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## LETTER OF TRANSMITTAL

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To: Ms. Piper Peterson Lee – EPA, Region 10  
1200 Sixth Avenue, Suite 900, ECL-111  
Seattle, WA 98101-3140  
Date: April 22, 2009

From: Tom Meyer – City of Seattle  
Nick Varnum – Integral Consulting Inc.

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Project reference: **T-117 Quality Assurance Project Plan (QAPP) Addendum – Adjacent Streets PCB Boundary Refinement**

<u>Hardcopy:</u>	<u>Electronic:</u>	<u>Description:</u>
<u>1</u>	<u>X</u>	<u>Cover letter for transmittal of QAPP</u>
<u>2</u>	<u>X</u>	<u>QAPP text, tables, and figures, dated April 17, 2009</u>

cc:

<u>Hardcopy:</u>	<u>Electronic*:</u>	<u>Name:</u>	<u>Affiliation:</u>
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1	X	Kris Flint	EPA, Region 10
1	X	Rick Thomas	Dept of Ecology
1	X	Brad Helland	Dept of Ecology
1	X	Marla Steinhoff	NOAA
1	X	Glen St. Amant	Muckleshoot Tribe
1	X	B.J. Cummings	Duwamish River Cleanup Coalition
1	X	Thea Levkovitz	Duwamish River Cleanup Coalition
1	X	Heather Trim	People for Puget Sound
2	X	Roy Kuriowa	Port of Seattle
4	X	T-117 Technical Team	Windward, DOF, ENSR, Integral

\* Electronic version of complete document is available online on the project portal.



# City of Seattle

Gregory J. Nickels, Mayor

## Seattle City Light

Jorge Carrasco, Superintendent

April 21, 2009

Piper Peterson Lee  
Superfund Project Manager  
ECL-111, Region 10  
U.S. Environmental Protection Agency  
1200 Sixth Avenue  
Seattle, WA 98101-3140

**Subject: T-117 Quality Assurance Project Plan (QAPP) Addendum – Adjacent Streets PCB Boundary Refinement**

Dear Ms. Peterson Lee:

The City of Seattle, in coordination with the Port of Seattle, is pleased to submit to you the above-referenced QAPP Addendum for refinement of the T-117 Adjacent Streets PCB boundary. This final includes revisions made in response to EPA/Stakeholder comments on the March 6 version of this QAPP Addendum. Note that this is an addendum to the 2003 Lower Duwamish Waterway Superfund Site, Terminal 117 Early Action Area QAPP (Windward et al. 2003).

Please feel free to contact me at 206.386.9168 ([tom.meyer@seattle.gov](mailto:tom.meyer@seattle.gov)) if you have any questions.

Sincerely,

A handwritten signature in blue ink, appearing to read "Tom Meyer", written over a light blue background.

Tom Meyer  
Environmental Affairs  
City of Seattle/City Light Department

Enclosure



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Piper Peterson Lee  
April 21, 2009  
Page 2

cc: Kris Flint, EPA  
Kym Takasaki, USACE  
Roy Kuroiwa, Port of Seattle  
B.J. Cummings, DRCC  
Thea Levkovitz, DRCC  
Glen St. Amant, Muckleshoot Tribe  
Heather Trim, People for Puget Sound  
Marla Steinhoff, NOAA  
Rick Thomas, Ecology  
Brad Helland, Ecology  
Warren Hansen, Windward  
Grant Hainsworth, ENSR  
Nick Varnum, Integral



# QUALITY ASSURANCE PROJECT PLAN

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## Addendum – Adjacent Streets PCB Boundary Refinement Lower Duwamish Waterway Superfund Site Terminal 117 Early Action Area

Prepared for

**City of Seattle**  
and  
**Port of Seattle**

For submittal to

**US Environmental Protection Agency, Region 10**  
1200 Sixth Avenue  
Seattle, WA 98101

Prepared by



411 1<sup>st</sup> Avenue South, Suite 550  
Seattle, WA 98104

April 17, 2009



## SECTION A: PROJECT MANAGEMENT

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### A1 TITLE AND APPROVAL PAGE

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**QUALITY ASSURANCE PROJECT PLAN  
ADDENDUM – ADJACENT STREETS PCB BOUNDARY REFINEMENT  
SEATTLE, WASHINGTON**

Quality Assurance Project Plan Approvals

**Integral Project Manager**



Nick Varnum, L.G.

April 17, 2009

Date

**Integral QA Manager**



Kimberly Magruder Carlton

April 17, 2009

Date

**EPA Project Manager**

Piper Peterson Lee

Date

**EPA QA Manager**

Ginna Grepo-Grove

Date



Nick Varnum

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## ACRONYMS AND ABBREVIATIONS

ACRONYM	DEFINITION
<b>ASAOC</b>	Administrative Settlement Agreement and Order on Consent
<b>CAS</b>	Columbia Analytical Services, Inc.
<b>CERCLA</b>	Comprehensive Environmental Response, Compensation and Liability Act
<b>CFR</b>	Code of Federal Regulations
<b>City</b>	City of Seattle
<b>COC</b>	chemical of concern
<b>cPAH</b>	carcinogenic polycyclic aromatic hydrocarbon
<b>CSM</b>	conceptual site model
<b>CUL</b>	cleanup level
<b>dioxins/furans</b>	polychlorinated dibenzo- <i>p</i> -doixins and polychlorinated dibenzofurans
<b>DQI</b>	data quality indicator
<b>DQO</b>	data quality objective
<b>DU</b>	decision unit
<b>EAA</b>	early action area
<b>Ecology</b>	Washington State Department of Ecology
<b>EDD</b>	electronic data deliverable
<b>EE/CA</b>	engineering evaluation/cost analysis
<b>EPA</b>	US Environmental Protection Agency
<b>HASP</b>	health and safety plan
<b>mg/kg</b>	milligram per kilogram
<b>MIS</b>	multi-increment sampling
<b>MQO</b>	measurement quality objective
<b>ng/kg</b>	nanogram per kilogram
<b>NTCRA</b>	non-time-critical removal action
<b>PARCC</b>	precision, accuracy or bias, representativeness, completeness, and comparability
<b>PCB</b>	polychlorinated biphenyl
<b>PCDDs/PCDFs</b>	polychlorinated dibenzo- <i>p</i> -doixins and polychlorinated dibenzofurans
<b>Port</b>	Port of Seattle
<b>ppm</b>	parts per million
<b>ppt</b>	parts per thousand
<b>QA</b>	quality assurance
<b>QAPP</b>	quality assurance project plan
<b>QA/QC</b>	quality assurance/quality control
<b>ROW</b>	right-of-way
<b>SOP</b>	standard operating procedures
<b>Streets and Yards QAPP</b>	Investigation of Potential PCDD/PCDF Contamination in Soil City Street Rights-of-Way and Residential Yards QAPP (Integral 2008)
<b>T-117</b>	Terminal 117
<b>TPH</b>	petroleum hydrocarbon
<b>WAC</b>	Washington Administrative Code

