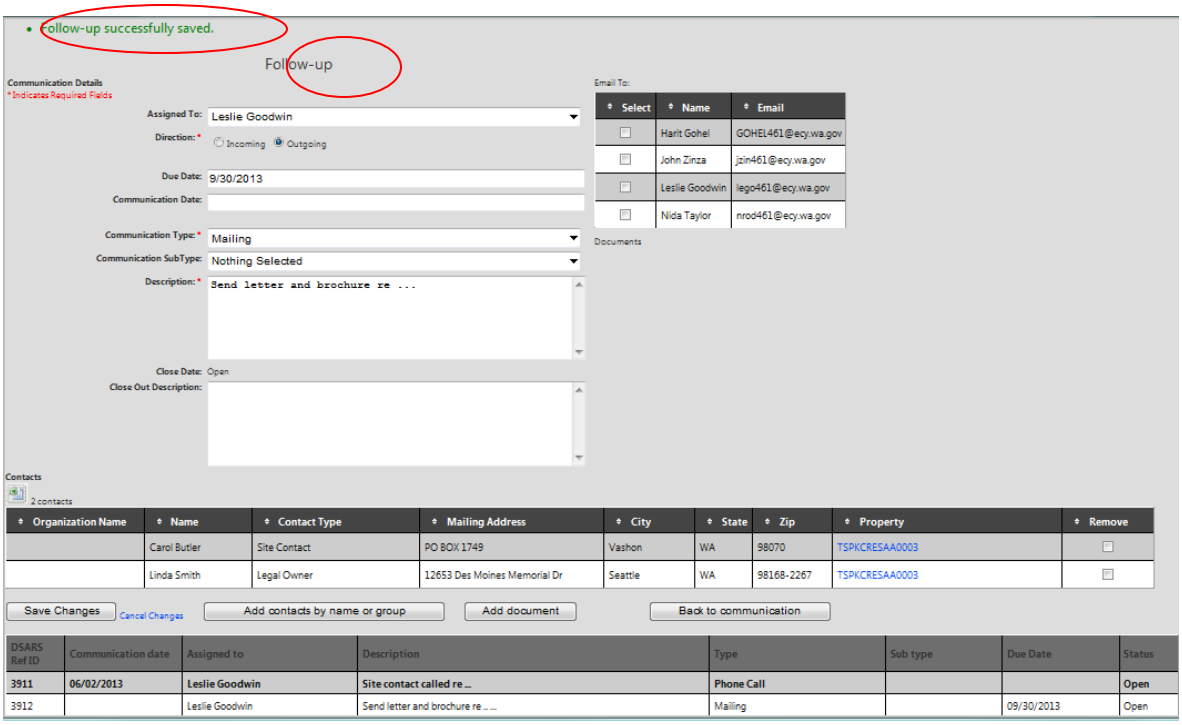
Note: the contact selected for the parent communication is defaulted here. You could remove this contact and/or select additional contacts – the follow-up doesn't have to use the same contacts as the parent communication.



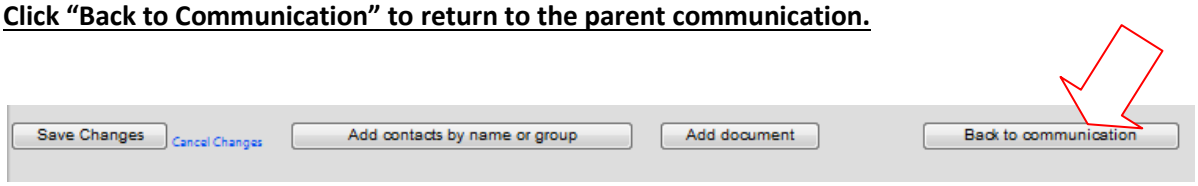
5) **<u>Click "Save Changes" to save your changes to the follow-up.</u>**



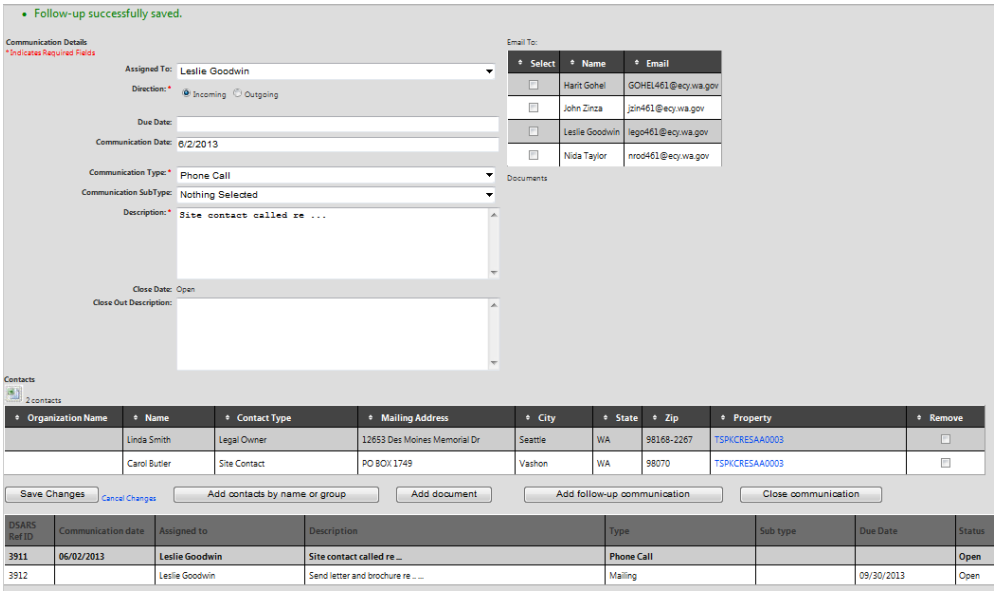
AREIS displays a message displays at the top, “Follow-up successfully saved”.



6) <u>Click “Back to Communication” to return to the parent communication.</u>

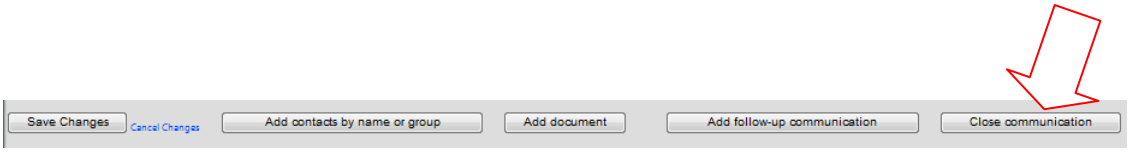


AREIS returns to the parent communication.

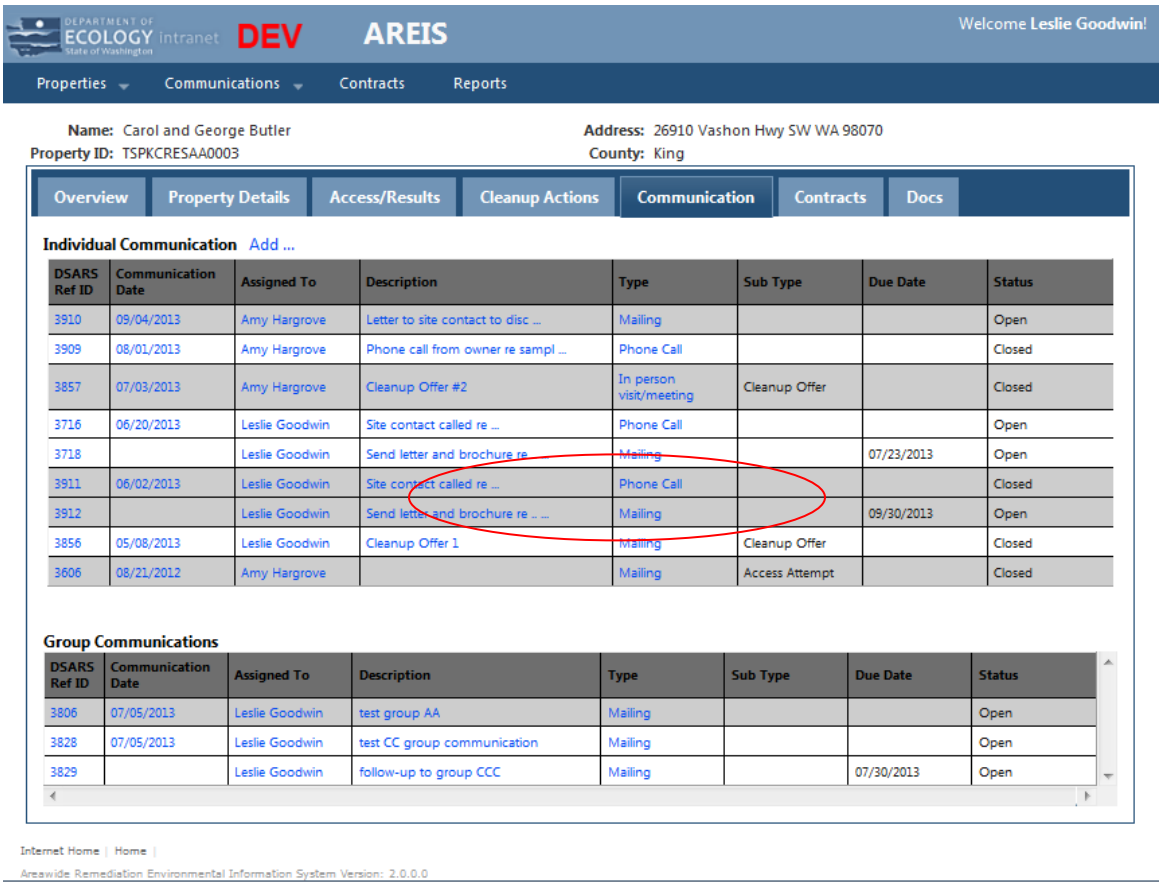


7) <u>Either "Save Changes" or "Close Communication" for the parent communication.</u>

(See "Add an Individual Communication" for more information about saving your communication.) Usually the parent communication will be closed:

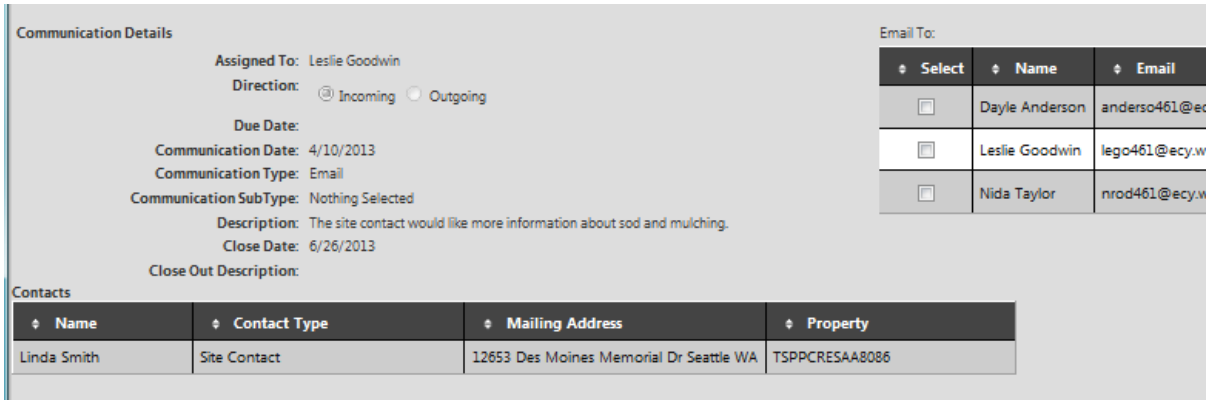


AREIS closes the communication popup and returns you to whatever screen you started on, in this case, the property communication tab. The new communications (parent and follow-up) are listed as a thread in your Open Communications list.



View, Edit, Follow-Up, or Close a Communication

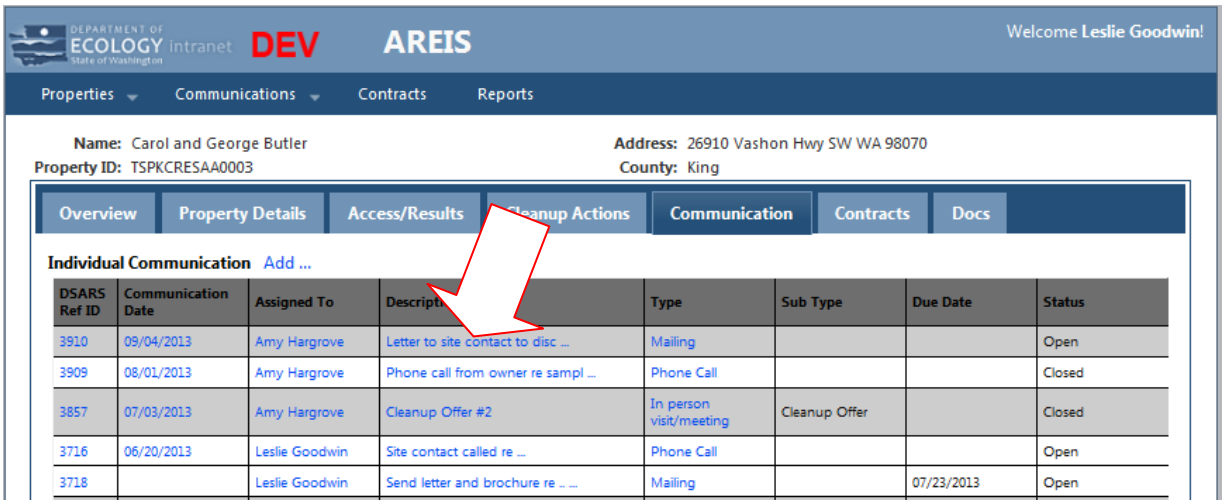
Closed communications: Once a communication is closed, it cannot be edited, and a follow-up cannot be added to it. If you click its hyperlink, the Communication Details popup will display. You can view the communication and email it to someone if needed.



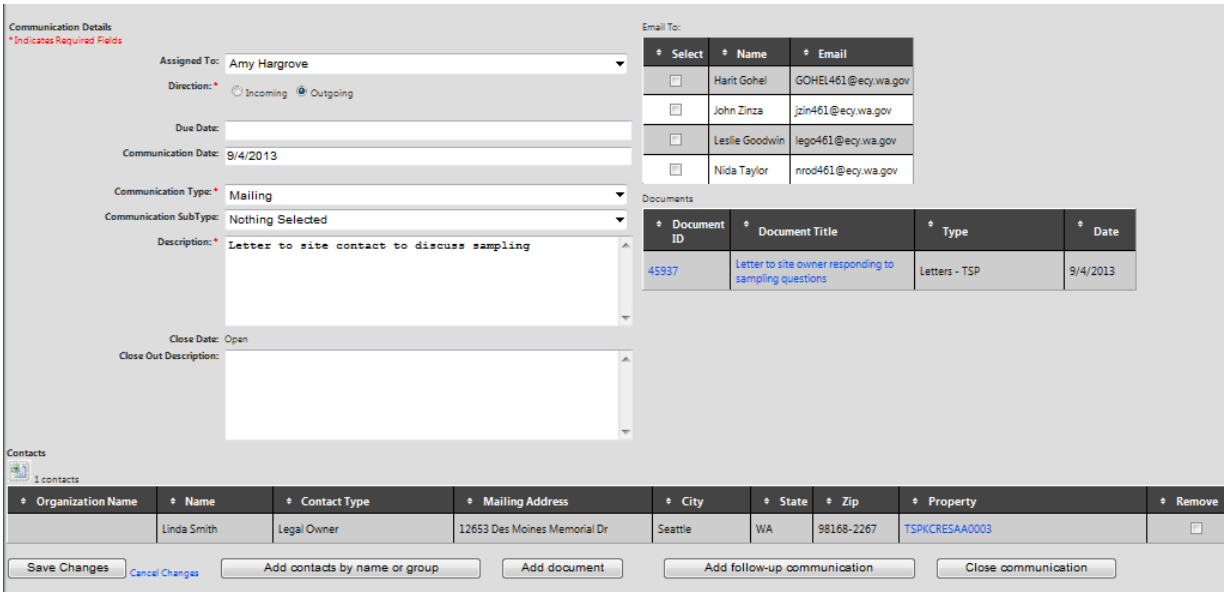
Click the "X" in the upper right-hand corner of the popup to close it.

Open communications: If the status is "open", you can edit, add a follow-up, and close it.

1) From the property communications window or the open communications window or the search communications window, click an open communication.



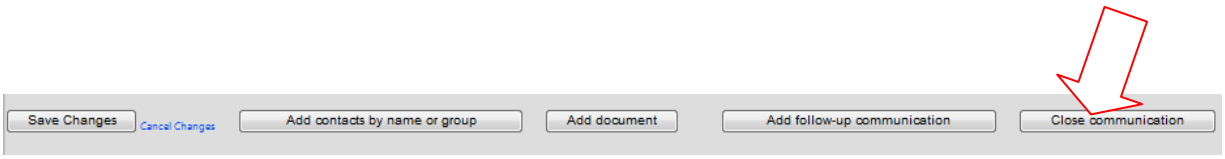
2) AREIS opens the Communication Details popup.



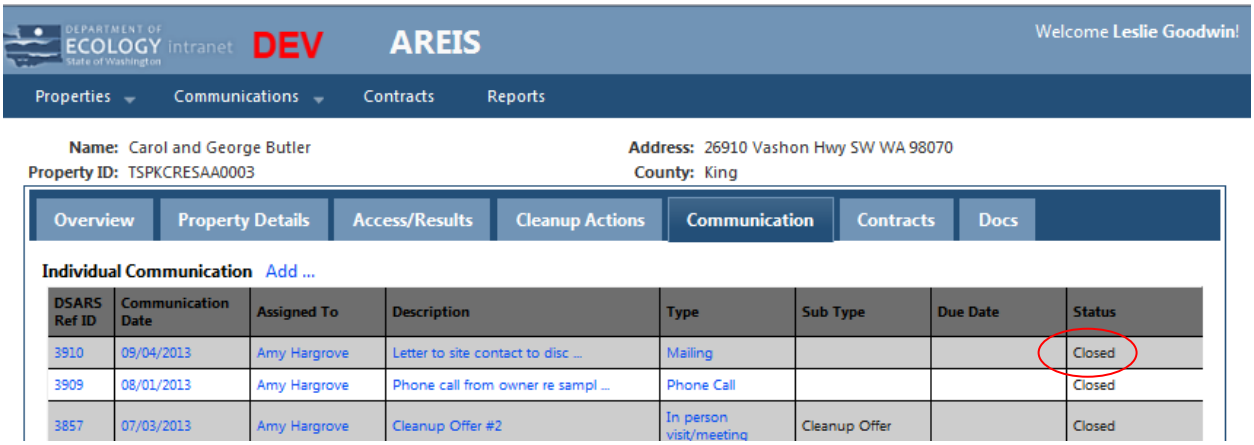
3) You have several options:

- Edit and Save Changes – change the communication details and click “Save Changes”
- Cancel Changes – cancels any unsaved changes
- Change Contacts –you can remove contacts by clicking the “remove” button, or add new contacts by clicking “Add contacts by name or group”. Click “Save Contacts” to save those changes.
- Add Document – allows you to select documents to attach to this communication.
- If you have completed this communication and are ready to close it, you should complete the Close Out Description and verify that the details and contacts are correct, then either:
    - Add a follow-up - don’t do this if there is already a follow-up
    - Close Communication – if it’s complete and no further editing or follow-ups are needed.

You just want to close this communication, so click “Close Communication”.

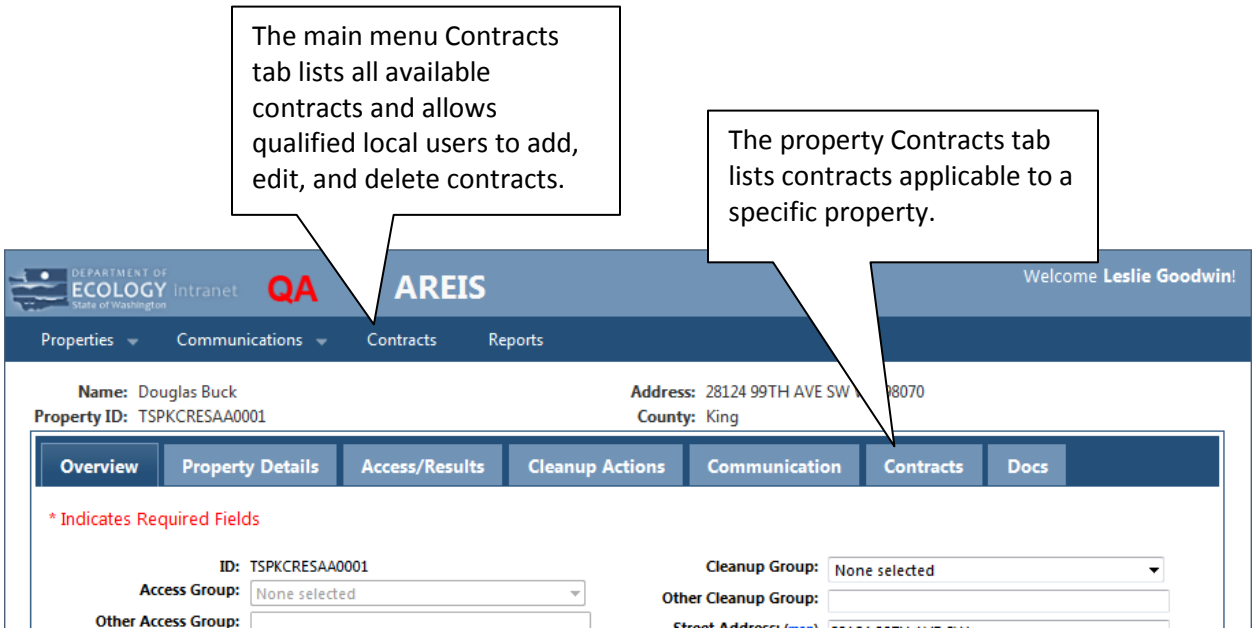


4) AREIS returns to the Property Communication screen or whatever screen you were on. The communication status is now “closed” and any changes are reflected.



E. Contracts Tab

AREIS has two Contracts tab:

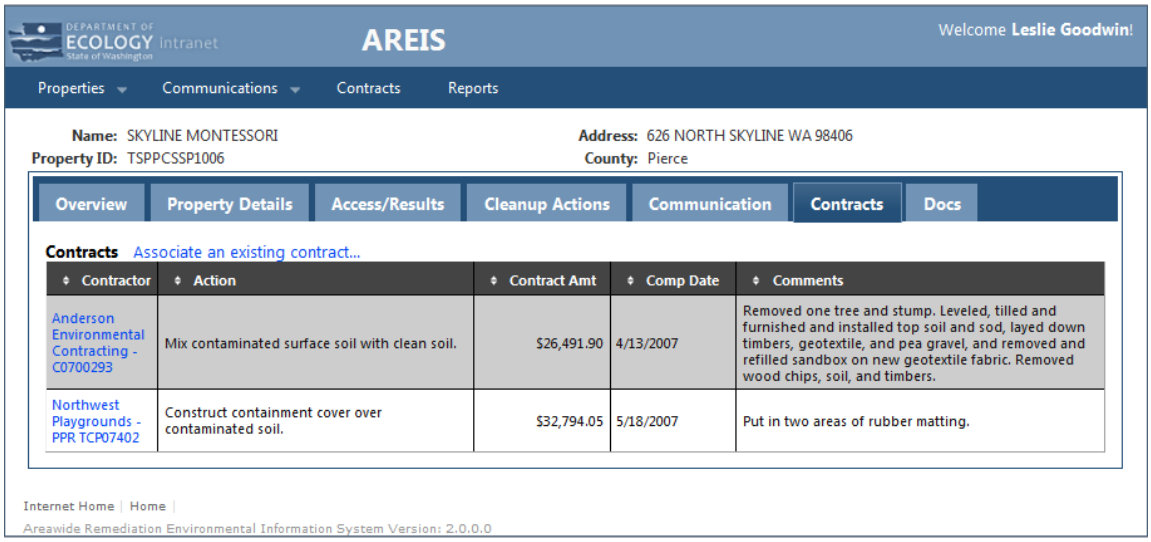


The contracts sections of AREIS has some restrictions. Local agency users can add, edit, and assign contracts. County agency users can only view contracts for properties in their respective counties. General users have read-only access.

To access the property-level contracts tab:

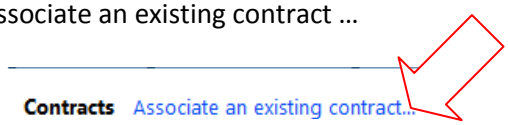
Search for a property. Click to open the property, then click its property contracts tab.

The contracts tab lists all contracts associated with that property.

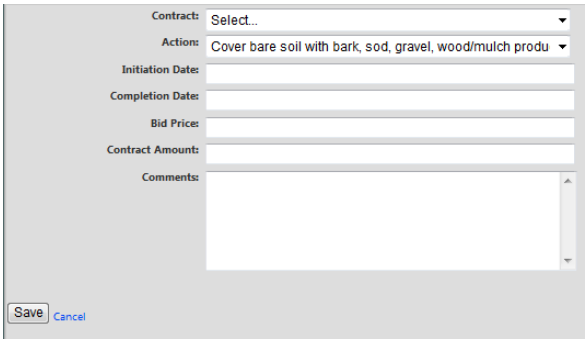


From here, you can:

- <u>Associate an existing contract with this property</u>:
  Click "Associate an existing contract …

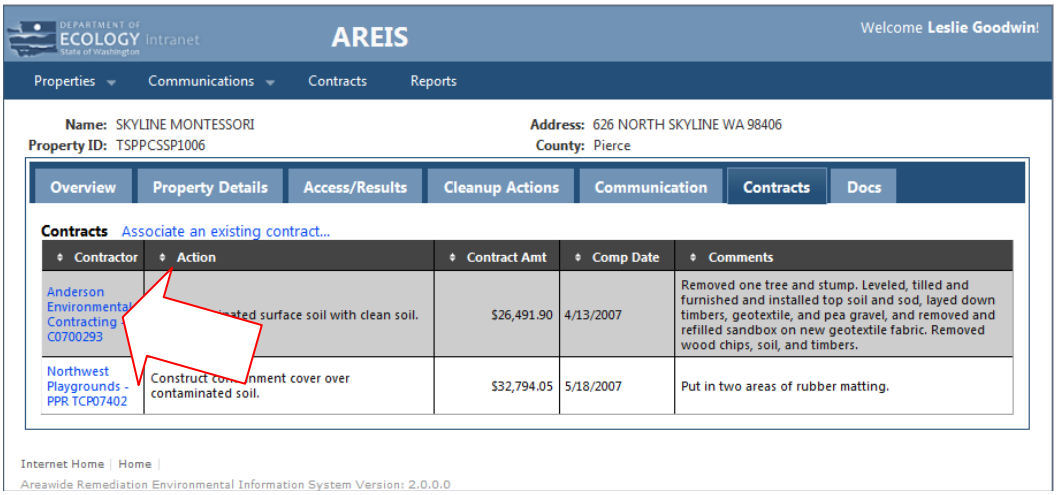


  A popup allows you to select a contract and enter the contract information. Click "save" or "cancel" when finished.

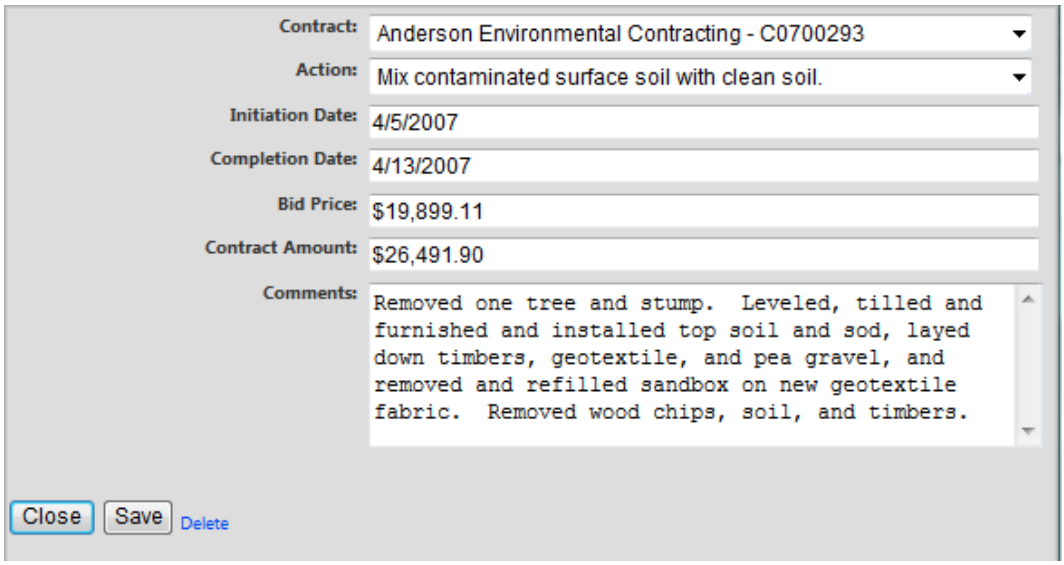


- View/edit the contractor information:

  Click the hyperlinked contractor's name, if any contracts are listed.



A popup allows you to view and edit the contract information related to this property.



F. Docs Tab

The Docs tab lists all documents pertaining to the selected property that have been scanned into Ecology's Document Storage and Retrieval System (DSARS) and imported into AREIS.

To view a document, click on the document title. A PDF copy of the original document opens for you to view.

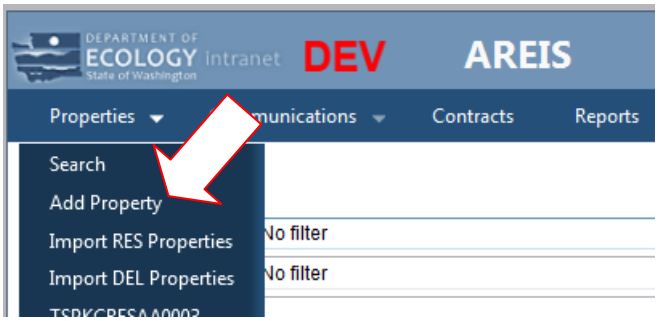
EPA document types:

- Internal EPA Document - consists of detailed notes for the selected property, including handwritten notes, rough map drawings, etc.

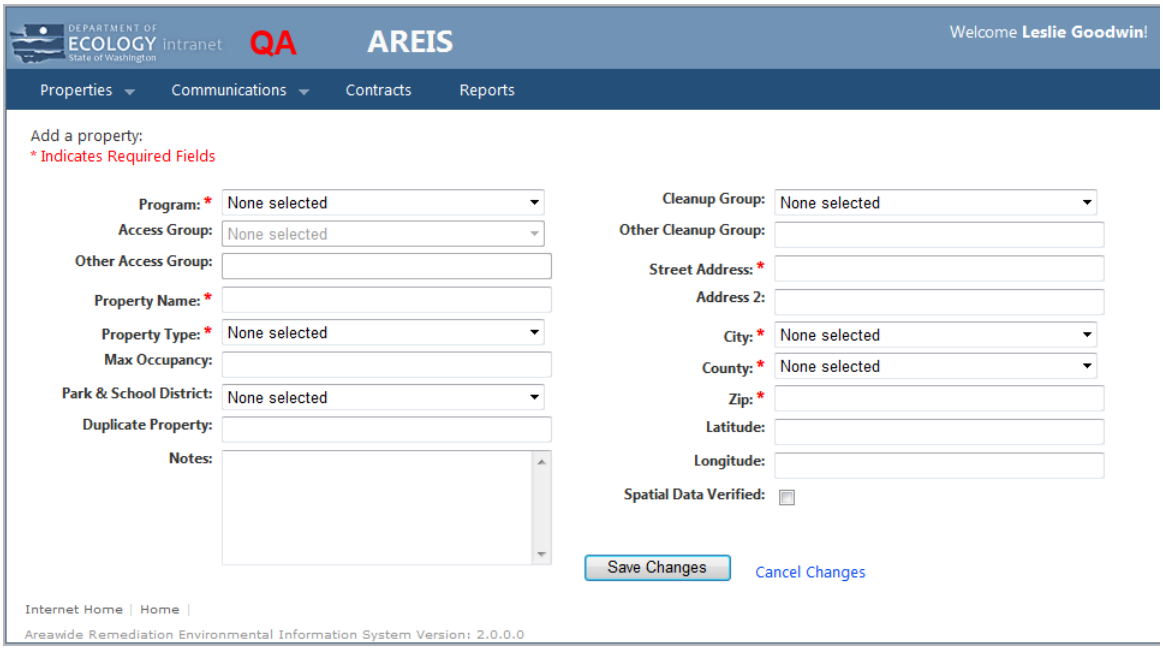
- EPA Document - consists of a summarized document for the selected property – clearer notes, cleaner map drawings, etc.

3. Add Property

1) To add a new property to the AREIS database, from the Properties dropdown menu, select “Add Property”.



The “Add a property” screen appears:



A red asterisk (*) indicates required fields.

Modified fields turn yellow to indicate impending change when you tab between fields.

“Save Changes” saves all impending changes and creates a new property record, assigning it a new Property ID in accordance with AREIS guidelines.

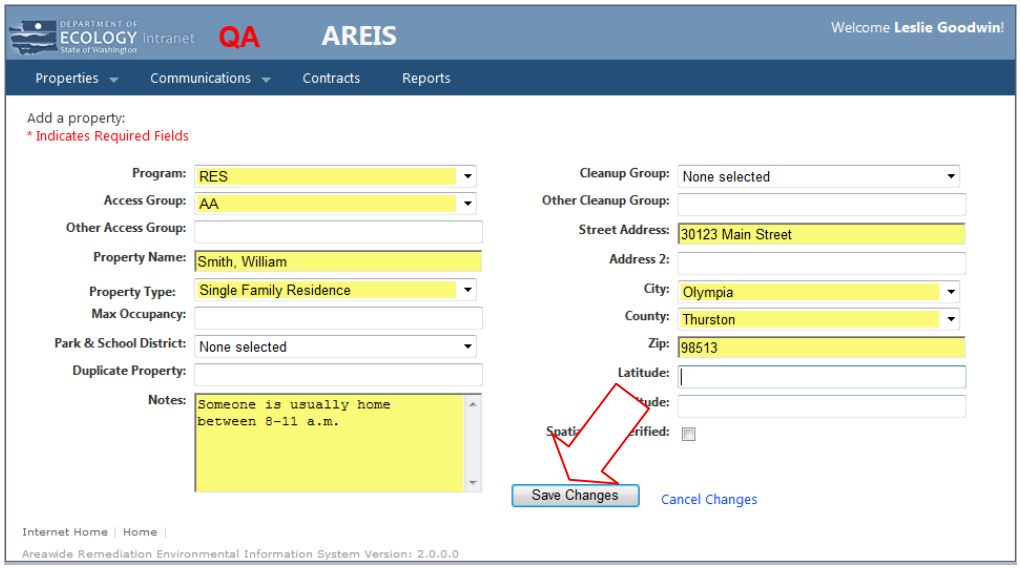
“Cancel Changes” cancels impending changes and clears the screen.

The fields on this screen vary depending upon the program (EPA, SSP, RES) and property type (public school, single family residence, etc.) you select.

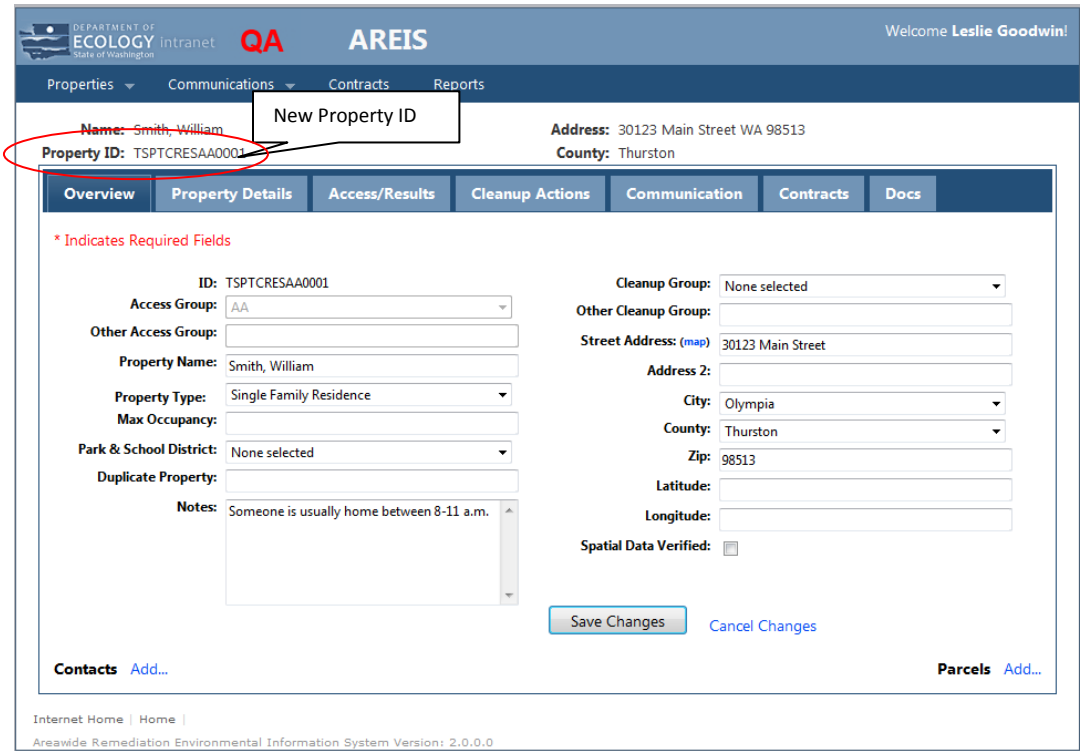
- Program – when adding a new property, select SSP or RES. No new sites will be entered into EPA.

- Access Group – Only for RES properties
- Add Access Group – Only for RES properties. If your access group is not in the dropdown list, type it here to add it to the list.
- Cleanup Group – If you know the cleanup group, select it here.
- Add Cleanup Group – if your cleanup group is not in the dropdown list, type it here to add it to the list. No property upon entering into the database will have a cleanup group
- Property Name – For RES and SSP properties, this is usually the owner's name or childcare facility.
- Park & School District – only for SSP properties
- Duplicate Property – is this property also entered in AREIS under a different program? This is a convenient place to list the "other" property ID.
- County – select which county the property is located in, County users will only be able to enter new properties within their own county.

2) Enter your new property information (the changed fields turn yellow) and press "Save Changes".



3) AREIS opens the property Overview screen for the new property



Your new Property ID is listed in the upper left corner of the screen.

You can enter information for this property in the property tabs (Overview, Property Details, Access/Results, Cleanup Actions, Communications, Contracts, Docs). These are discussed in the previous section.

4. Import RES Properties

This function allows AREIS administrators to import groups of residential properties. We usually receive the property information from the county in spreadsheet format. We clean up the spreadsheet, save it as a CSV file, then run the Import RES Properties function. The Import RES Properties function checks that the property address is in a standard format, checks AREIS to confirm that this property is not a duplicate of one already in the system, geocodes it if necessary, and checks whether the contact already exists in the Ecology affiliations database. If all of these checks pass, it loads the property into AREIS in the Residential program as a single family residence, and adds the listed contact as the legal owner.

A. Prepare your data

First you need to gather and format your data correctly. We usually receive this information from the county in spreadsheet format, so the easiest way to do this is from a Microsoft Excel spreadsheet. The first row contains the column headings (field names) which must be named exactly as listed below:

SiteCode - The Residential Access Code. Required.
TaxParcel - The parcel number from the tax assessor's office. Required.
Latitude - The latitude of the property.
Longitude – The longitude of the property.
TaxPayer - This will be saved as the "Property Name" and also the property contact entered in the Ecology Affiliations database. It should be entered as "lastname firsname", with no commas, for example, "Smith John" or "Smith John & Dianne". The contact will be saved as a "person" (instead of an organization) as the legal owner of the property. If this property is owned by a company, the company name will still be created as a "person" contact, with the first word taken as the lastname, and the rest taken as a firstname. If the default settings aren't correct for a contact, then you should edit that contact through the property overview page after loading the property. Required.
AddressM - The contact's street address. Required.
CityM - The contact's city. Required.
StateM - The contact's zip code. Required.
AddressSite - The property's street address. Required.
CitySite - The property's city. Required.
StateSite - The property's state. Required.
ZipCodeSite - The property's zip code. Required.
YearBuilt - The year the property was built. Optional.
URL - The URL to the site in the assessor's database. Optional.

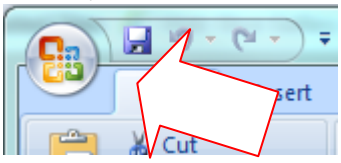
Here is an example spreadsheet:

	A	B	C	D	E	F	G	H	I	J	
1	SiteCode	TaxParcel	Latitude	Longitude	TaxPayer	AddressM	CityM	StateM	ZipCodeM	AddressSite	Ci
2	AA	221233025	47.28896	-122.5249131	ZITTEL EDWARD A & CONNIE R	4324 N LEXINGTON ST	TACOMA	WA	98407-1710	4324 N LEXINGTON ST	Ta
3	AA	221233034	47.28892	-122.5232597	THOMPSON LOUISE R	4309 N FRACE AVE	TACOMA	WA	98407-1707	4309 N FRACE AV	Ta
4	AA	221233036	47.28754	-122.5245374	PEARSON JEANNE K	4206 N FRACE AVE	TACOMA	WA	98407-1706	4206 N FRACE AV	Ta

Don't use any plus symbols. If the TaxPayer refers to multiple persons, use "and" or "&".
Suggestion: If this is your first time running the RES import, it might be best to import just a few properties in your spreadsheet the first time, to be sure you have your spreadsheet formatted correctly.