### **A3 DISTRIBUTION LIST**

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EPA Project Manager:	Piper Peterson Lee
EPA Technical Advisor:	Kym Takasaki
EPA QA Manager	Ginna Grepo-Grove
City of Seattle Project Manager:	Tom Meyer
Port of Seattle Project Manager, T-117 Project Coordinator:	Roy Kuroiwa
Integral Project Manager:	Nick Varnum
Integral QA Coordinator:	Kim Magruder Carlton
Integral Task Manager/Field Coordinator:	Susan FitzGerald
CAS Project Manager:	Greg Salata
CAS QA Manager:	Lee Wolf
EcoChem Data Validation and Verification Specialist:	Linda Bohannon

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## **A4 BACKGROUND AND PROBLEM DEFINITION**

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This addendum to the Terminal 117 (T-117) Early Action Area (EAA) Quality Assurance Project Plan (QAPP; Windward et al. 2003) provides guidance to field and laboratory personnel for the acquisition and analysis of soil samples to be collected from areas of City of Seattle rights-of-way (ROWs) and residential yards outside the Adjacent Streets portion of the T-117 EAA non-time-critical removal area (NTCRA) boundary.

The City of Seattle (City) and the Port of Seattle (Port) are currently performing an NTCRA at the T-117 EAA under the authority of the Administrative Settlement Agreement and Order on Consent (ASAOC) for the T-117 EAA pursuant to the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) (USEPA 2005a). The City is the lead in performing tasks that address the Adjacent Streets portion of the NTCRA EAA (USEPA 2005a). This investigation includes locations within and immediately adjacent to the Adjacent Streets, and thus is being performed by the City in cooperation with the US Environmental Protection Agency (EPA).

The purpose of this investigation is to determine whether areas along South Cloverdale Street, 16th Avenue South, and South Donovan Street should be included in the EAA removal boundary. The results of this investigation may be incorporated into a revision of the 2008 Engineering Evaluation/Cost Analysis (EE/CA) (Windward et al. 2008a) or used during design to address the presence of polychlorinated biphenyls (PCBs) beyond the current EAA boundary. The objectives of this work are as follows:

- ◆ Determine the vertical extent of the T-117 EAA PCB remedial boundary within northern and southern planting strips along South Cloverdale Street where PCB cleanup level exceedances are known to exist in surface soil
- ◆ Conduct sampling in residential yards along the north side of South Cloverdale Street and the south side of Dallas Avenue South between 14th and 16th Avenue South to determine whether residential soils contain PCBs above the cleanup level (CUL)
- ◆ Confirm that PCB concentrations along portions of the eastern and western margins of 16th Avenue South and along the base of the hill on the lower part (westbound lane) of South Donovan Street are below the CUL
- ◆ Evaluate the southern extent of the current EAA boundary near the intersection of 16th Avenue South and South Cloverdale Street.

The scope of this additional work consists of analysis of archived discrete samples collected in 2008, collection and analysis of new discrete samples, and sampling and analysis of portions of residential yards and right-of-way areas adjacent to streets using a multi-increment sampling (MIS) methodology. The program described herein is based on the working assumption that a final soil CUL for PCBs will be set at 1 milligram per kilogram (mg/kg) or part per million (ppm).

EPA will be conducting analysis of polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (referred to as PCDDs/PCDFs, or dioxins/furans) on the samples collected as part of this QAPP. Details, including sample handling and analysis associated with this effort will be provided in a separate QAPP generated by EPA.

This T-117 QAPP addendum addresses details that are specific to this PCB boundary refinement soil investigation. The T-117 QAPP (Windward et al. 2003) and the *Investigation of Potential PCDD/PCDF Contamination in Soil City Street Rights-of-Way and Residential Yards QAPP* (Streets and Yards QAPP; Integral 2008) are referenced, as appropriate, for details that remain unchanged from previous investigations.

#### **A4.1 Background**

Background information about the site can be found in the 2008 draft EE/CA (Windward et al. 2008a) and the Streets and Yards QAPP (Integral 2008).

#### **A4.2 Problem definition**

This QAPP Addendum has been prepared to describe additional sampling and analysis efforts to be undertaken to refine the delineation of PCB exceedances for the purposes of soil removal.

Sampling conducted in 2008 in adjacent streets and yards resulted in the detection of PCBs above the CUL in soil in certain locations along South Cloverdale Street. This led to the determination that data gaps exist as well on 16th Avenue South and South Donovan Street with respect to possible PCB exceedances in those areas. In addition, EPA has directed the City to use multi-increment sampling techniques for residential properties and rights-of-way in this investigation. Summaries of the existing data and identified data gaps in these areas are included with the discussion of sampling design in Section B1.

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## **A5 ORGANIZATION AND SCHEDULE**

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This section presents the organizational structure and schedule for activities associated with this investigation.

### **A5.1 Task organization**

Integral is performing this investigation on behalf of the City, in coordination with the Port and EPA. The organizational structure and associated contact information for this investigation is presented below.

#### **A5.1.1 Regulatory agency management**

EPA Project Manager – Piper Peterson Lee from EPA is the remedial project manager with responsibility for overseeing the implementation of the T-117 NTCRA. All submittals associated with this investigation will be delivered to the EPA remedial project manager.

EPA QA Manager – Ginna Grepo-Grove is the EPA QA Manager.

#### **A5.1.2 City and Port management**

City Project Manager – Tom Meyer is the City’s program manager and primary City point of contact for the T-117 NTCRA and for this investigation. Mr. Meyer will coordinate with Mr. Roy Kuroiwa, who is the program manager on behalf of the Port and the designated lead project coordinator for the T-117 NTCRA.

#### **A5.1.3 Integral project personnel**

Project Manager – Nick Varnum is Integral’s project manager. Mr. Varnum will have responsibility for the overall implementation of the investigation. His duties include planning and coordinating the investigation, and overseeing and reviewing all project deliverables for completeness, accuracy, and quality. In the event that changes due to field conditions are needed, Mr. Varnum will ensure that proposed changes are coordinated with the City’s project manager.

Project QA Coordinator – Kim Magruder Carlton is the QA coordinator. She is responsible for providing overall direction to the testing laboratory. She will also work closely with the laboratory project and QA managers to ensure that the objectives of the QAPP are met. Ms. Magruder Carlton is responsible for ensuring that laboratory method development (if needed) is satisfactorily completed prior to the analysis of samples, coordinating with the testing laboratory and tracking the laboratory’s progress, verifying that the laboratory has implemented the requirements of this QAPP, addressing QA issues related to sample analyses, ensuring that laboratory capacity is sufficient to undertake the required analyses in a timely manner, and addressing scheduling issues related to sample analyses. She is the primary point of contact for the Data Validation and Verification Specialist.

Task Manager/Field Coordinator – Susan FitzGerald is the task manager and field coordinator for the investigation. Ms. FitzGerald will be responsible for all aspects of sampling, including coordinating production of this QAPP, field sampling preparation, and contracting and overseeing the drilling subcontractor. She is also responsible for ensuring that appropriate sampling, quality assurance, and documentation procedures are used.

MIS Specialist – Ms. FitzGerald will be assisted with MIS sampling by William Cutler. Mr. Cutler will be available to consult on establishing random sampling grids, sample collection and MIS subsample collection.

Project Data Manager – Gerald Palushock is the project data manager. Mr. Palushock will have primary responsibility for data management and database maintenance. Mr. Palushock will work with the field crew to ensure field data entries are correct and complete, and with the QA coordinator to ensure that the data are delivered in the correct format for entry into the Integral project database, and to ensure correct and efficient entry of data qualifiers. Mr. Palushock will also be responsible for taking all necessary measures to develop and maintain the integrity and completeness of the database, and for providing various data summaries to data users for interpretation and importing into the T-117 EE/CA database.

#### **A5.1.4 Integral project subcontractors**

Major services subcontracted through Integral for this investigation include the laboratory analyses, data validation, and subsurface drilling.

*Columbia Analytical Services, Inc.*

The following responsibilities apply to the project managers and QA managers at Columbia Analytical Services, Inc. (CAS):

Laboratory Project Manager – The laboratory project manager is Greg Salata at CAS. He is responsible for ensuring that the laboratory sample processing and analyses are successful and completed in a timely manner, as well as the following actions:

- ◆ Ensuring that samples are received and logged in correctly, that the correct methods and modifications are used, and that data are reported within specified turnaround times
- ◆ Reviewing analytical data to ensure that procedures were followed as required in this QAPP, the cited methods, and laboratory standard operating procedures (SOPs)
- ◆ Keeping the Integral QA coordinator apprised of the schedule and status of sample analyses and data package preparation

- ◆ Notifying the Integral QA coordinator if problems occur in sample receiving, analysis, or scheduling, or if control limits cannot be met
- ◆ Taking appropriate corrective action as necessary
- ◆ Reporting data and supporting QA information as specified in this QAPP.

Laboratory QA Manager – The laboratory QA manager is Lee Wolf at CAS. He is responsible for overseeing the QA activities in the laboratory and ensuring the quality of the data for this task. Specific responsibilities include the following:

- ◆ Overseeing and implementing the laboratory's QA program
- ◆ Maintaining QA records for each laboratory production unit
- ◆ Ensuring that quality assurance/quality control (QA/QC) procedures are implemented as required for each method and providing oversight of QA/QC practices and procedures
- ◆ Reviewing and addressing or approving nonconformity and corrective action reports.

#### *EcoChem, Inc.*

Linda Bohannon of EcoChem, Inc. will be performing data validation and verification. Ms. Bohannon is responsible for verifying the accuracy of the laboratory electronic data deliverables (EDDs) (i.e., verifying that analytical procedures and calculations were completed correctly and checking transcriptions of the laboratory data) for the first data package for each analysis as part of the full validation that will be completed for these packages, validating the laboratory data, communicating any data quality issues to the Integral QA coordinator, and working with the QA coordinator to address any data limitations. The data validation and verification specialist will work closely with the Integral QA coordinator to ensure that the objectives of this QAPP are met.

#### *Cascade Drilling, Inc.*

Cascade Drilling, Inc. of Woodinville, Washington will be contracted to work with the Integral field crew to accomplish the aspects of this investigation that call for subsurface pushprobe soil sampling. Cascade personnel will work closely with the Integral task manager/field coordinator to ensure that the objectives of this QAPP are met.

## **A5.2 Schedule**

A preliminary schedule for this investigation, beginning with the submission of this QAPP through submittal of the draft investigation report to EPA and stakeholders, is outlined in the following table.

<b>MILESTONE</b>	<b>COMPLETION DATE (APPROXIMATE)</b>
Draft QAPP to EPA/Stakeholders	March 6, 2009
EPA/Stakeholder Comments on Draft QAPP	March 27, 2009
Final QAPP to EPA/Stakeholders	April 13, 2009
Field Sampling	April 20, 2009
Sample Analysis	
Final Data Package from Laboratory	May 18, 2009
Data Validation	May 22, 2009
Draft Investigation Report to EPA/Stakeholders	June 26, 2009

It is anticipated that all samples proposed in this QAPP will be collected during one field event scheduled to occur from approximately April 20 to May 1, 2009. Field sampling will include sample collection from test holes in streets and residences where owners and tenants have submitted signed access agreements. Analysis of 2008 archived samples will be conducted upon EPA approval of this QAPP.