B. Save your spreadsheet as a CSV file

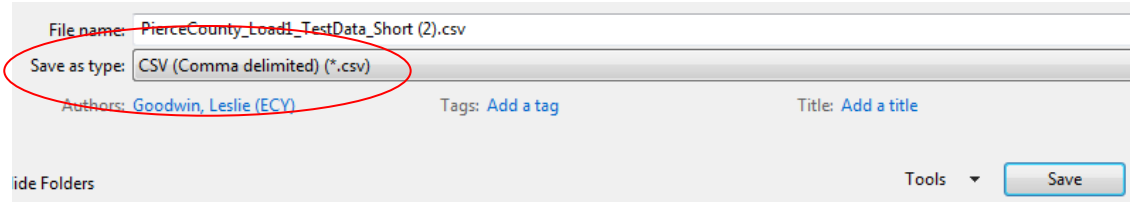
In Excel, click the Office Button in the upper lefthand corner.



Select “Save”

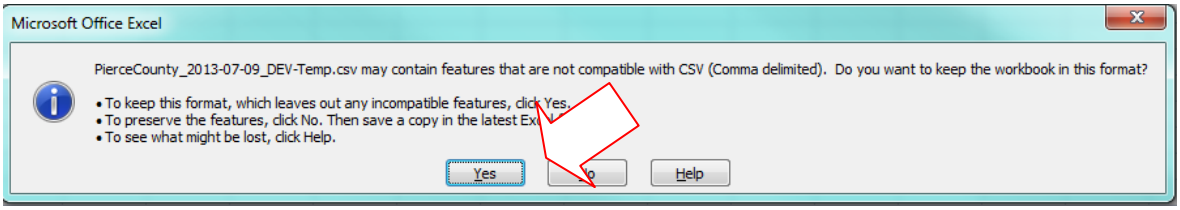
From the “save” menu, select “Save as”.

Enter a filename, and change the “save as type” to CSV (Comma Delimited) (*.csv):



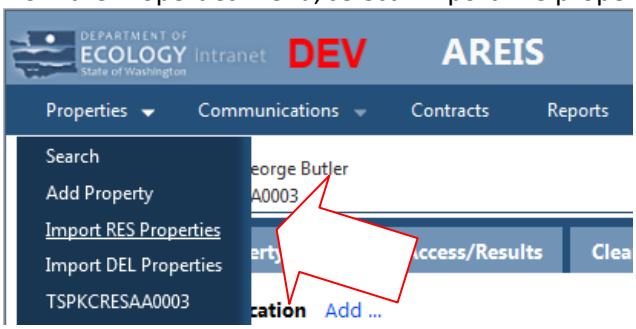
Then click “save”.

A popup warns that your file may contain features that are not compatible with CSC (Comma delimited) and asks if you want to keep the workbook in this format. Click “yes”.



C. Run “Import RES Properties”

From the Properties menu, select “Import RES properties”:



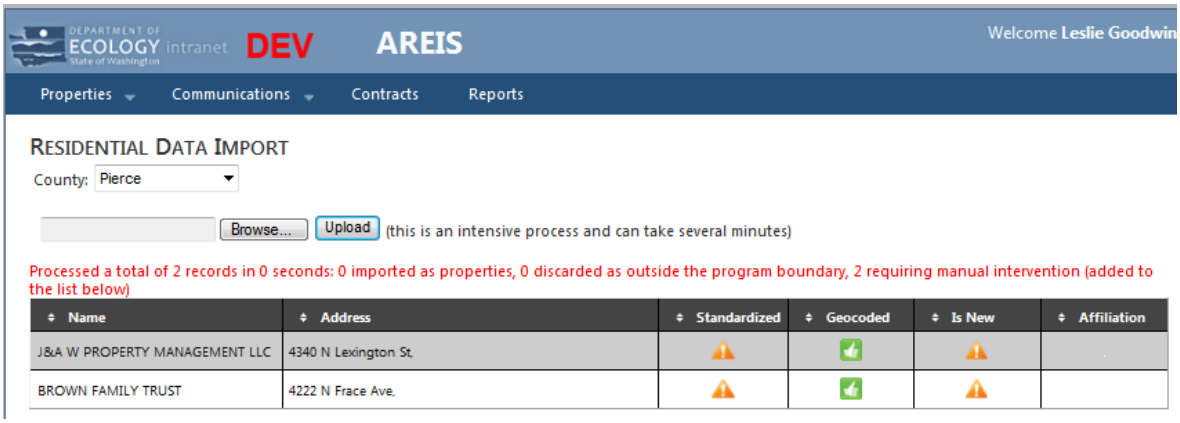
AREIS opens the Residential Data Import page.

Use the dropdown menu to select the county.

Browse to select your CSV file.

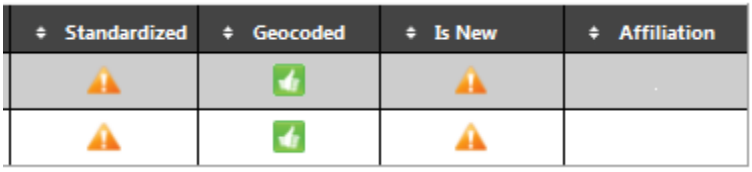
Click “Upload”.

Uploads may take a few seconds to several minutes, depending upon how much data is processed. Eventually the following screen will appear:

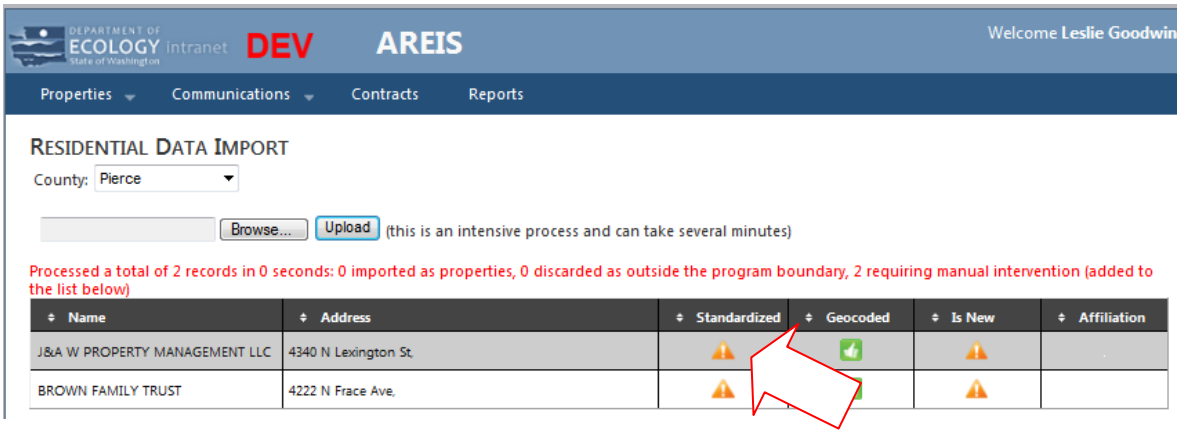


This screen tells you how many records were processed and lists any records that require manual intervention.

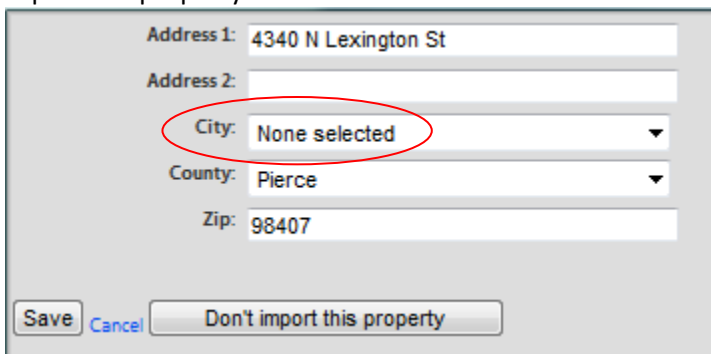
The manual intervention is broken down into 4 categories. An orange exclamation point indictes there is a problem for that record. A green thumbs-up icon indicates it passed that category.



For each property, click the exclamation point icons (**start at the left and move to the right**) to open popups that explain the problem and offer solutions:

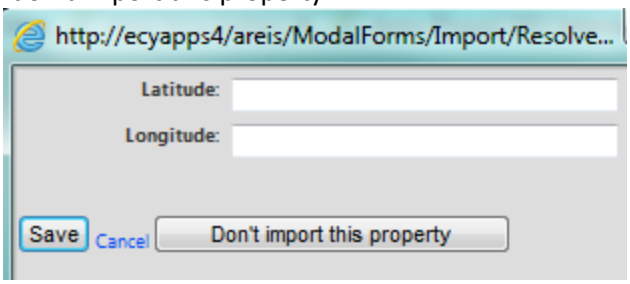


Standardized – An issue occurs if there's a problem with the name, address, etc., for example, if the city is missing. Click the orange excalamation to open a popup with details of the problem. The popup displays the address that didn't pass the "standardized" test. In this one, you can see that the city is missing. Use the dropdown to select a city, then select "save" or "cancel" or "don't import this property".

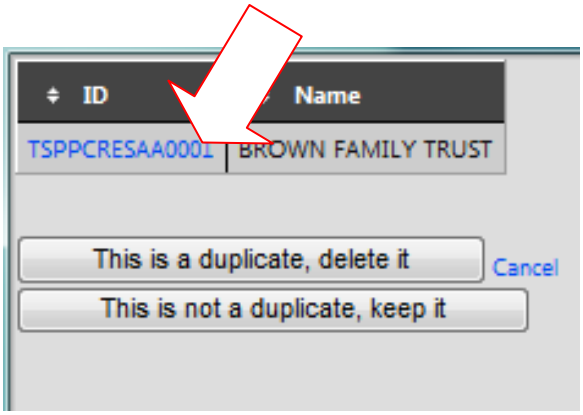


Sometimes a property is outside of the TSP boundaries. When you see one of these, you should select "don't import this property".

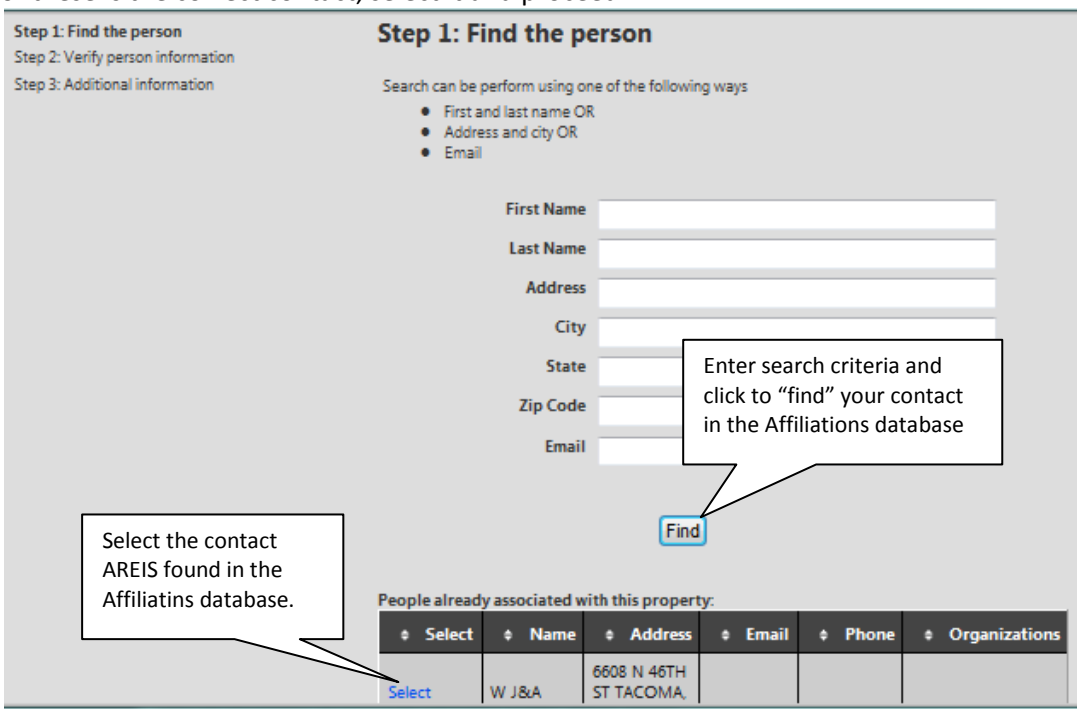
Geocoded – Occurs if the latitude/longitude aren't imported, or if AREIS isn't able to calculate the latitude/longitude from the address. Clicking the exclamation point opens a popup similar to the Standardized box where you can enter the latitude and longitude, then select "save" or "cancel" or "don't import this property".



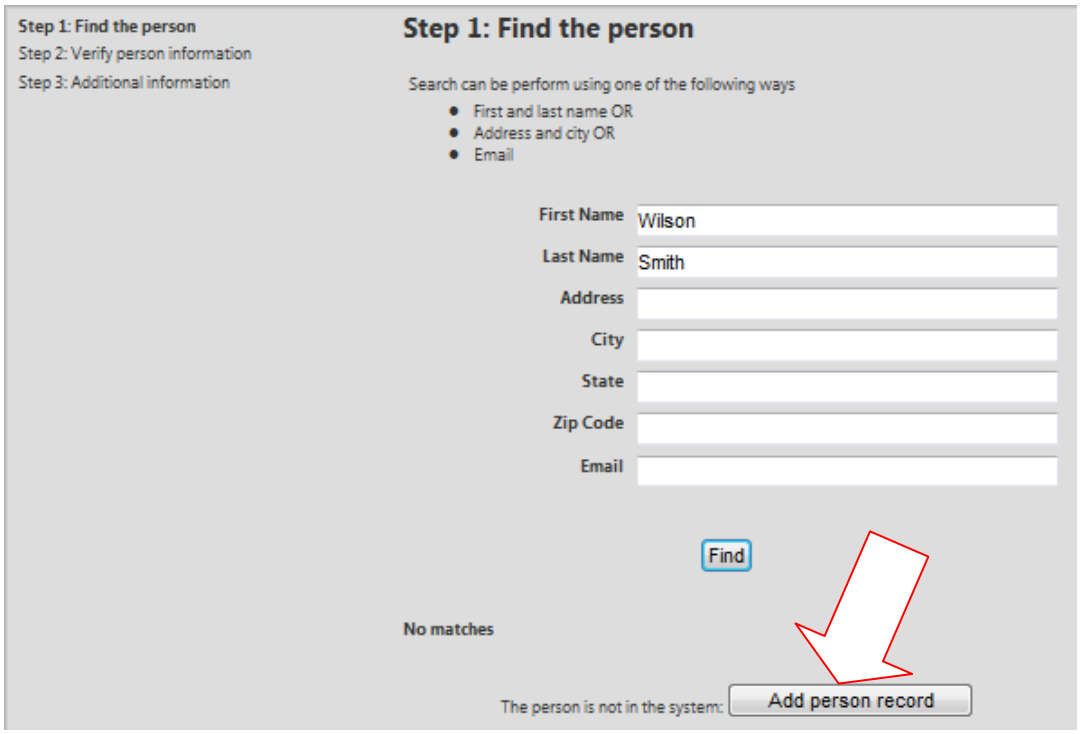
Is New – Occurs if AREIS finds a property with the same (or a very similar) address. Clicking the exclamation point opens a box listing the possible duplicate record(s). Click the ID to open that property record, and compare the existing property (which may be in a different program) to your new one. It is often helpful to open your spreadsheet to compare.



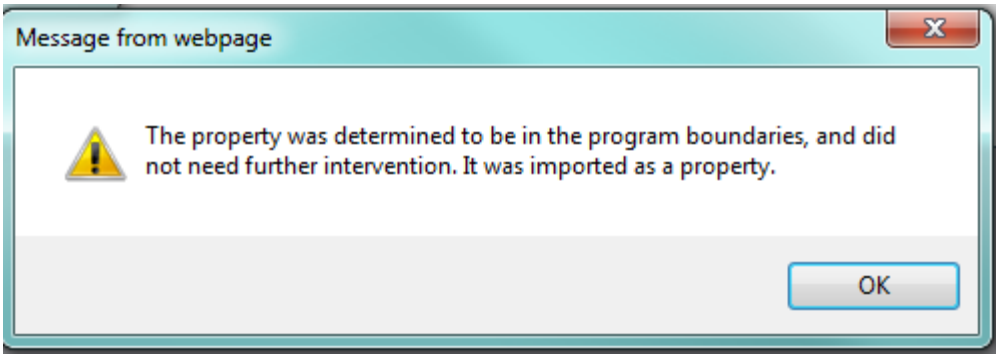
Affiliation – occurs if AREIS believes the affiliation exists already. Clicking the exclamation point opens a popup listing the person(s) or organization(s) that AREIS found in Ecology's Affiliations database. If one of these is the correct contact, select it and proceed.



If your contact isn't listed, first try to find it in the Ecology database. If you cannot "find" it, then after selecting "find", AREIS will give you an option to add a new contact, and you can "add" and save your new contact.



You should always move through the issues in a property **from left to right**. Often, if you resolve the first issue, the other issues will also be resolved and you'll get a message like the one below.



5. Import DEL Properties

This function allows AREIS administrators to import groups of SSP properties (nurseries, daycares, etc.). We receive the property information from the county in spreadsheet format. We open the file in Excel, save it as a CSV file, then run the Import DEL Properties function. The Import DEL Properties function checks that the property address is in a standard format, checks AREIS to confirm that this property is not a duplicate of one already in the system, geocodes it if necessary, and checks whether the contact already exists in the Ecology affiliations database. If all of these checks pass, it loads the property into AREIS in the SSP program, and adds the listed contact as the operator organization.

A. Prepare your data

The county sends us the data in in spreadsheet format, with the columns correctly labeled. We merely open it in Excel and then save it as a CVS file. :

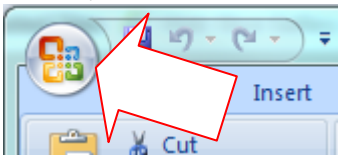
Here is an example spreadsheet:

	A	B	C	D	E	F
1	PROVIDER_ID	FACILITY_NAME	FACILITY_DB	LOCATION_ADDRESS1	LOCATION_ADDRESS2	LOCATION
2	186243	CHILCOTT KIMBERLY CAROL		3905 SW 98th ST		Seattle
3	245697	EL SHAMMA MANAL		4014 189TH PL SW		LYNNWOC
4	283950	CREATIVE ADVENTURES		5822 GROVE STREET		MARYSVIL

Don't use any plus symbols. If the Facility_Name refers to multiple persons, use "and" or "&".

B. Save your spreadsheet as a CSV file

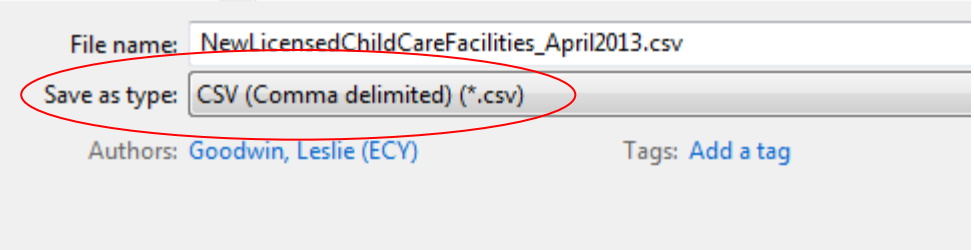
In Excel, click the Office Button in the upper lefthand corner.



Select “Save”

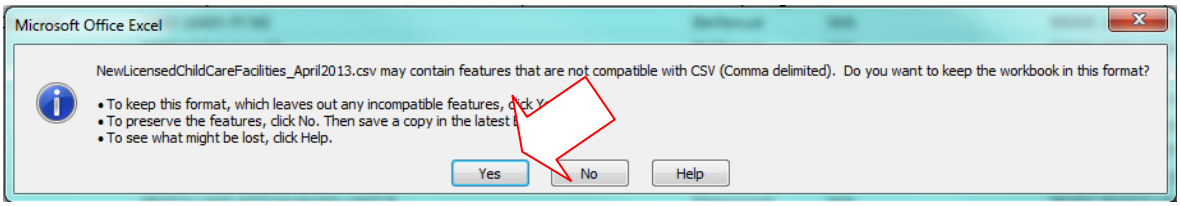
From the “save” menu, select “Save as”.

Enter a filename, and change the “save as type” to CSV (Comma Delimited) (*.csv):



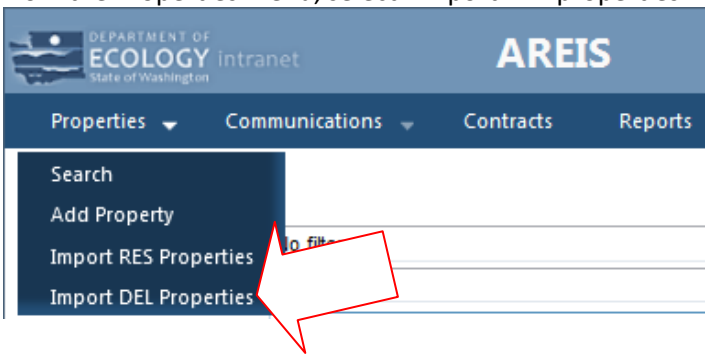
Then click “save”.