## **A6 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA**

Data quality objectives (DQOs) and quality control criteria are described in this section. Data quality indicators (DQIs) such as the PARCC parameters (precision, accuracy or bias, representativeness, completeness, and comparability) (USEPA 2002) and analytical sensitivity will be used to assess conformance of data with quality control criteria and are described later in this section.

### **A6.1 Data quality objectives**

The goal of this QAPP is to ensure that data collected for this investigation are technically defensible. The DQO process is used to develop appropriate investigation goals and objectives; collected data will be evaluated relative to the DQOs and QA objectives described below.

1. **State the problem** – The problem definition is presented in Section A4.
2. **Identify the goal of the study** – The objectives of this investigation are presented in Section A4.
3. **Identify information inputs** – The information inputs are discussed in the project task description presented in sections B1 and B2.
4. **Define the boundaries of the study** – The investigation will occur within curbside planting strip areas along the north and south sides of South Cloverdale Street, residential yards fronting the north side of South Cloverdale Street and south side of Dallas Avenue South

between 14th and 16th Avenues, the east and west sides of 16th Avenue South, and the south side of lower South Donovan Street (Figure A1).

5. **Identify the analytical approach** – Laboratory analyses will be conducted using EPA-approved analytical methods. Method reporting limits for this investigation are provided in Table A-1 of the Streets and Yards QAPP (Integral 2008).
6. **Specify performance or acceptance criteria** – Laboratory QA/QC will meet method requirements as specified in the Streets and Yards QAPP (Integral 2008) with modifications as discussed in this QAPP Addendum.
7. **Develop the plan for obtaining data** – The plan for obtaining the data required to meet project objectives is presented in Section B of this QAPP.

## **A6.2 Data quality indicators**

To meet project DQOs, procedures to ensure the collection of representative data of known and acceptable quality need to be followed. The QA procedures and measurements that will be used for this investigation are based on EPA guidance (USEPA 2001, 2002). PARCC parameters are commonly used as DQIs to assess the quality of environmental data and are described in detail in the Streets and Yards QAPP (Integral 2008). Measurement quality objectives (MQOs) for the quantitative PARCC parameters, accuracy (or bias), precision, and completeness, are provided in Table A-3 of the Streets and Yards QAPP (Integral 2008).

## **A7 SPECIAL TRAINING/CERTIFICATION**

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Training requirements for personnel participating in sample collection can be found in the T-117 QAPP (Windward et al. 2003). Integral's 2008 site health and safety plan will be updated for this sampling effort. The Integral project manager will ensure that the field team receives the final approved version of this QAPP and the site health and safety plan (HASP) prior to the initiation of field activities.

## **A8 DOCUMENTS AND RECORDS**

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Records will be maintained documenting all activities and data related to field sampling and chemical analyses. Results of data verification and validation activities will also be documented. Procedures for documenting field

observations, laboratory records, and data reduction can be found in the T-117 QAPP (Windward et al. 2003). Copies of field sampling forms to be used during this investigation are included as Attachment 1.

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## **SECTION B: DATA GENERATION AND ACQUISITION**

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This section presents the sampling design and sampling methods. Details regarding decontamination procedures, field-generated waste disposal, sample handling and custody, inspection/acceptance requirements for supplies and consumables, and data management can be found in the T-117 QAPP (Windward et al. 2003).

### **B1 SAMPLING DESIGN**

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The sampling design for this investigation is intended to support the project objectives identified in Section A4 and restated below:

The specific objectives of this work are to:

- ◆ Determine the vertical extent of the T-117 EAA PCB remedial boundary within northern and southern planting strips along South Cloverdale Street where PCB cleanup level exceedances are known to exist in surface soil
- ◆ Conduct sampling in residential yards along the north side of South Cloverdale Street and the south side of Dallas Avenue South between 14th Avenue South and 16th Avenue South to determine whether residential soils contain PCBs above the cleanup level (CUL)
- ◆ Confirm that PCB concentrations along portions of the eastern and western margins of 16th Avenue South and along the base of the hill on the lower part (westbound lane) of South Donovan Street are below the CUL
- ◆ Evaluate the southern extent of the current EAA boundary near the intersection of 16th Avenue South and South Cloverdale Street
- ◆ Evaluate the excavation prism at certain 2008 boring locations within the current EAA at the intersection of South Dallas Avenue and 16th Avenue South.

In the following sections, a brief summary of the existing data and identified data gaps are provided, followed by a description of the sampling design. Sample types and locations are shown in Figure A1. Samples are summarized in Table B1.

#### **B1.1 South Cloverdale Street planting strips**

Twelve soil samples were collected in the grass planting strips on the north and south sides of South Cloverdale Street between 14th Avenue South and 16th Avenue South in August 2008. The samples were collected from surface

intervals of approximately 0.0 to 0.5 ft and subsurface intervals of approximately 0.5 to 1.0 ft; all surface intervals and one subsurface interval sample (YC08c) were analyzed for PCBs (Integral 2008); the remaining samples were archived. Surface samples at six locations in the north planting strip exceeded 1 ppm PCBs with a maximum concentration of 4.7 ppm. The concentration in subsurface sample YC08c was 1.9 ppm. One sample in the south planting strip exceeded 1 ppm PCBs (1.2 ppm). No other archived subsurface samples from the planting strips have been analyzed for PCBs to date. The identified data gap is to evaluate subsurface PCB concentrations where surface concentrations exceeded 1 ppm.

Archived subsurface (0.5-1.0 ft bgs) samples at the planting strip stations where PCBs exceeded 1 ppm in the surface 0-0.5 ft bgs (i.e., YC06, YC07, YC09, YC10, and YC14) will be analyzed for PCBs to evaluate concentrations in the 0.5-1.0 ft bgs interval to estimate the target soil excavation depth. Due to the dimensions of the planting strip and the presence of sidewalks and streets, this additional information will assist in planning for the removal. Actual depths will be confirmed with confirmation sampling.. Archived samples to be analyzed are listed in Table B1. Archived samples will be analyzed in accordance with the Streets and Yards QAPP (Integral 2008) by ARI.

A spatial data gap has been identified in the planting strip on the south side of South Cloverdale Street, between 16th Avenue South and sample location YC14 (Figure A1). Surface (0 to 0.5 ft) and subsurface (0.5 to 1 ft) samples will be collected in accordance with yard sampling methods described in the 2008 T-117 Streets and Yards QAPP (Integral 2008). The surface sample will be analyzed for PCBs; if PCB levels in the surface sample exceed 1 ppm, then the subsurface sample will be analyzed.

## **B1.2 16th Avenue South**

Four data gaps have been identified along 16th Avenue South.

The first data gap is at the intersection of 16th Avenue South and South Cloverdale Street where sampling conducted in 2008 identified PCBs in the 0 to 1 ft soil interval at 1.5 ppm (Station P93) just inside (north of) the current cleanup boundary. A sampling station (P101) will be located on 16th Avenue South approximately 5 ft east of the historical pavement edge of South Cloverdale Street as shown on the 1947 drawings in Attachment 2, and 10 ft south of Station P93 (Figure A1). A second sampling station (P102) will be collected south of P101, near the intersection of the centerline of 16th Avenue South and the south side of South Cloverdale Street. Samples will be collected from both stations using direct-push sampling techniques in accordance with the Streets and Yards QAPP (Integral 2008) and at the following sample intervals: 0 to 1 ft; 1 to 2 ft; 2 to 4 ft. These intervals are consistent with the previous approach for station P93 and are based on the anticipated 1 ft excavation depth for the EAA at the current

boundary on 16<sup>th</sup> Avenue South. The surface sample from P101 will be analyzed and lower intervals will be archived. All samples from P102 will be archived; the surface sample from P102 will be analyzed if the surface sample from station P101 exceeds 1 ppm PCBs.

The second data gap is the area on the west side of 16th Avenue South to the south of South Cloverdale Street. Existing data in the area include samples SD32 and SD33, which are described as 5-point composite samples on the west side of 16th Avenue South (Table 1, Integral 2006). PCB concentrations at these locations are reported at 0.29 and 0.26 ppm, respectively. EPA has requested additional MIS sampling in this area. Two MIS samples will be collected along two strips parallel to the street. One strip will include the area draining to the street; the other will be the higher grassy area closer to the adjacent property boundaries (Figure A1).

The third data gap is the planting strip on the east side of 16th Avenue South between the current EAA boundary and south end of the adjacent apartment property (Figure A1). There are no existing surface soil data along this strip and EPA has requested an MIS sample. The sampling within the MIS decision unit will be limited to the portion of the planting strip draining to the street.

Finally, there are four 2008 boring locations (P88, P90, P91, P93) at the South Dallas Avenue–16th Avenue South intersection with draft EE/CA excavation depths of 1 (P88, P91, and P93) to 2 ft (P90). Concentrations in the surface intervals from these borings are 1.5 to 2 ppm. To confirm the excavation depths contemplated for these areas, archived samples below the anticipated excavation depth will be analyzed.

### **B1.3 South Donovan Street**

A data gap has been identified on South Donovan Street. There are no existing surface soil samples along the south side of the lower (westbound) lane of South Donovan Street. EPA has requested that two MIS samples be collected along the south side of lower South Donovan Street at the base of the hill (Figure A1). Samples within each MIS decision unit will be collected along a single line within 3 ft of the pavement.

### **B1.4 South Cloverdale Street and Dallas Avenue South residential properties**

PCBs have been identified in historical on-pavement street dirt samples and soils in the curbside planting strips and residential yards along the north side of South Cloverdale Street between 14th Avenue South and 16th Avenue South, as discussed above. Previous investigations have utilized discrete and composite

soil sampling and analysis procedures to evaluate the distribution of PCBs in this area.

Historical samples collected on South Cloverdale Street include SD31, SD30A and SD11. SD30A and SD31 were on-pavement street dust composites collected from both sides of the road and had PCB concentrations of 2.4 and 2.3 ppm, respectively. SD11 was a catch basin composite with a PCB concentration of 0.58 ppm. In 2005, South Cloverdale Avenue was pressure washed and catch basins were cleaned (Windward et al. 2008b, Figure 2-26).

Detected total PCB concentrations in 12 surface and two subsurface samples collected in 2008 from yards on the north side of South Cloverdale Street range from 0.02 (YC08a) to 2.9 mg/kg (YC08b). Only two of these sample stations exceeded 1 ppm: YC11a at 1.5 ppm in surface soil, and YC08b at 2.9 in surface soil and 1.1 ppm in subsurface soil (Windward et al. 2009, in preparation).

Due to the prior determination that no data gaps exist in residential yards adjoining Dallas Avenue South based on historical yard sample data (Windward et al. 2008b), none of the discrete or composite samples collected in 2008 in residential yards along Dallas Avenue South were analyzed for PCBs. However, based on the exceedances found in yards facing South Cloverdale in 2008, which suggest the possibility that PCBs could have potentially migrated onto adjacent residential yards, EPA has requested additional analysis for PCBs in yards facing Dallas Avenue South as well as South Cloverdale Street.

EPA has directed the City to evaluate the yards to be sampled in this investigation using an MIS approach, which is described in the methods section below.

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## **B2 SAMPLING METHODS**

The following sections describe the sampling methods and chemical analysis that will be conducted on the soil samples.

### **B2.1 Field collection methods**

Various field collection methods will be employed to achieve the sampling objectives, as described below. All field activities will be performed under the direction of the field coordinator and other oversight personnel as described in Section A5, with EPA oversight at EPA's discretion.