A popup warns that your file may contain features that are not compatible with CSC (Comma delimited) and asks if you want to keep the workbook in this format. Click “yes”.



C. Run “Import DEL Properties”

From the Properties menu, select “Import DEL properties”:

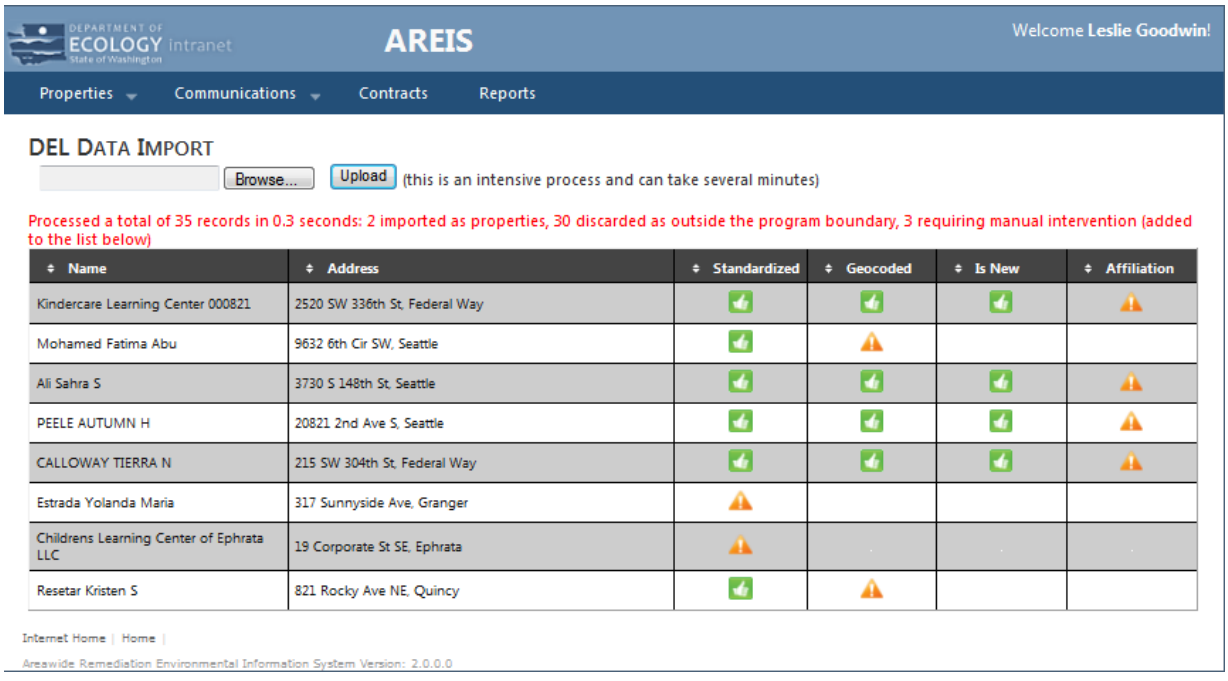


AREIS opens the DEL Data Import page.

Browse to select your CSV file.

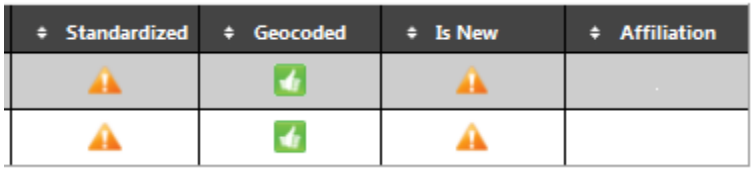
Click "Upload".

Uploads may take a few seconds to several minutes, depending upon how much data is processed. Eventually the following screen will appear:

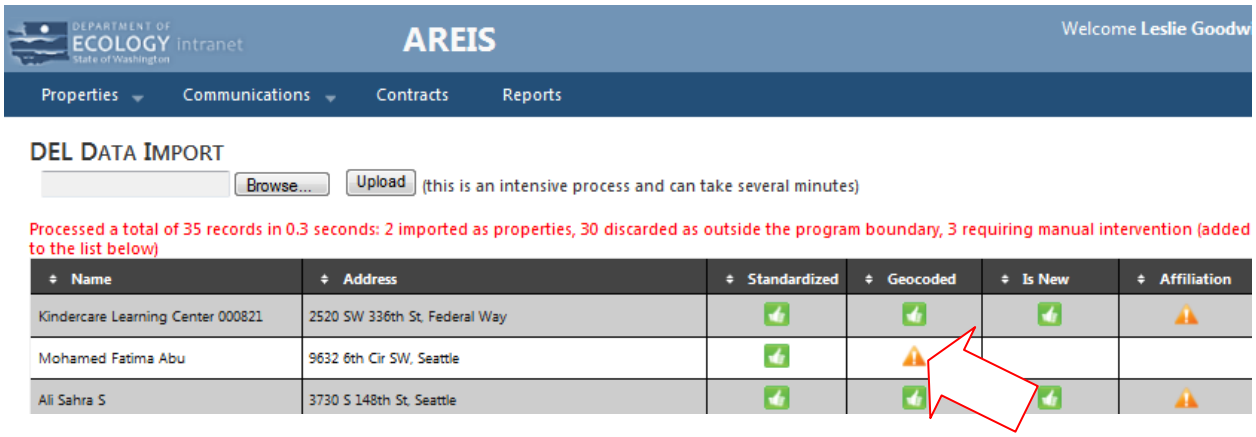


This screen tells you how many records were processed and lists any records that require manual intervention.

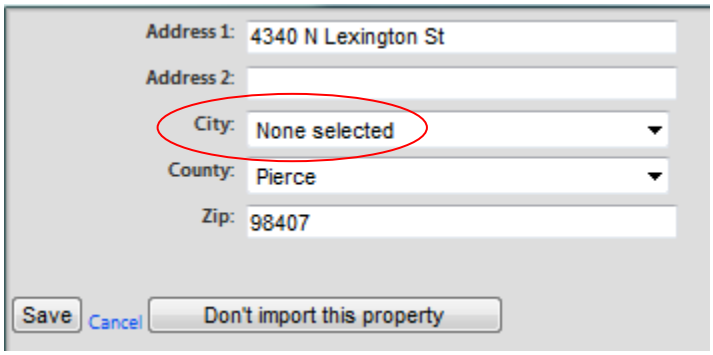
The manual intervention is broken down into 4 categories. An orange exclamation point indictes there is a problem for that record. A green thumbs-up icon indicates it passed that category.



For each property, click the exclamation point icons (start at the left) to open popups that explain the problem and offer solutions:

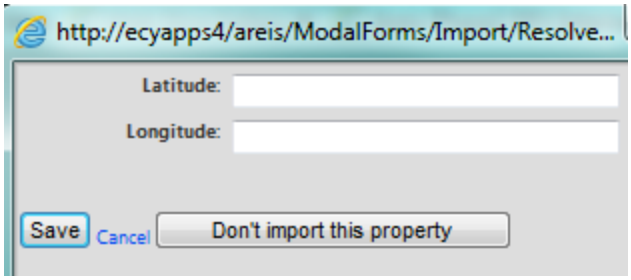


Standardized – An issue occurs if there's a problem with the name, address, etc., for example, if the city is missing. Click the orange excalamation to open a popup with details of the problem. The popup displays the address that didn't pass the "standardized" test. In this one, you can see that the city is missing. Use the dropdown to select a city, then select "save" or "cancel" or "don't import this property".

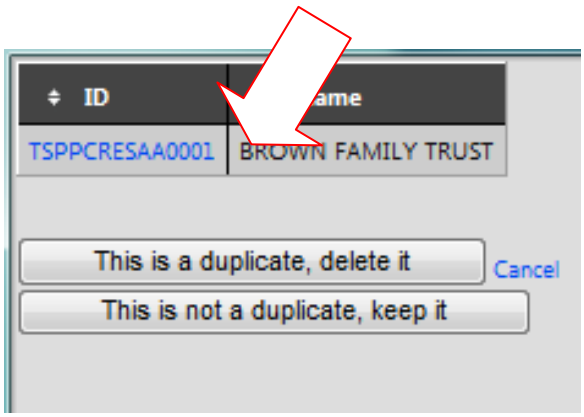


Sometimes a property is outside of the TSP boundaries. When you see one of these, you should select "don't import this property".

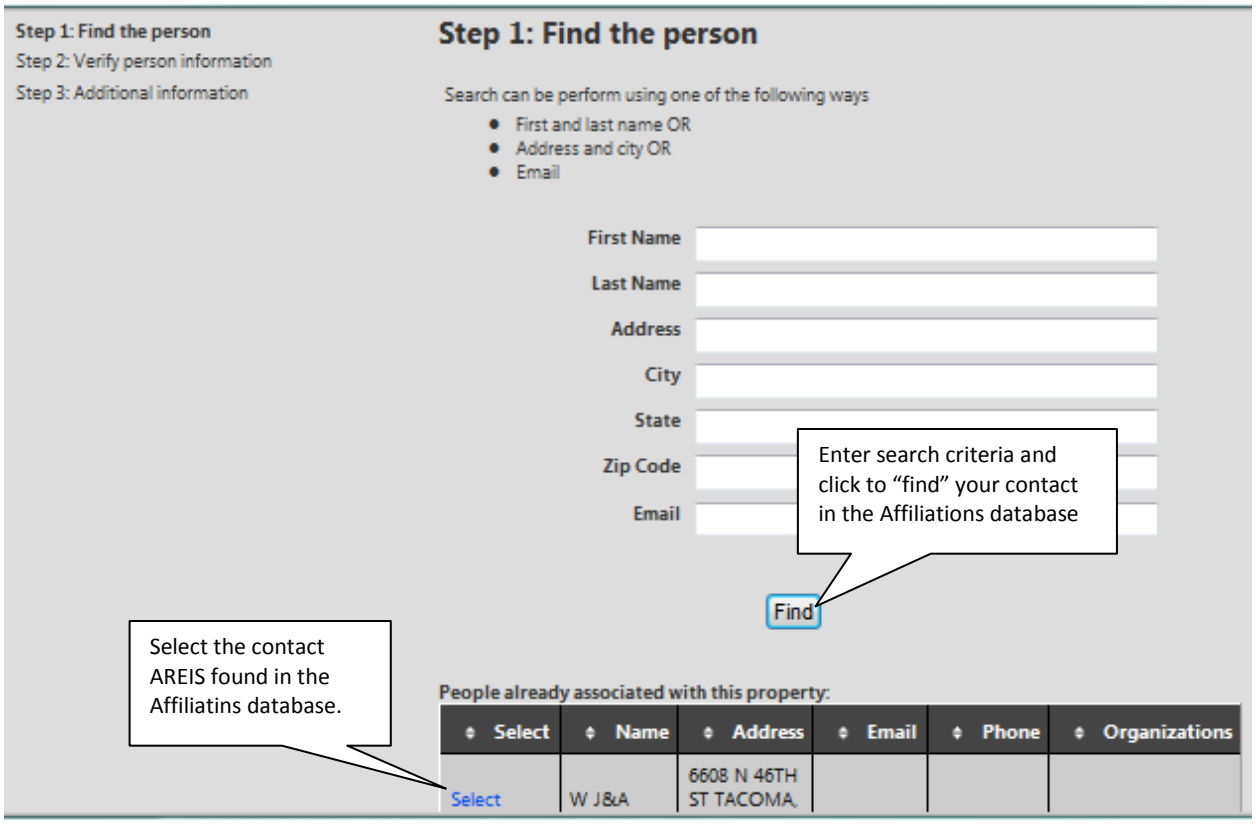
Geocoded – Occurs if the latitude/longitude aren't imported, or if AREIS isn't able to calculate the latitude/longitude from the address. Clicking the exclamation point opens a popup similar to the Standardized box where you can enter the latitude and longitude, then select "save" or "cancel" or "don't import this property".



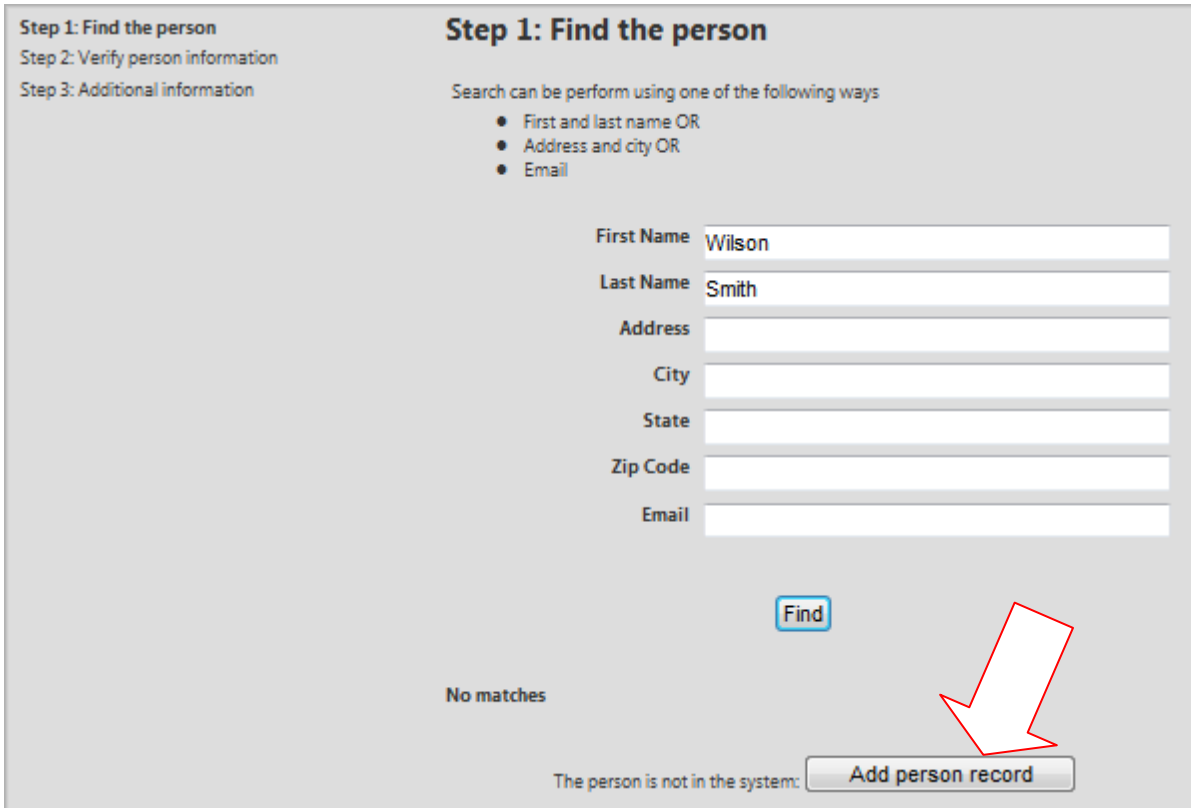
Is New – Occurs if AREIS finds a property with the same (or a very similar) address. Clicking the exclamation point opens a box listing the possible duplicate record(s). Click the ID to open that property record, and compare the existing property (which may be in a different program) to your new one. It is often helpful to open your spreadsheet to compare.



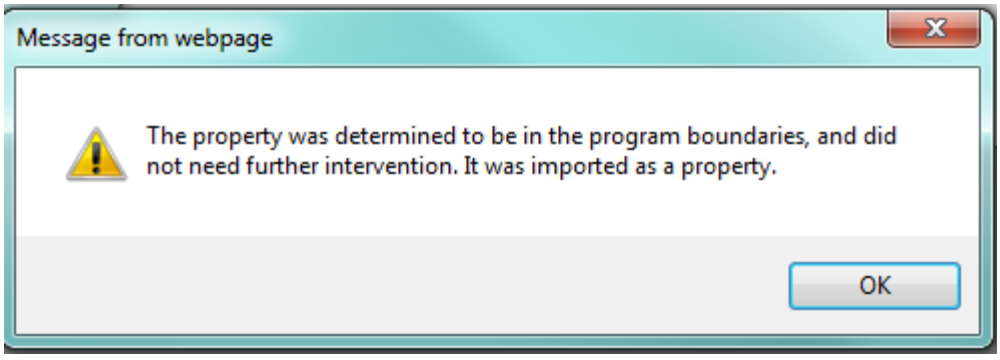
Affiliation – occurs if AREIS believes the affiliation exists already. Clicking the exclamation point opens a popup listing the person(s) or organization(s) that AREIS found in Ecology's Affiliations database. If one of these is the correct contact, select it and proceed.



If your contact isn't listed, first try to find it in the Ecology database. If you cannot "find" it, then after selecting "find", AREIS will give you an option to add a new contact, and you can "add" and save your new contact.



You should always move through the issues in a property **from left to right**. Often, if you resolve the first issue, the other issues will also be resolved and you'll get a message like the one below.



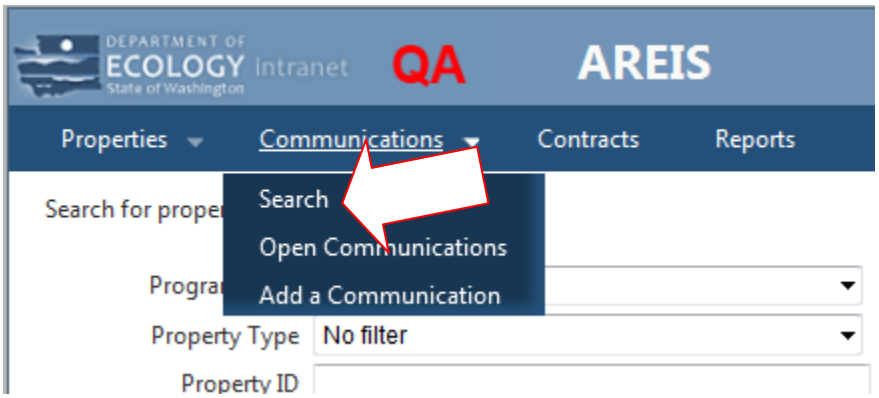
Communications Menu

This is a top-level AREIS menu, with three options available from its dropdown menu:

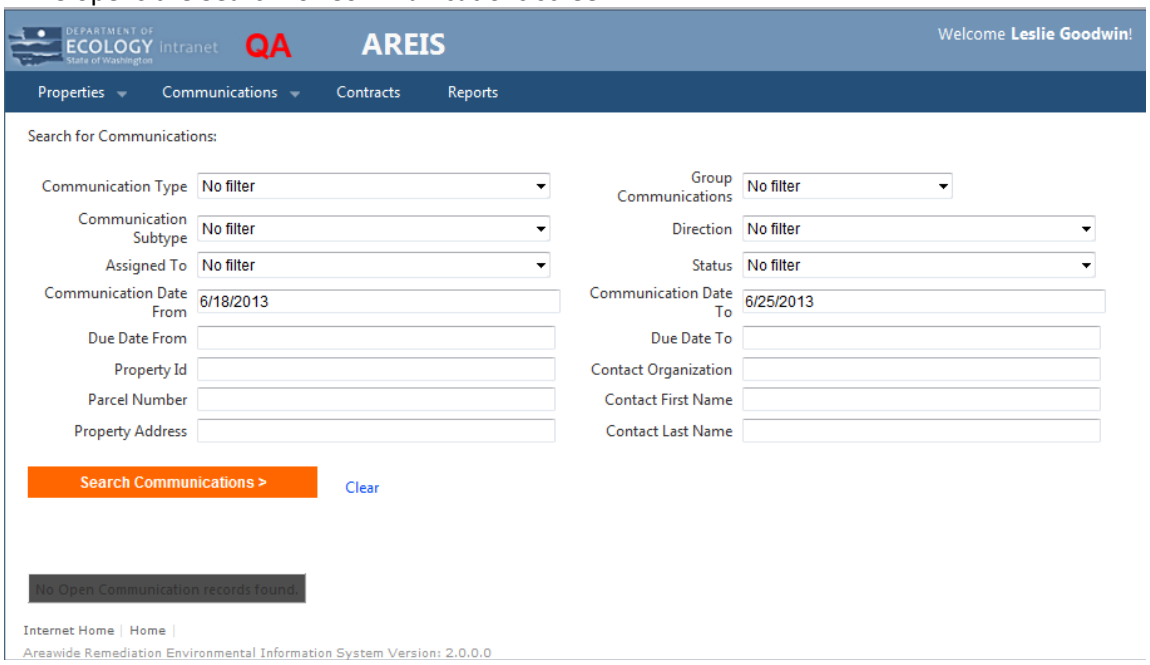
1) Search
2) Open Communications (My Open Communications)
3) Add a Communication – primarily used to add group communications

1. Search for a Communication

To search for a communication, scroll over the main/global Communications tab, then click "Search" from the dropdown menu:



AREIS opens the Search for Communications screen.