#### **B2.1.1 Street borings**

Prior to conducting pushprobe soil borings, Integral will conduct a utility survey to identify all known underground utilities within the study area. Integral will use available utility information provided by the City as the baseline for the

utilities survey. Integral will also use the regional One-Call service (1-800-424-5555) for utility identification.

Pushprobe soil borings will be completed in the intersection of South Cloverdale Street and 16th Avenue South, using a pushprobe rig operated by Cascade Drilling, Inc. under direction from Integral personnel. Samples will be collected using a 4- to 5-ft-long macrocore sampling probe (2.5 in. outside diameter), with new, clear polyethylene liners. The cores will be logged, sampled, and homogenized as described in Integral (2008). In order to minimize potential cross-contamination, soil in contact with the liner will not be included in samples, to the extent practicable. Each homogenized soil sample will be placed in a 4-oz glass jar.

### **B2.1.2 Planting strip samples**

Two discrete soil samples will be collected from one location in the planting strip along the south side of South Cloverdale Street, at 1445 South Cloverdale Street. Samples from 0-6 in. bgs and 6-12 in. bgs will be collected and logged as described for the residential yard samples discussed in Integral (2008).

### **B2.1.3 MIS samples**

MIS consists of collecting a large number of individual soil samples (increments) from within an area delineated for decision making, called a Decision Unit (DU), and aggregating the increments to form a single composite MIS for that DU. The MIS is then analyzed to provide an average chemical concentration for soil in that DU. DUs are laid out in a logical fashion such that the each MIS result can provide answers to key questions regarding each DU. In this study, DUs will be laid out to encompass individual residential properties or portions thereof based on a conceptual model of land use for residential properties (i.e., differences in uses for front yards and backyards) and proximity to potential PCB track-out in streets (i.e., grassy strips on property side of sidewalks and rights-of-way). The resulting MISs will be used to determine whether the soils in that DU contain PCBs at concentrations above the CUL.

Gy sampling theory (Gy 1998; Pitard 1993) forms the basis for the sampling protocols presented herein. Chemical compounds, including contaminants such as PCBs, are heterogeneously distributed in particulate media such as soil. To reduce sampling error and to obtain a sample representative of the average composition of the media within a large sampling volume, multiple subsamples randomly distributed throughout the volume are needed. MIS sampling theory consists of the following major components:

- ◆ DUs are established to define an area of a site where a decision is to be made regarding the extent and magnitude of contaminants identified

- within the unit, as well as the potential environmental hazards posed by the contaminants.
- ◆ Within a DU, 30 or more subsamples (sample increments) of an adequate mass will provide a sample representative of the average composition of the entire decision unit, regardless of the size of the decision unit (USEPA 2003).
  - ◆ With the DU, a systematic random (preferred in most cases) or stratified random sample collection scheme is utilized. Both these strategies result in the sample collection points being spread out roughly equally across the DU.
  - ◆ Subsampling of the MIS sample at the laboratory is also conducted to increase homogeneity and reduce measurement error.

The multi-increment sampling procedures describe herein are consistent with EPA guidance (USEPA 1999, USEPA 2002). Technical guidance on MIS put forth by the states of Alaska (ADEC 2007) and Hawaii (HDOH 2008) has been consulted in developing this plan.

#### **B2.1.4 Project Decision Units – Residential Properties**

DUs are laid out such that a decision about the status of the DU can be reached by MIS sampling and analysis. For the yards, the area of interest is a block of residential properties north of South Cloverdale Street and south of Dallas Avenue South between 16th Avenue South and 14th Avenue South, based on evaluation of previous discrete soil sampling results, as described in Section B1. Residential addresses planned for MIS include 1410, 1412, 1420, 1424, and 1440 South Cloverdale Street and 8523, 8525, and 8529 Dallas Avenue South.

For this study, the residential properties along South Cloverdale Street are generally divided into two DUs: “front yard” and “backyard,” whereas the smaller parcels fronting only Dallas Avenue South (8523 and 8525) will each be treated as a single DU. Preliminary backyard and front yard DUs delineated for each property were modified during a site visit with EPA on February 10, 2009 and may be further refined during the field effort. Any changes to the DU boundaries will be documented in field notes. Based on field observations, the following DU modifications were made:

- ◆ A DU has been identified in a grassy strip on South Cloverdale Street between the sidewalk and a fence at 8529 Dallas Avenue South (backyard) resulting in three DUs for this property.
- ◆ Due to the small size of the yard at 1410 South Cloverdale Street, a single DU has been identified for this property.

A total of 14 yard DUs are defined as shown on Figure A1.

### **B2.1.5 Project Decision Units – Adjacent Streets**

EPA has directed the City to employ the MIS approach to the additional investigation of the Adjacent Streets.

For 16th Avenue South, three DUs have been identified. Two DUs are located on the west side of the street between South Cloverdale Street and the alley to the south. As requested by EPA, this area is split into two DUs along a north-south line and parallel to the street. The east side targets the area draining to the street and the west side targets the elevated area adjacent to the neighboring yard. The western DU will target an elevated grassy area and the eastern DU will target the low area adjacent to the street. The sampling grid for these two DUs will be two to three rows oriented north and south.

The third 16th Avenue South DU is the road shoulder on the east side of 16th Avenue South extending from the Cloverdale intersection to the south end of the apartment complex. This DU will target the low area of the road shoulder. The DU is approximately 3 ft wide and will be sampled as a single row of increment samples.

For South Donovan Street, two DUs have been identified along the base of the hill on the south side of lower South Donovan Street. One DU extends from Dallas Avenue South to 16th Avenue South. The other DUs extend from 16th Avenue South to the west end of the convergence of upper and lower South Donovan Street. These DUs are approximately 3 ft wide and will be sampled as a single row.

There are 19 DUs for this overall study. One DU will be sampled in triplicate for QA purposes with the two additional replicates assigned a unique “DU” number for blind laboratory submittal, as discussed in Section B5 (Figure A1 and Table B1).