At least one criteria must be entered. Entering multiple criteria will narrow your search.

- To find all phone calls made or received between June 18 and June 25, 2013, enter:
  - Communication Type: Phone call
  - Communication Date From: 6/18/2013
  - Communication Date To: 6/25/2013

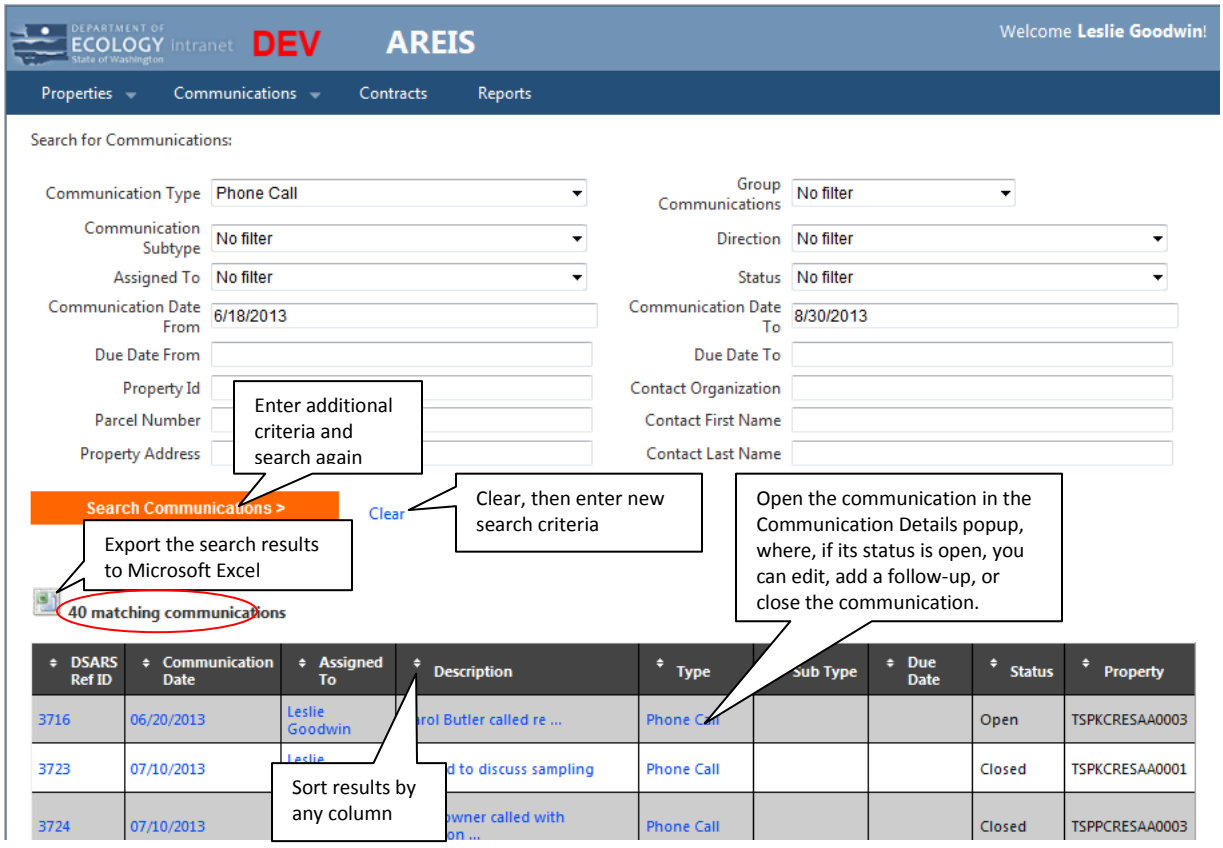
- To find all communications to/from Linda Smith, enter:
  - Contact First Name: Linda (or I could enter just two characters)
  - Contact Last Name: Smith

- To find all open communications due between July 1-15, 2013:
  - Due Date From: 7/1/2013
  - Due Date To: 7/15/2013

- To find all communications sent to Tacoma Smelter Plume, King County, Residential Access Group "AB" properties, enter:
  - Group Communications: Group Communication
  - Property ID: TSPKCRESAB (this is a string that will match those properties)

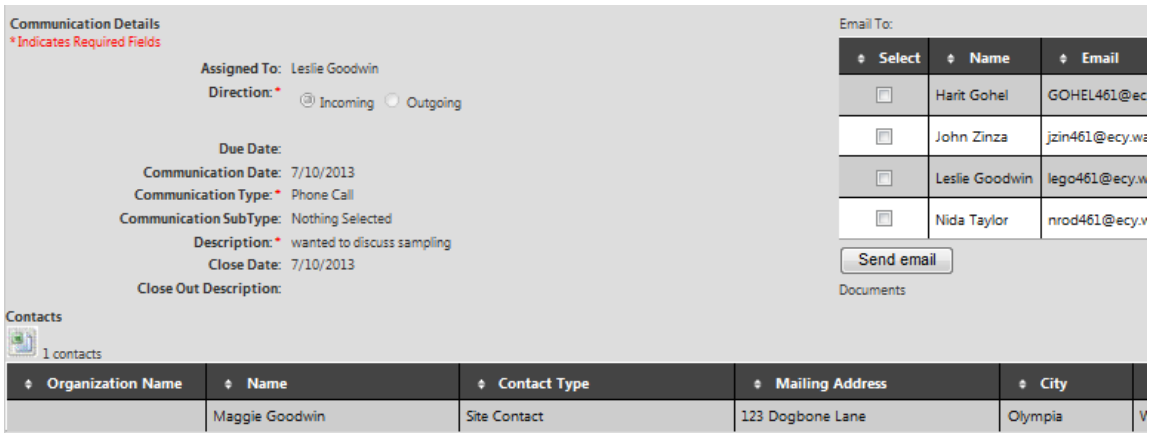
Then press "Search Communications".

The search results are displayed at the bottom of the screen. Nine matching communications were found in this search.

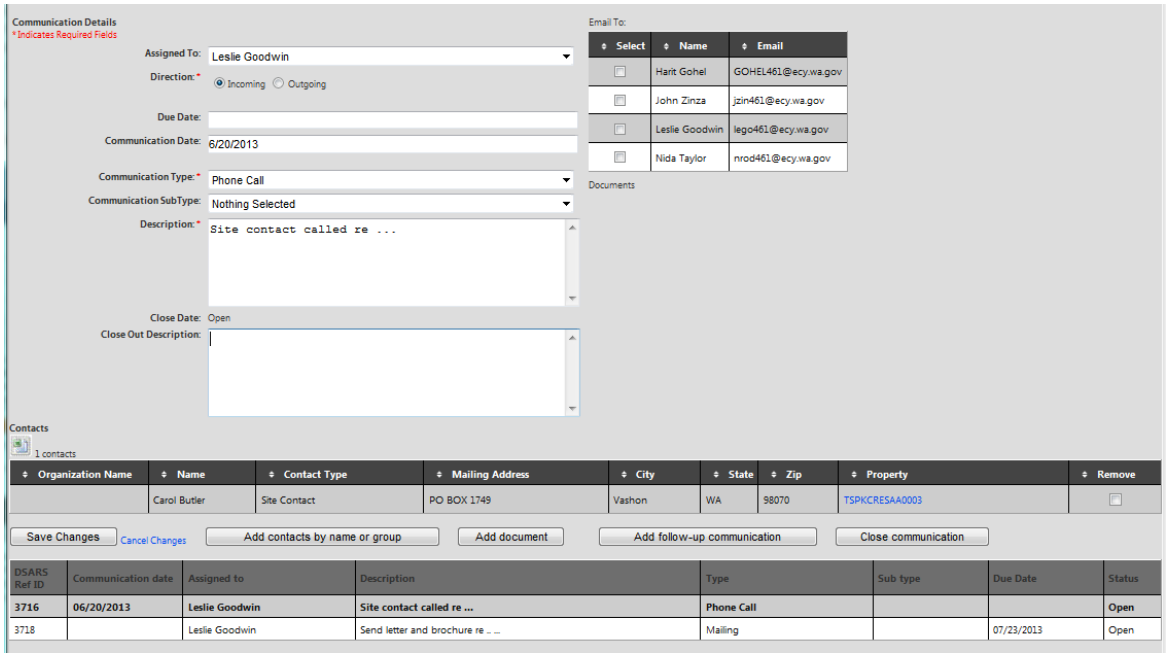


Click any hyperlinked communication to open it in the Communication Details popup

- If the communication is closed, you can't edit, but you can email it to a listed user

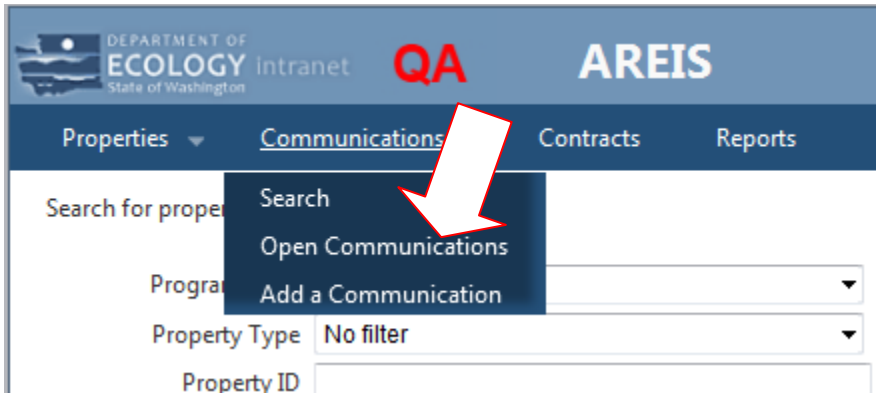


- If the communication is open, you can edit and save changes, cancel changes, mail it to a listed user, add or remove contacts, add documents, add a follow-up, and close the communication. These actions are covered under the "View, Edit, Follow-Up, or Close a Communication" section of this manual.

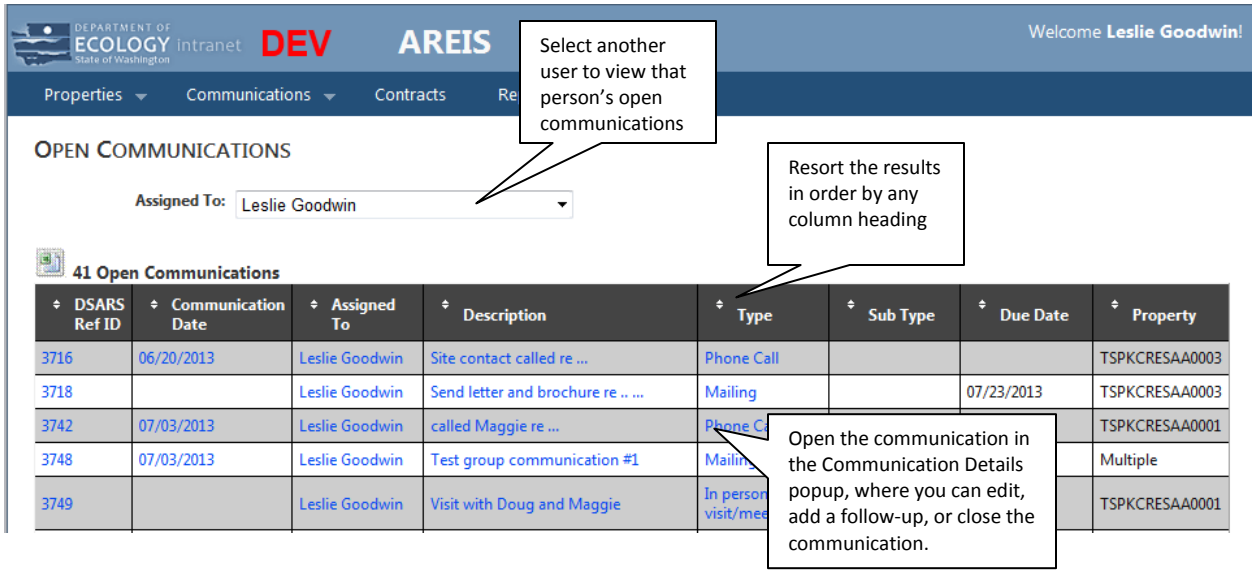


2. Open Communications

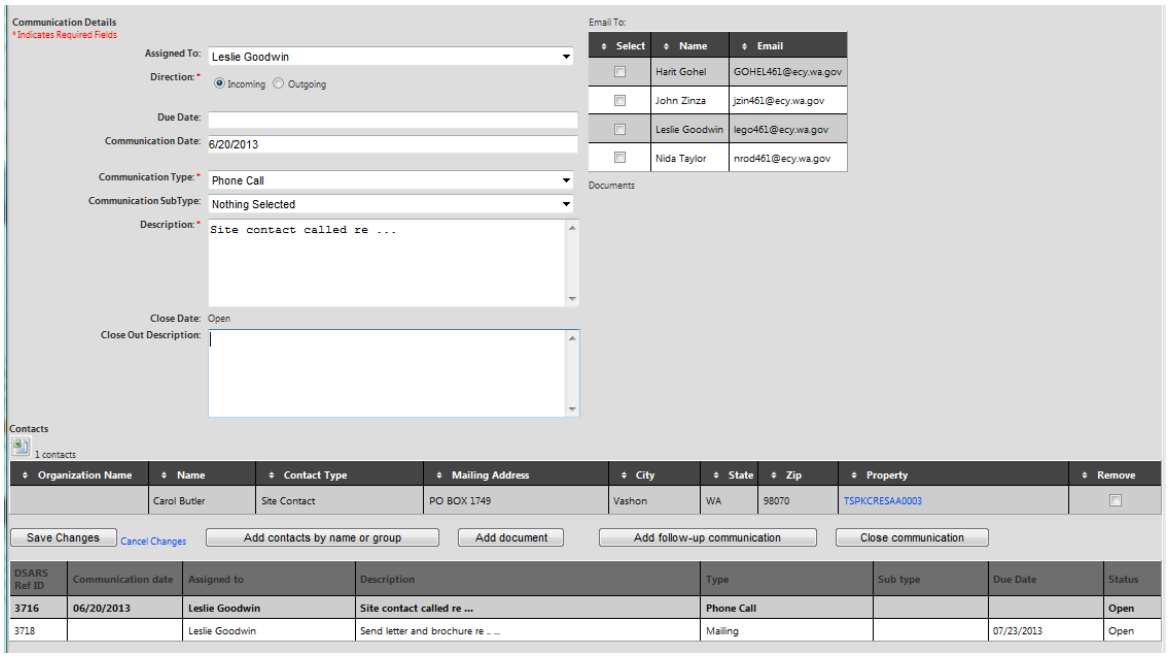
To view a list of open communications for a particular user, scroll over the main/global Communications tab and click "Open Communications" from the dropdown menu:



The Open Communications screen is displayed. By default, AREIS displays all open communication assigned to you. You can change the "assigned to" selection to view another person's open communications.



Click a communication to open it in the Communication Details popup. These are all open communications, so you can edit and save changes, cancel changes, add a follow-up (if applicable), and close the communication. These actions are covered under the "View, Edit, Follow-Up, or Close a Communication" section of this manual.



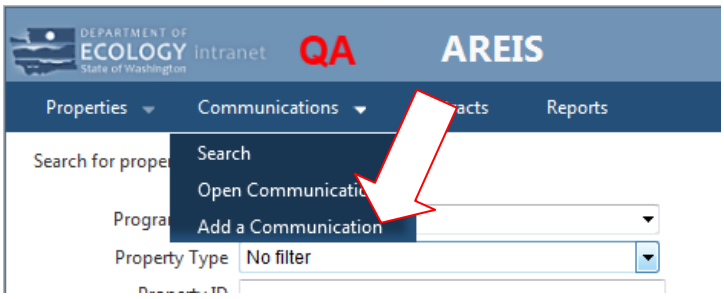
3. Add a Communication (Group Communications)

Group communications are added from the main/global Communications tab. The process is similar to adding an individual communication, except a group communication includes contacts from more than one property.

When you edit or close a group communication, it affects the entire group.

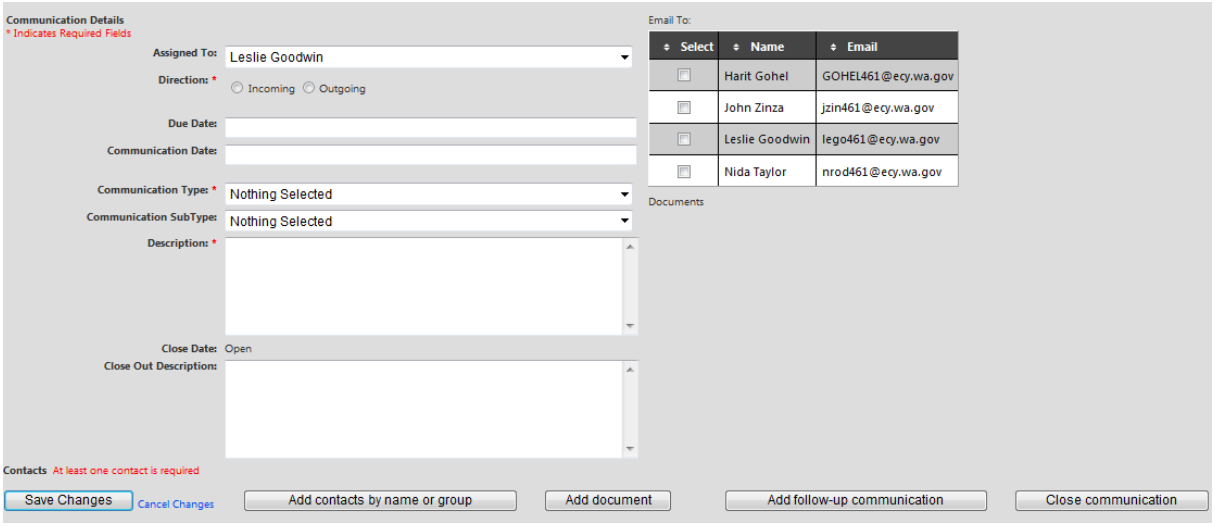
To add a group communication:

1) <u>Click "Add a Communication" from the main/global Communications menu.</u>



The Communication Details popup appears. This is the same popup you use when creating an individual communication from the property communication tab, however, when you try to find/add a contact, no default contacts appear (because no property is selected). Instead, you will use "Find by Name" and "Find by Group" to locate contacts from any properties. If you select

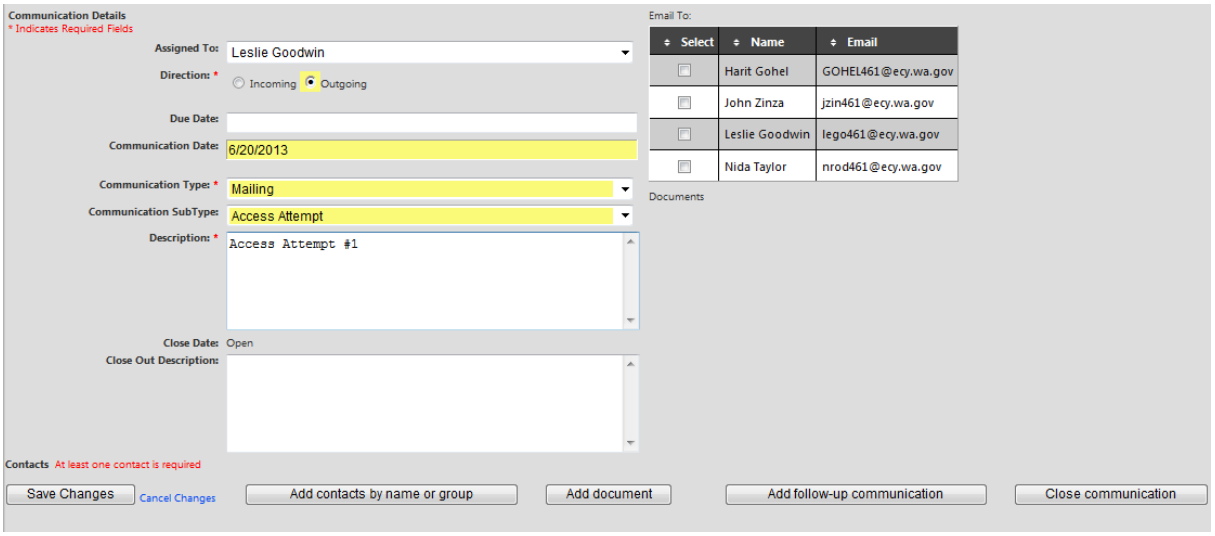
contacts from only one property, this will be an individual communication. If you select contacts from multiple properties, it will be a group communication.



The fields and close/save actions are the same as from "Add an Individual Communication". (See that section for a description, if needed.)

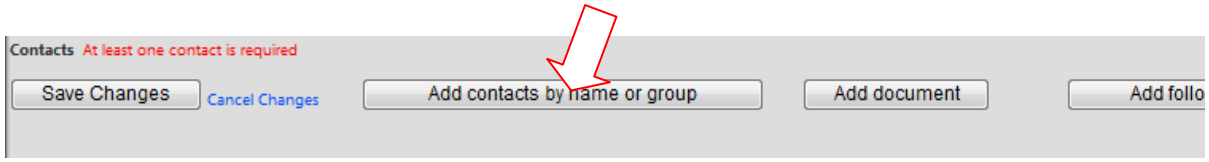
2) **<u>Fill in the communication details</u>**.

The fields turn yellow to indicate pending changes.

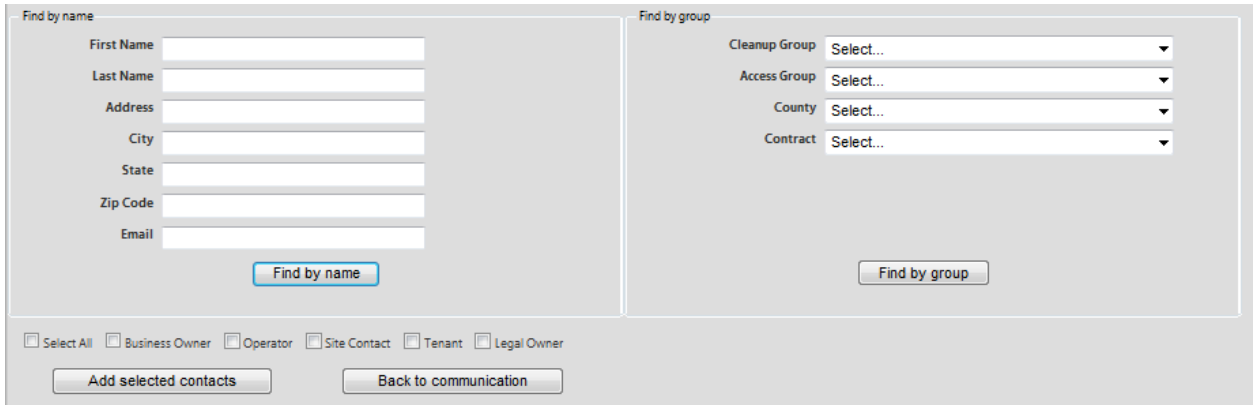


3) Select your contacts

At least one contact is required for every communication. Click "Add contacts by name or group".



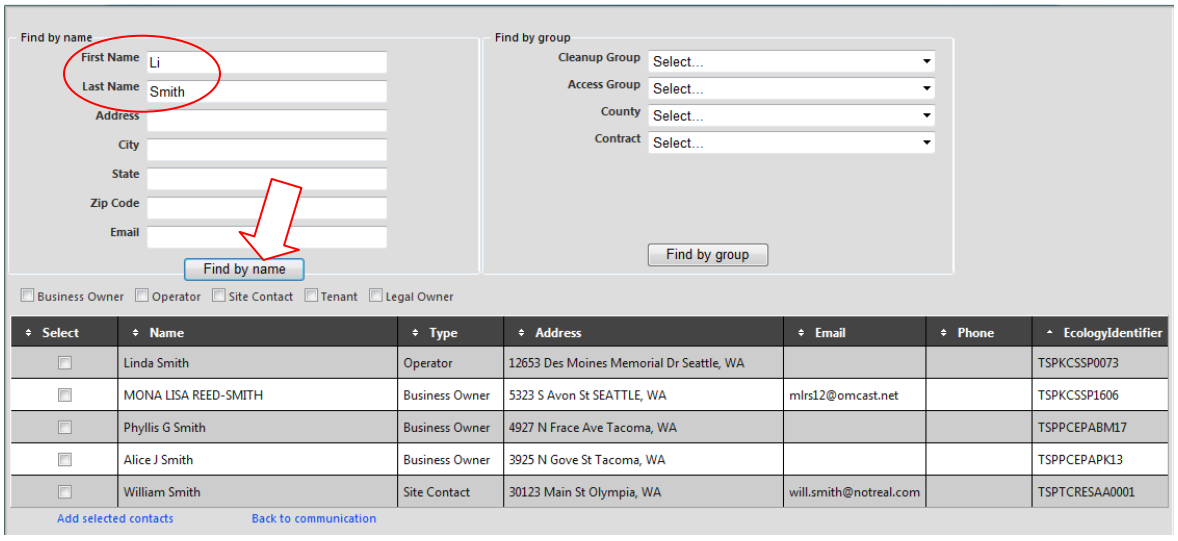
The Find Contact popup appears. You can search by name or by group. The more information you enter, the narrower your search will be.



a) Find by Name: Fill out as many criteria in the "Find by Name" box as you wish, then click "Find by Name". The more information you enter, the narrower your search will be. You can enter parts of a string to be searched:

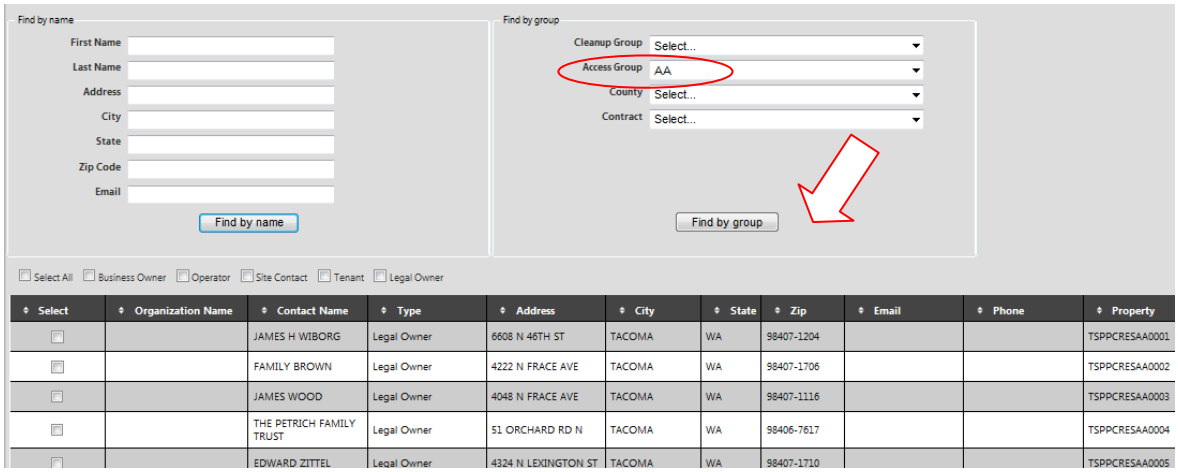
- Entering "Liz" in the first name will find "Liz", "Lizzie", and "Elizabeth".
- Entering "123" for the address will find "123 Main Street" and "50123 North Blvd"

The example below searched for a first name containing "li" and a last name "Smith".



b) Find by Group: Select your criteria from the dropdown boxes, then click “Find by Group”. The more criteria you enter, the narrower your search will be.

The example below searched for any contacts from properties in the “AA” access group.



Select	Organization Name	Contact Name	Type	Address	City	State	Zip	Email	Phone	Property
		JAMES H WIBORG	Legal Owner	6608 N 46TH ST	TACOMA	WA	98407-1204			TSPPCRESAA0001
		FAMILY BROWN	Legal Owner	4222 N FRACE AVE	TACOMA	WA	98407-1706			TSPPCRESAA0002
		JAMES WOOD	Legal Owner	4048 N FRACE AVE	TACOMA	WA	98407-1116			TSPPCRESAA0003
		THE PETRICH FAMILY TRUST	Legal Owner	51 ORCHARD RD N	TACOMA	WA	98406-7617			TSPPCRESAA0004
		EDWARD ZITTEL	Legal Owner	4324 N LEXINGTON ST	TACOMA	WA	98407-1710			TSPPCRESAA0005

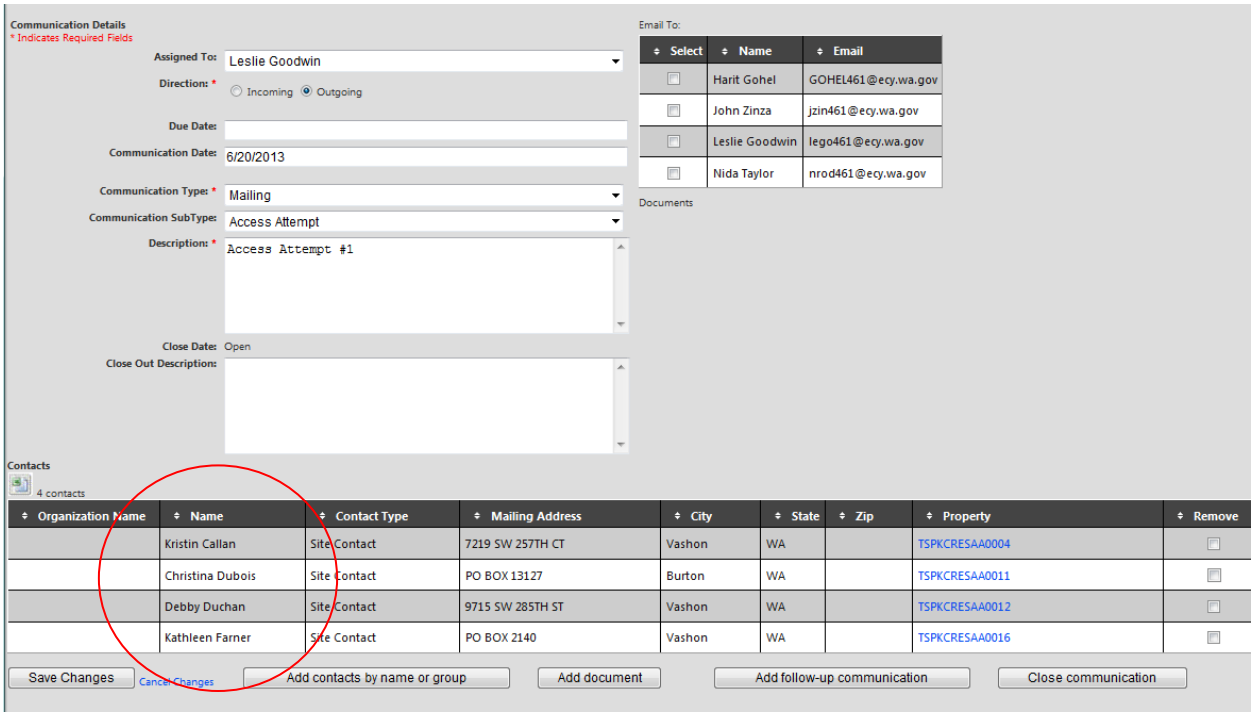
Click the “select” boxes to select your contacts, then click “Add selected contacts”.

- If you select contacts from multiple properties, this will be a group communication. If you select contacts from only one property, this will be an individual communication.
- Use the checkboxes above the results to select groups of contacts. The example below selects all site contacts.

Select	Organization Name	Contact Name	Type	Address
☑		JAMES H WIBORG	Legal Owner	6608 N 46TH ST
☑		FAMILY BROWN	Legal Owner	4222 N FRACE AVE
☑		JAMES WOOD	Legal Owner	4048 N FRACE AVE
☑		THE PETRICH FAMILY TRUST	Legal Owner	51 ORCHARD RD N
☑		EDWARD ZITTEL	Legal Owner	4324 N LEXINGTON ST
☑		LOUISE THOMPSON	Legal Owner	4309 N FRACE AVE

- Click “add selected contacts” to add them to the communication. (You may need to scroll down to see this option – it’s below the list of contacts.)

4) <u>AREIS returns to the Communication Details popup. Your contacts are listed at the bottom.</u>

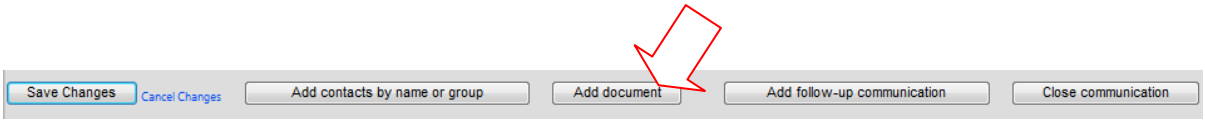


To add additional contacts, click “Add contacts by name or group” again and repeat step 4.

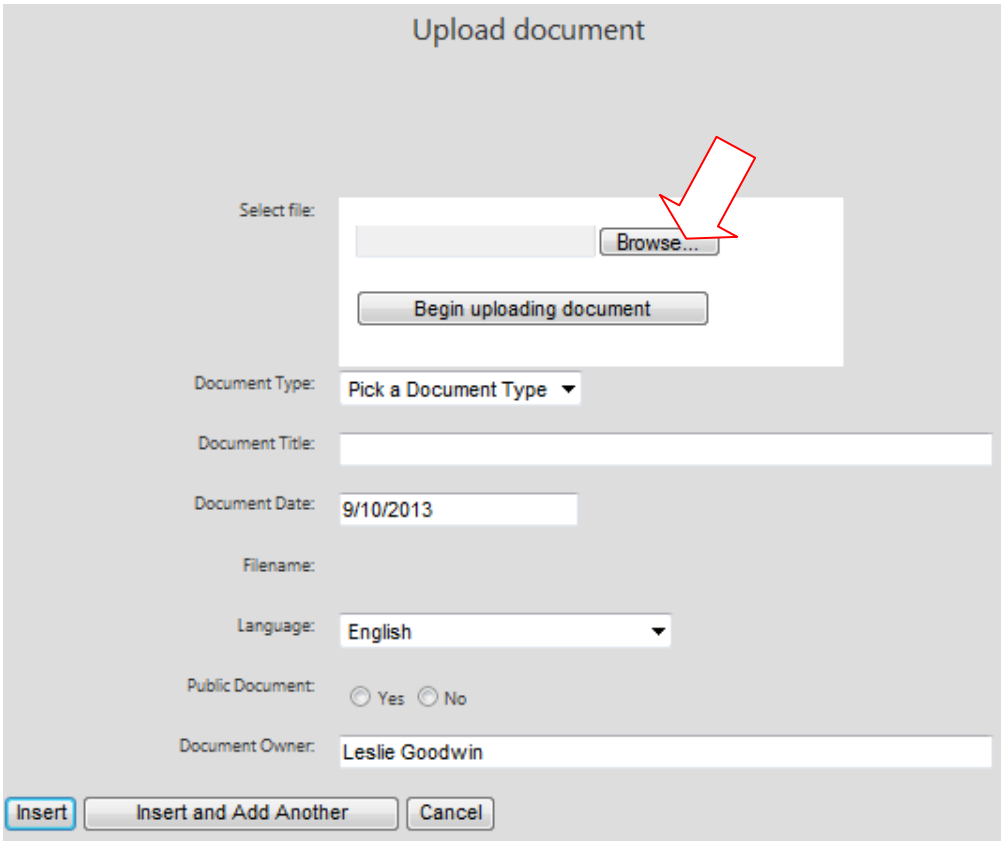
To remove a contact from this communication, click the “Remove” checkbox for that contact.

5) <u>Add/attach any documents that apply to this communication, as needed.</u>

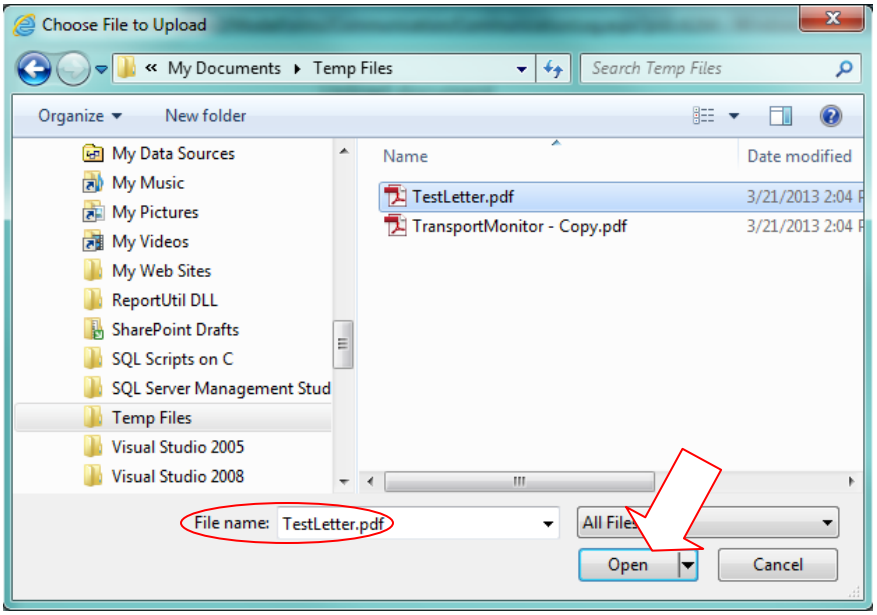
To attach copies of documents, click the “Add Document” button:



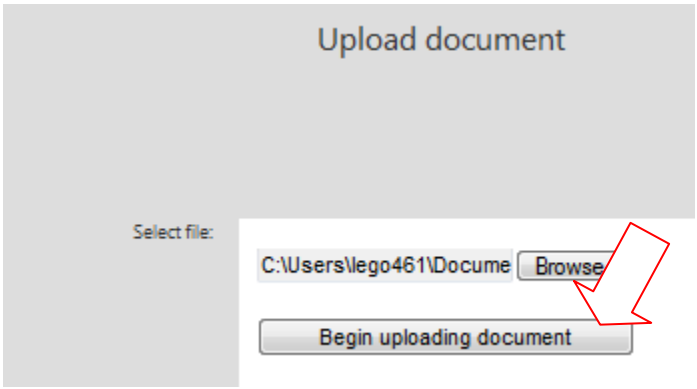
The Upload Document screen appears. First, select the document to be uploaded by clicking "Browse".



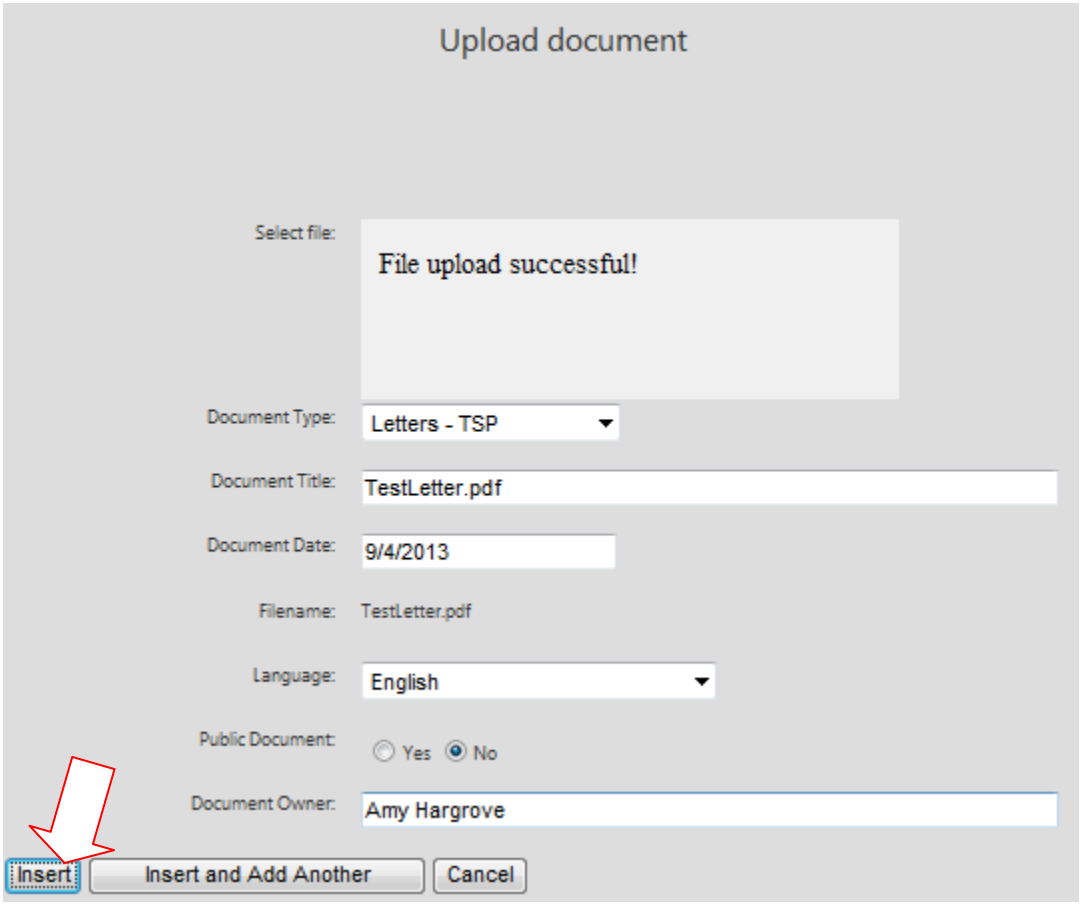
A window opens for you to navigate to thefile to be uploaded. Select the file and click "Open".



Click the “Begin uploading document” button.



The screen refreshes and displays “File upload successful!”. Now fill in the rest of the fields, then click “Insert” or “Insert and Add Another”. (NOTE: Your document is not successfully uploaded and attached to the communication until you click “Insert” or “Insert and Add Another”.)