#### *Collecting multi-increment samples*

For each DU, the MIS will be composed of at least 30 aggregated individual soil increments. A target number of 35 increments will be used to ensure that a minimum of 30 are collected, allowing for loss of increments due to unanticipated obstructions or problems in the field. As directed by EPA to address concern for variations in individual property histories (soil disturbing activities) and consequent contaminant depth profiles, two depth horizons, 0 to 2 in. and 2 to 6 in., will be sampled from each DU, resulting in two MISs from each DU (USEPA 2009). Two samples will therefore be collected at each increment location, one from each depth interval.

Concentrations in both targeted intervals must meet the CUL. However, if the upper sampled interval (0-2 in.) exceeds the CUL, and remediation is assumed to remove both sampled intervals (i.e., removal depth of at least 6 inches), the lower

sampled interval need not be analyzed because design, performance, or compliance sampling will be done to confirm that cleanup actions were complete with respect to depth. However, to expedite the sampling program, both the surface and subsurface samples will be analyzed.

#### *Sample increment locations*

The 30+ sample increment locations within a DU will be distributed across the DU in a random fashion, yet covering the extent of the sampling area. To achieve this goal, a systematic random sample location layout is proposed. This layout consists of a randomized grid (randomized in one dimension) composed of a series of parallel sampling transects, along each of which soil increments are collected at a given distance along each transect. Transects are typically laid out perpendicular to a baseline, and the sampling interval distance (X) along all transects is approximately the same as the distance between parallel transects. A “square grid” would represent a non-randomized layout; however, to provide a degree of randomness, the starting sample location along each transect is randomly selected (using a random number generator) as a whole number distance from 1 to X, and the first sample along each transect is collected at this random distance from the baseline. All subsequent samples along each transect are collected at distance increments of X from the first sample location. An example layout is shown in Figure B1. One DU will be sampled in triplicate, in which new transects and corresponding new sampling interval distances (X) will be laid out for each replicate collected; resulting in three independent samples being generated from the one DU. A triplicate sample will be generated for both the surface and subsurface sample.

Since most DUs are neither perfectly rectangular nor free of obstructions, the sample increment layout must be customized for each DU. Typically, the series of transects and sample locations along transects is laid out ignoring obstructions, however samples will only be collected from accessible areas; samples will not be collected from under structures, such as porches, or from beneath hedges, thick vegetation, debris, or non-soil materials. Open garden and landscaped areas will be included in the sampling program. If obstacles are encountered, the sample location may be modified or the location may not be sampled. Care will be taken to count the number of accessible sample increment locations to ensure the sampling pattern is sufficiently dense to allow 30+ sample increments to be collected. Field notes will include any observations of interest regarding the MIS sample locations, including the identification of sample increment locations excluded or modified, and the reason for the exclusion or modification.

### *Sample increment collection*

As described above, soils from two depth intervals will be collected: a surface soil sample from 0 to 2 in. depth and a subsurface sample from 2 to 6 in. depth. The datum for the top of the sampling interval will be defined as the top of mineral-based soil (such that dominantly organic surface materials, if present, are not included in the soil sampling). At each of the 30+ sample increment locations within a DU, soil samples will be collected and added to two aggregate master samples, one for each of two depth intervals.

A small soil sample, approximately 80 g in mass, will be collected at each sample increment location for a given depth interval. The surface materials such as grass and/or garden mulch will be removed to accommodate a small sampling tube or pit (see below).

Samples will be collected using a small diameter stainless steel or brass sampling tube, dedicated to the surface interval MIS for that DU, that will be driven into the soil to a depth of 2 in. The tube will be removed and the soil plug emptied into a stainless steel bowl. If mineral soil is retained on the bottom of surface material, such as a plug of grass sod, reasonable attempts will be made to shake or dislodge such mineral soil and place it on the top of the exposed mineral soil surface. Grass, roots, sticks, and rocks larger than about 1 in. will be removed by hand. A measuring cup will be filled to a pre-set volume (approximately 80 cc). The diameter of the sampling tube will be selected such that nearly all of the sample increment is used to fill the pre-set measuring volume. The surface sample will be driven to 2 in. and removed. Another tube (dedicated to the deeper sample interval for that DU), will be driven from 2 to 6 in. to collect the subsurface sample increment. The surface and subsurface sample increments will be placed directly into their respective sample containers.

At sample locations where the sampling tube cannot collect the soil (rocky or dry non-cohesive sandy soils), an alternative sample collection method will be employed: a thin spade will be used to open a small sample pit slight more than 6 in. deep. Stainless steel trowels or spoons will be used to collect approximately 80 cc of soil from the sidewalls of the pit across the 0 to 2 in. depth interval, and again for the 2 to 6 in. depth interval for the subsurface MIS. Separate dedicated trowels or spoons will be utilized for the two sampling depth intervals.

Care will be taken to return sampling locations to their original condition and appearance. Soil not collected for analysis, grass sod, or landscaping materials will be replaced in the sampled area from which it was collected. Commercial potting soil will be used to replenish soil volume, if needed. The need for replacement of sod or landscape materials will be evaluated on a case-by-case basis.

Increment samples will be placed directly into the sampling jars provided by the laboratory. All sample jars for a given DU increment will be combined and thoroughly homogenized at the analytical laboratory prior to subsampling as described below.

#### *MIS subsampling*

The aggregation of 30+ sample increments of 80 cc typically yields an MIS sample of approximately 2.5 to 3.0 kg (depending on soil bulk density and moisture content). Because the laboratory method for PCB analysis (EPA Method 8082A) calls for extraction and analysis of 2 to 30 g of sample material, the MIS sample must be subsampled prior to the laboratory procedure. Extraction and analysis of a larger sample mass provides lower measurement error due to sample heterogeneity, and typically lower detection limits. Therefore, a 30 gram subsample is recommended for this study. In addition, a duplicate 30 gram subsample will be created for archive and a 15 gram subsample will be created for total solids correction.

EPA will be conducting dioxin/furan analyses on MI subsamples and will require two 50 gram subsamples and a 15 gram subsample for total solids correction.