AREIS returns you to your communication. Your documents are listed.

6) <u>Select your save/follow-up/close option</u>

You can:

Save Changes: Saves all pending changes and closes this popup. This closes the window, not the communication status.

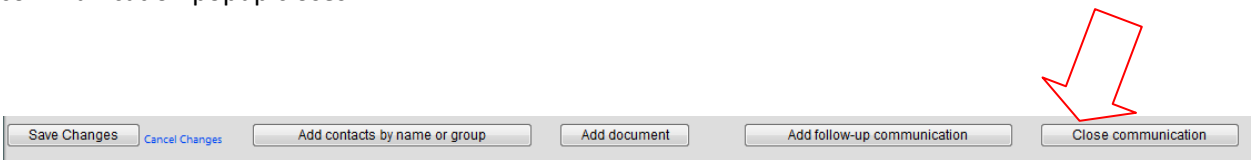
Cancel Changes: Cancel all changes to this communication. If you haven't saved, nothing will be saved.

Add Contacts by Name or Group: Opens the Find Contact popup, where you can find and select the contacts for this communication, i.e., the site contact, owner, operator.

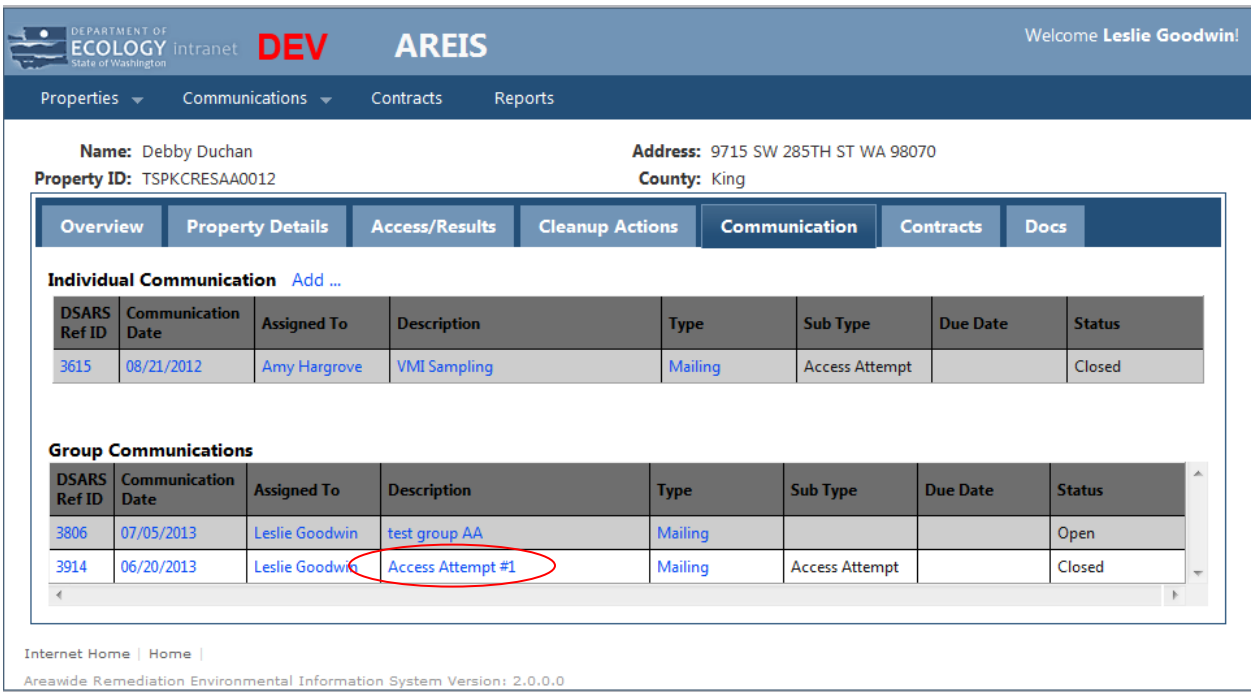
Add Follow-Up Communication: Click to add a follow-up.

Close Communication: Set this communication status to "closed". This does NOT mean to close this popup window.

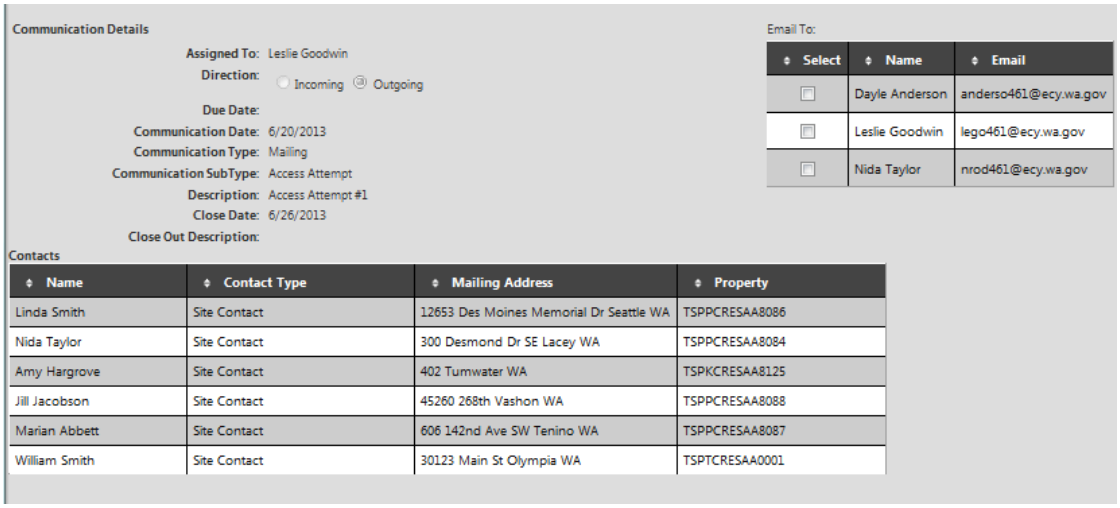
Since you are finished with this communication and don't expect to edit it or create a follow-up, and don't want it to appear on the "Open Communications" screen, select "Close Communication". The communication popup closes.



7) <u>To view this communication</u>, open the property communication page for one of the properties you included on the communication. Your new communication is listed under Group Communications.



You can click the hyperlinked communication to view the communication details in a popup. If the communication is open, it can be edited, closed, or given a follow-up from the popup. This communication is closed, so you can only view it or choose to email it to a user.



Communication Details

Assigned To: Leslie Goodwin
Direction: Incoming / Outgoing
Due Date:
Communication Date: 6/20/2013
Communication Type: Mailing
Communication SubType: Access Attempt
Description: Access Attempt #1
Close Date: 6/26/2013
Close Out Description:

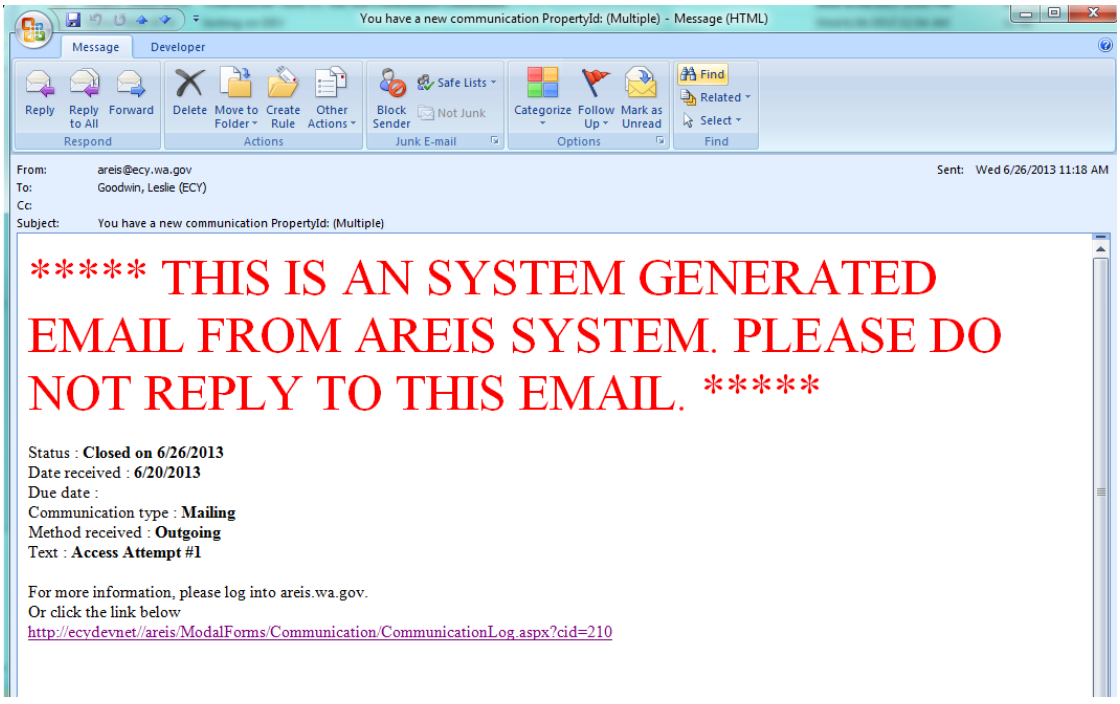
Email To:

Select	Name	Email
☐	Dayle Anderson	anderso461@ecy.wa.gov
☐	Leslie Goodwin	lego461@ecy.wa.gov
☐	Nida Taylor	nrod461@ecy.wa.gov

Contacts

Name	Contact Type	Mailing Address	Property
Linda Smith	Site Contact	12653 Des Moines Memorial Dr Seattle WA	TSPPCRESAA8086
Nida Taylor	Site Contact	300 Desmond Dr SE Lacey WA	TSPPCRESAA8084
Amy Hargrove	Site Contact	402 Tumwater WA	TSPKCRESAA8125
Jill Jacobson	Site Contact	45260 268th Vashon WA	TSPPCRESAA8088
Marian Abbett	Site Contact	606 142nd Ave SW Tenino WA	TSPPCRESAA8087
William Smith	Site Contact	30123 Main St Olympia WA	TSPTCRESAA0001

Below is a sample email that was sent when "Email To" was checked:



You have a new communication PropertyId: (Multiple) - Message (HTML)

Message | Developer

Reply | Reply to All | Forward | Delete | Move to Folder | Create Rule | Other Actions | Block Sender | Safe Lists | Not Junk | Categorize | Follow Up | Mark as Unread | Find | Related | Select

Respond | Actions | Junk E-mail | Options | Find

From: areis@ecy.wa.gov
To: Goodwin, Leslie (ECY)
Cc:
Subject: You have a new communication PropertyId: (Multiple)
Sent: Wed 6/26/2013 11:18 AM

***** THIS IS AN SYSTEM GENERATED EMAIL FROM AREIS SYSTEM. PLEASE DO NOT REPLY TO THIS EMAIL. *****

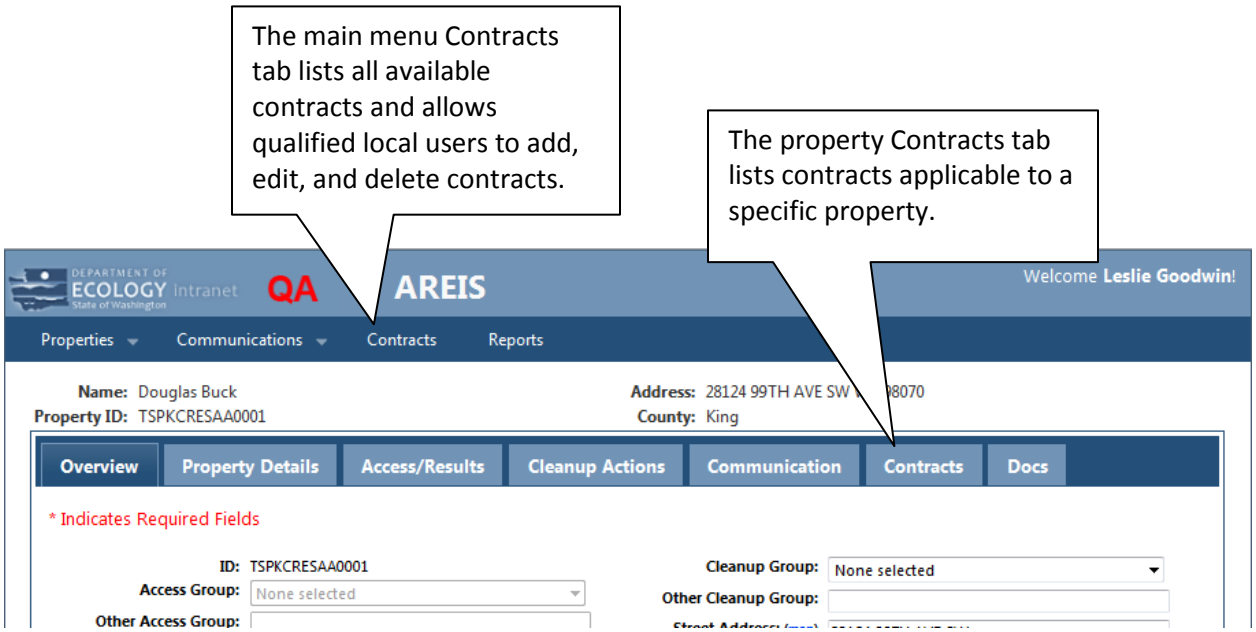
Status : **Closed on 6/26/2013**
Date received : **6/20/2013**
Due date :
Communication type : **Mailing**
Method received : **Outgoing**
Text : **Access Attempt #1**

For more information, please log into areis.wa.gov.
Or click the link below
http://ecydevnet//areis/ModalForms/Communication/CommunicationLog.aspx?cid=210

The "Email to" information is not saved with the communication. You can click to "Email to" any communication at any time.

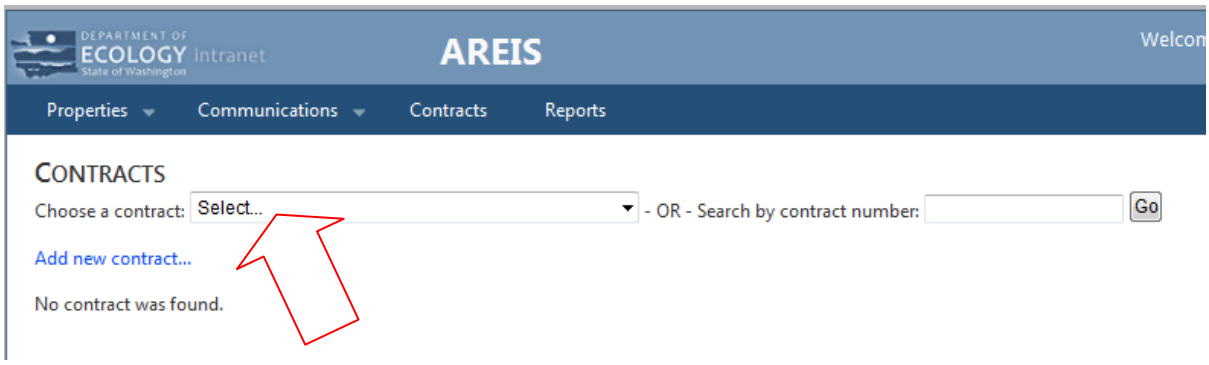
Contracts (Main Menu)

AREIS has two Contracts tab:



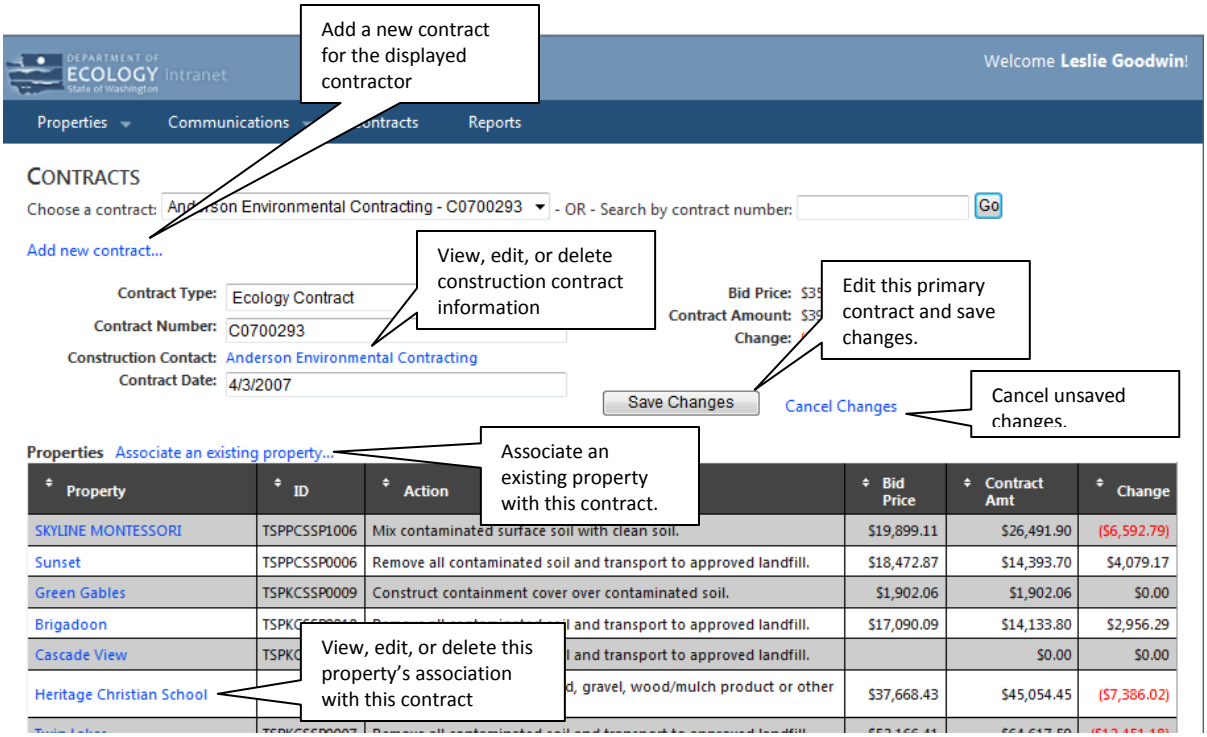
This section of AREIS has some restrictions. Local agency users can add, edit, and assign contracts. County agency users can only view contracts for properties in their respective counties. General users have read-only access.

Clicking the main menu Contracts tab brings up a contracts search form:



Use the dropdown to select a contract, or enter a contract number and press “Go”.

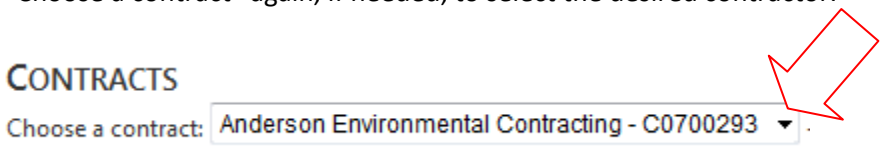
AREIS lists all properties that have been associated with that contract.



From here, you can:

- <u>Edit the current contract, then "Save Changes" or "Cancel Changes"</u>
  You are editing one of the 8-10 main contracts used for TSP cleanup.

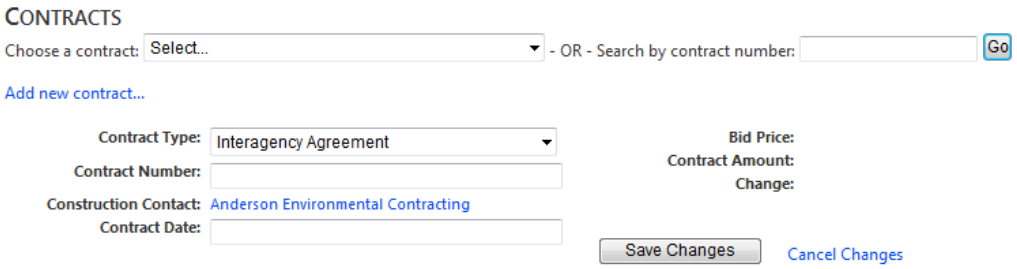
- <u>Add a new contract</u>
  First, "Choose a contract" again, if needed, to select the desired contractor.



The selected contractor's name is displayed in blue under the contract number field.

Next, click “Add new contract …”

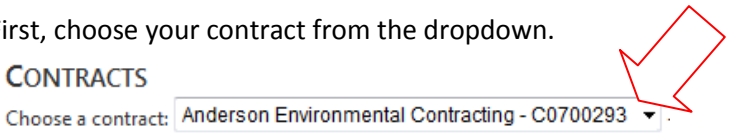
The screen changes, allowing you to enter new contract details, then save or cancel your changes. (It looks similar to the previous screen except there is no contract numer, and the bid price, contract amount, and change are blank.)



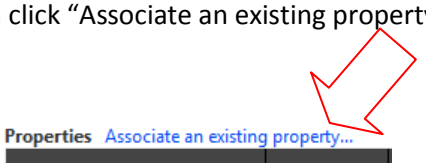
Add your new contract information and save changes, or cancel changes.

- <u>Associate an existing property</u>
  This can also be done from the property contract screen. If you do it here, you’ll need to know the property ID to associate with this contract.

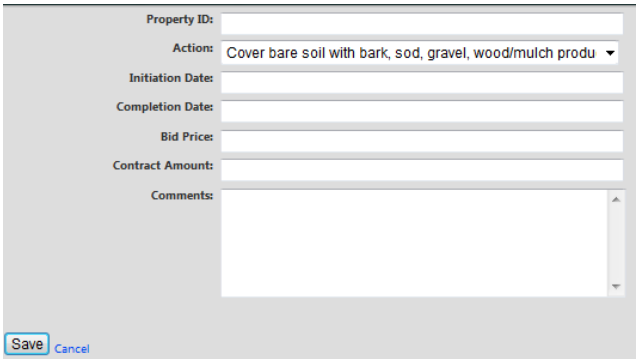
  First, choose your contract from the dropdown.



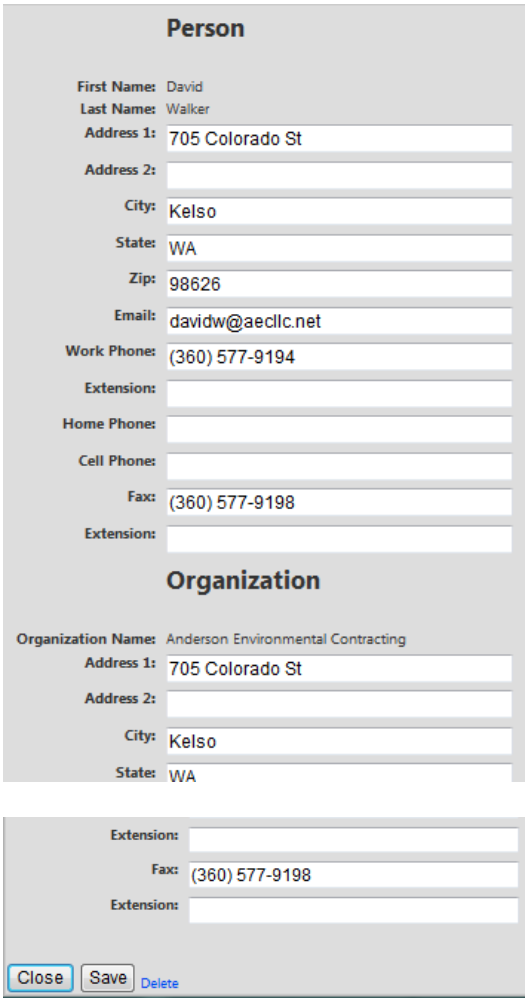
  Then click “Associate an existing property …”



A popup appears. Enter the property ID and contract information, then save or cancel your changes.

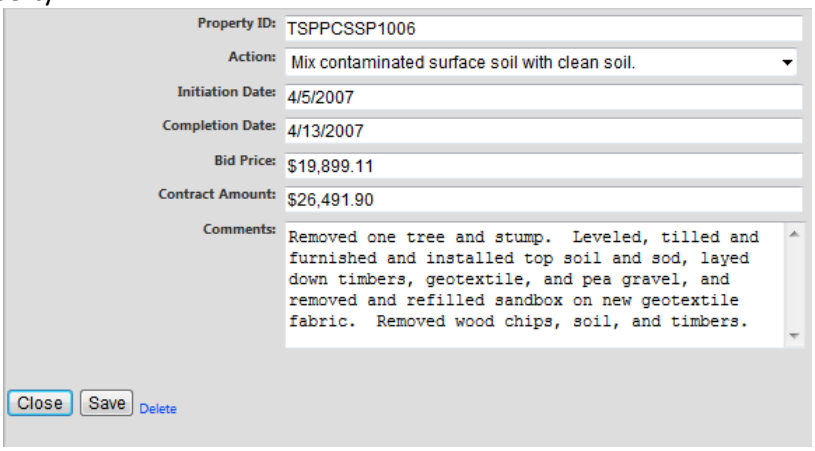


- Click the construction contact to view and edit the person/organization name for this contractor



Close without saving, edit and save changes, or delete this person/organization information.

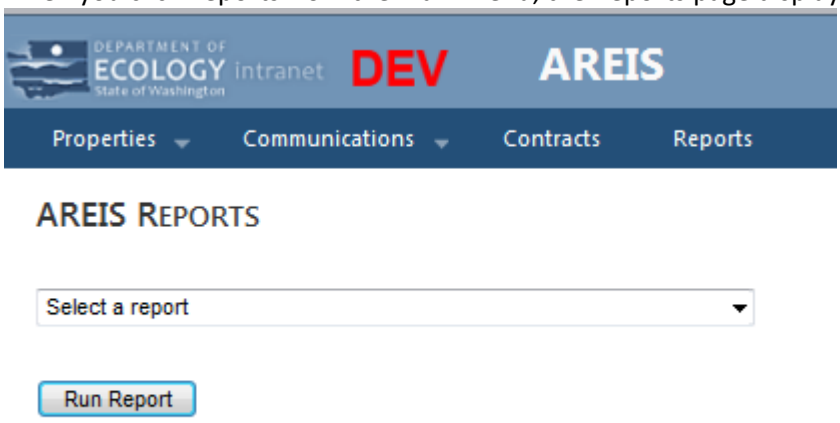
- Click a property name. A popup allows you to view, edit, or delete the contract for that property.



Reports Tab

The main menu "Reports" tab offers useful reports for data stored in AREIS.

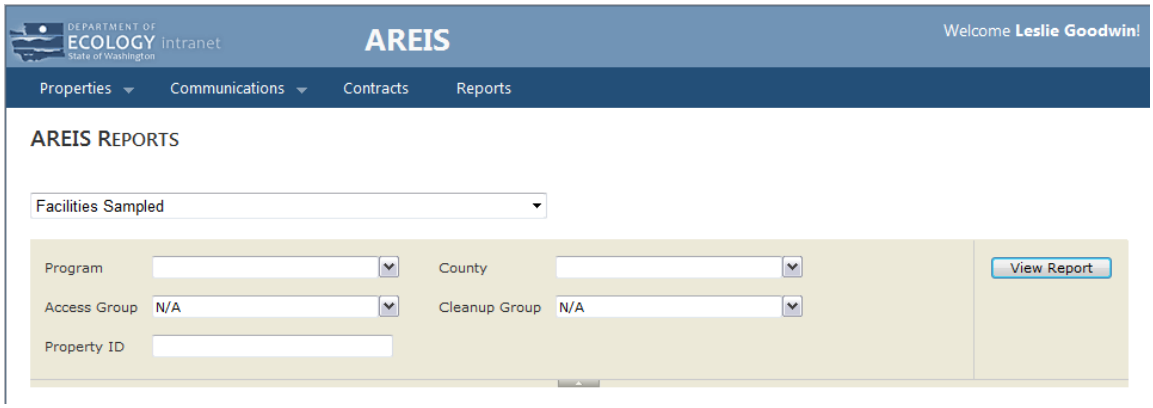
When you click Reports from the main menu, the Reports page displays:



1. Run a report:

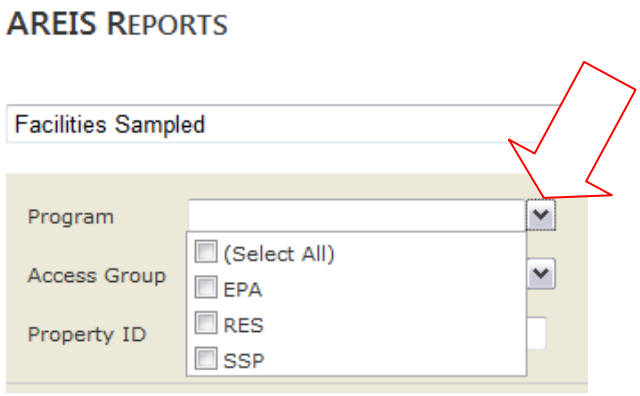
1) Click to select a report from the dropdown list.

AREIS displays a list of parameters (selection criteria) for the report you selected. In the example below, the user selected the Facilities Sampled report, so AREIS requested the program, county, access group, cleanup group, and property ID. This is the most commonly requested set of parameters, but there may be more, less, or different parameters depending upon the report you selected.

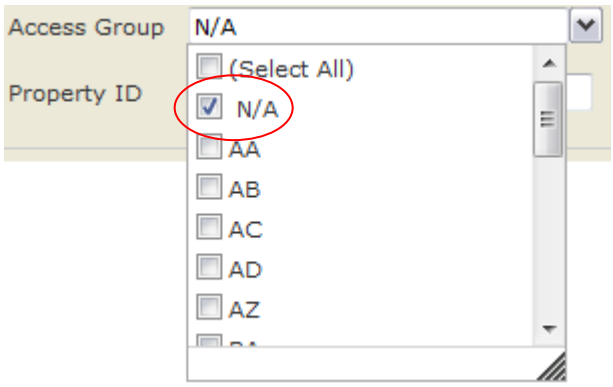


2) Select your responses from the list of report parameters.

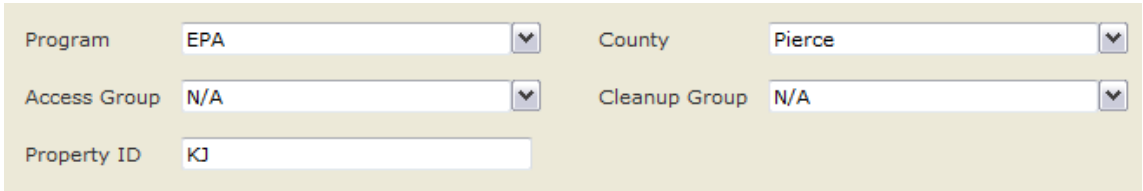
For the dropdown boxes, you can make multiple selections by clicking multiple items. "Select all" toggles on and off (clicking it a first time selects all items, clicking it a second time de-selects all items).



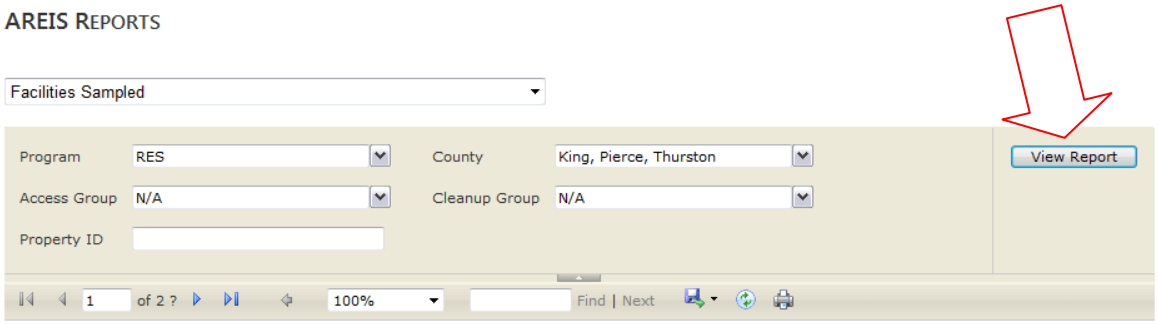
N/A – Some parameters default to "N/A". If "N/A" is checked, AREIS will ignore that parameter. In the example below, if you want to select all "AA" access groups, you need to UN-check "N/A". If you select "N/A" and other items (AA, AB,AC), then "N/A" will still apply, and AREIS will ignore that parameter.



Property ID – you can enter a full property ID, or just a portion of a property ID. For example, if you wanted to select all EPA properties in the Pierce County "KJ" area, you couldn't do this by selecting the "KJ" access group – the EPA properties don't have access groups. You can find all EPA properties in the Pierce County KJ area by selecting program type "EPA", county "Pierce", and property "KJ".



3) Click “View Report”.

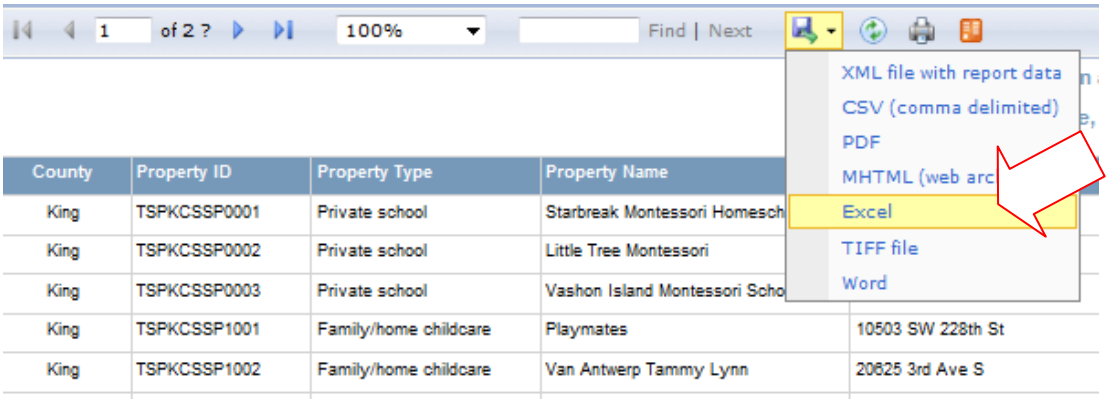


4) The report displays. You have several options:

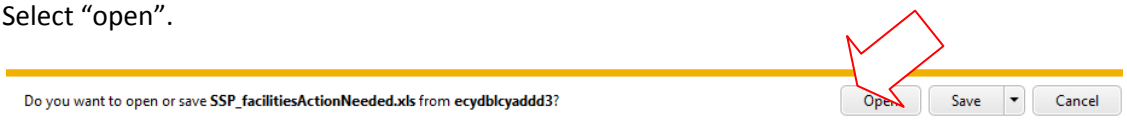
a) If a column name displays up/down arrows, you can click the arrows to re-sort the report by that column.

b) Use the icons/buttons at the top of the report to move to the first or last page, print, refresh, or export the report.

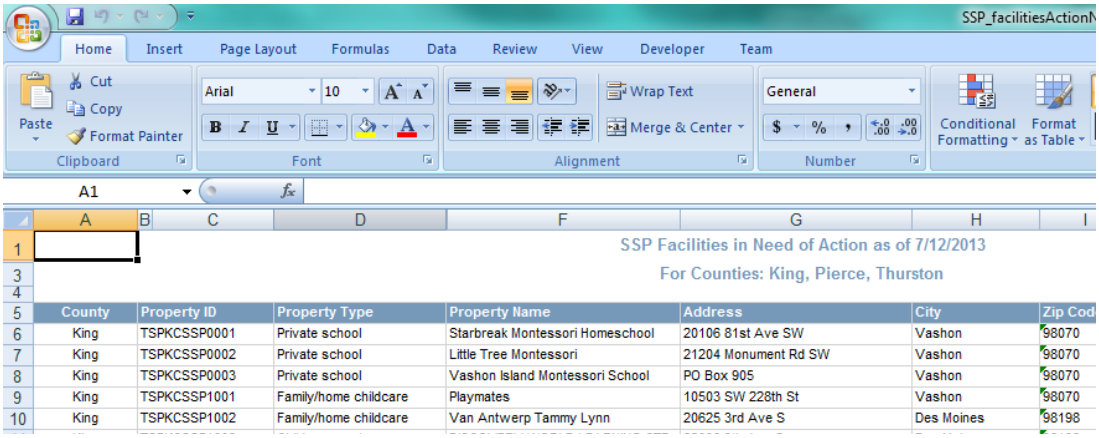
c) To export the report to Microsoft Excel, click the export menu and select “Excel”



A message at the bottom of your screen will ask whether you want to open or save the file. Select “open”.



Your report will open in Microsoft Excel. It can be edited, saved, and manipulated like any Excel file.



County	Property ID	Property Type	Property Name	Address	City	Zip Cod
King	TSPKCSSP0001	Private school	Starbreak Montessori Homeschool	20106 81st Ave SW	Vashon	98070
King	TSPKCSSP0002	Private school	Little Tree Montessori	21204 Monument Rd SW	Vashon	98070
King	TSPKCSSP0003	Private school	Vashon Island Montessori School	PO Box 905	Vashon	98070
King	TSPKCSSP1001	Family/home childcare	Playmates	10503 SW 228th St	Vashon	98070
King	TSPKCSSP1002	Family/home childcare	Van Antwerp Tammy Lynn	20625 3rd Ave S	Des Moines	98198

d) You can change the report criteria and re-run the report.

2. Mail Merge

You can easily generate a data source for your mail merge using the AREIS mail merge reports. These reports can be downloaded to Microsoft Excel, where you can save them and use them with Microsoft Word or whatever word process you are using.

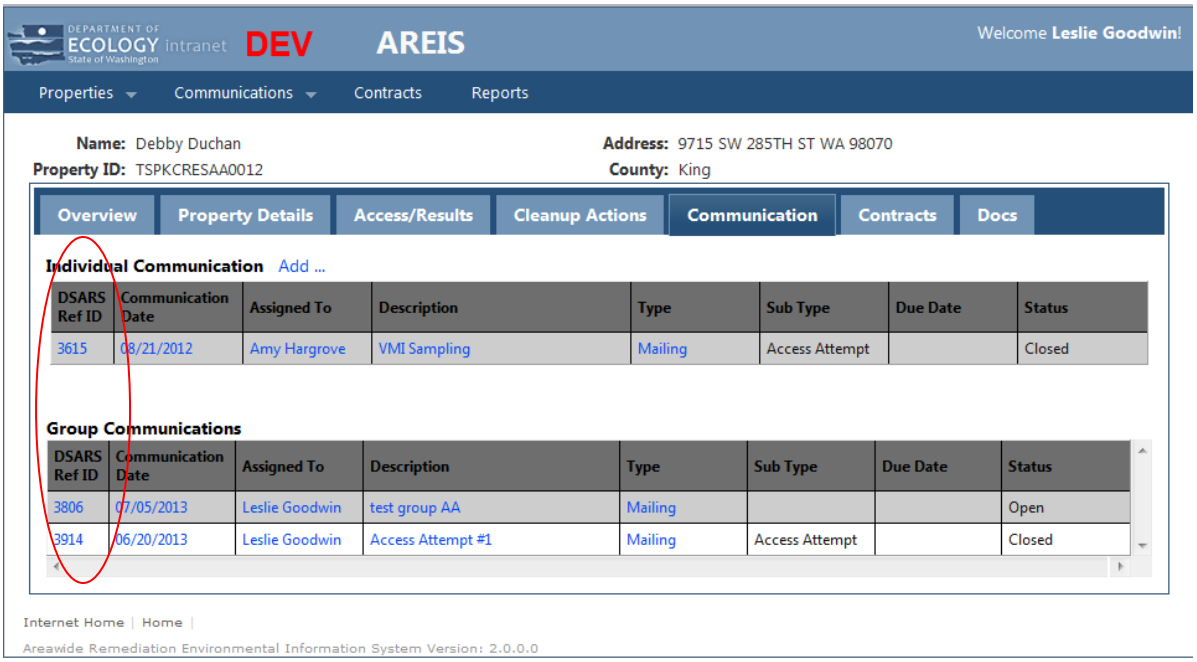
Suppose you wanted to create a big mailout – the first access attempt letter to the Pierce County "AC" access group.

1) Create a group communication. **Don't close the communication**!! (Don't set the status to "closed".) For this example, the communication subtype would be "Access Attempt." Set your communication due date for whenever you expect to send the letters – this will be a pending task, and we're going use it to assemble the mailing list.

2) Select the properties and contacts. You'll probably start with the Pierce County "AB" group. Then you might add a few "AZ" properties that you know belong here. You'll look through the list and remove properties that already have access agreements or have denied access. When you're finished creating your contact list, save the communication. **Don't close this communication**!!

3) Get your communication ID.

   View open communications,or search for the communication, and note the "DSARS Ref ID" for that communication. That is your Communication ID.



4) Run the "Mail Merge – Search by Communication ID" report. When AREIS requests the communication ID, enter the communication ID you found in step 3, then click "View Report".

5) AREIS creates the report. Export the report to Microsoft Excel (see step 4 of the previous section) and save the new spreadsheet.

6) Using Microsoft Word or another word processing software, create your mail merge template. Use your new spreadsheet as the data source, and run your mail merge. (For instructions to create a mail merge template and run a mail merge, see help for your word processing software.)

7) Suggestion: If you're going to be sending a second access attempt, and then a third, to this group, don't close your communication until the series of access attempts is complete. Instead, when your're ready to create the second access attempt, create a follow-up to your first access attempt communication. AREIS will default your follow-up to have the same contacts. In the follow-up, remove the contacts/properties that have responded to your first mailing (access agreements granted or denied), then use the follow-up to create your second access attempt mailing. Repeat for the third access attempt mailing.

   If you don't want to use a communication to create your mail merge data source, you can assemble it using "Mail Merge – Search by Property". This report allows requests parameters to select properties and contacts. The report can be exported to Excel and used as a mail merge data source.