The MIS sample will be subsampled by the laboratory performing the chemical analysis. The entire MIS sample will spread out evenly onto clean non-ink paper and air dried for a maximum of 3 days to facilitate sieving. As with previous analyses total solids will be used to report the final PCB results on a dry-weight basis. After drying, the sample will be passed through a 10 mesh (2 mm) sieve, gently breaking up soil aggregates before sieving.

The lab will create the following subsamples: 2 x 15g for total solids correction, 2 x 30g for PCBs, and 2 x 50g for dioxin/furans. Target weights will be within +/- 1 gram of that required for analysis; with tare weights for each jar provided. The master MIS sample will be subsampled after it has been air dried, sieved, and evenly spread. The sample will then be divided into 30-50 segments. A flat-bottomed scoop will be used to collect a sample of approximately ½ g for solids, 1g for PCBs, and a little less than 2 g for dioxin/furans. A scoop for each jar will be collected from one of the segments, then the next segment is sampled such that subsamples of 15g, 30g and 50g would be simultaneously collected. Alternatively, 15 g jars will be filled first, followed by 30 g jars, followed by 50 g jars.

This subsampling procedure is compliant with EPA guidance (USEPA 2003) and State of Alaska's Department of Environmental Conservation's Draft guidance on multi-increment soil sampling (March 2009). Additional details on the laboratory subsampling procedure are provided in CAS's Laboratory SOP

(Attachment 3). Note that CAS's SOP is not explicit about sample drying; the laboratory will be directed to include this step.

## **B2.2 Location and sample IDs**

Each sample and sampling location will be assigned a unique identification code.

Sample IDs will include the unique location code (made up of the sample type code, followed by a sequential number), a dash, then two two-digit numbers identifying the sample interval (rounded to the nearest 0.1 ft), separated by a dash.

Sample type codes to be used in sample IDs for this investigation include:

- ◆ YS = Discrete Planting Strip Sample
- ◆ P = Pushprobe sample
- ◆ DU = Decision unit MIS sample

Field QA/QC samples (field triplicates for MIS locations and field duplicates for all other field sample types) will be collected for all samples at a frequency of 1 per 20 samples per type. Field QA/QC samples will be assigned the appropriate sample type code, followed by the next available number in the sequence for that code.

Some example sample IDs are as follows:

- ◆ DU03-0.0-0.2: This sample ID indicates an MIS sample from the 0 to 0.2 ft depth interval from location DU03.
- ◆ YS1-0.5-1.0: This sample ID indicates the sample from the 0.5 to 1.0 ft below ground surface interval from the yard planting strip sampling location.
- ◆ YS2-0.5-1.0: This sample ID indicates the field duplicate sample from the 0.5 to 1.0 ft below ground surface interval from the yard planting strip sampling location.

Individual sample increments collected as part of the MIS sample will not be assigned sample IDs. MIS increment location IDs will consist of the MIS DU number with an appended sequential number (e.g., DU01-1, DU01-2, DU01-3, etc.).

Unlike the Streets and Yards investigation (Integral 2008) no sample numbers (e.g., SPD####) will be used for this investigation.

## **B2.3 Soil chemical analytes**

A number of analytes have been detected within the T-117 upland site, where all contamination associated with the site is assumed to have originated. However,

PCBs are the primary contaminant of concern from the site, have been widely used as the primary indicator chemical for boundary delineation and are the target for defining the EAA boundary. Chemical analyses described in this QAPP will therefore be confined to PCB Aroclors.

PCBs are assumed to have been present on the T-117 upland site in waste oils burned by former Malarkey Asphalt operations. The conceptual site model for T-117 identifies track-out as the transport pathway for PCBs from the upland portion of the site to adjacent streets. Other constituents associated with the waste oil (e.g., total petroleum hydrocarbons [TPH] and perhaps carcinogenic polycyclic aromatic hydrocarbons [cPAH]), would have been subjected to the same transport mechanisms as PCBs and would follow the same distributional patterns.

TPH and cPAH are also common urban contaminants. Parked cars, car repairs, and fraying edges of asphalted areas without curbs on streets and shoulders are common sources of TPH and cPAH. Therefore, it is likely that these and perhaps other sources unrelated to T-117 operations have contributed detectable levels of TPH and cPAH to the study area. Because routine laboratory analyses do not differentiate types of sources, cPAH and TPH present in the study area would not be discernable from track-out from the upland site. However, because PCBs are not as common an urban contaminant and are known to be the primary contaminants that originated on the upland site, PCBs will be used as an effective tracer for track-out of all T-117 contaminants. Ultimately, data from the site indicates that the removal of soils due to elevated concentrations of PCBs will also remove co-occurring constituents originating at the T-117 upland site, including TPH and cPAH.

Dioxins were investigated in all portions of the site in 2008 and a resulting data evaluation conducted by the Dioxin Technical Work Group, comprising representatives from the EPA, Washington State Department of Ecology (Ecology), City, and Port, was presented to EPA and stakeholders on December 15, 2008. The Work Group made the following conclusions about the relationship between PCBs and dioxins/furans in the adjacent streets and yards based on available analytical results:

- ◆ All but one street sample below the PCB cleanup level of 1 ppm are also below the MTCA default cleanup level for dioxin TEQ (the exception is P89).
- ◆ Regression analysis of Adjacent Street sample results (not including yard samples) shows a PCB concentration of 1 mg/kg corresponds to a dioxin TEQ concentration of 14 nanograms per kilogram (ng/kg; or parts per trillion [ppt]) or below.

EPA has directed the T-117 program to address the residential properties in this investigation on the basis of PCBs. Based on the Dioxin Technical Work Group conclusions, PCBs will be used as a suitable tracer for dioxins in soils in the adjacent streets that may have originated from the upland portion of the site via track-out. Evaluations of potential sources for dioxins/furans in yards are continuing and that EPA, Ecology, and other stakeholders believe there is sufficient uncertainty in preliminary conclusions about T117 contributions and PCBs as an indicator for dioxins/furans to warrant additional dioxin analyses. Dioxin/furan analyses will be conducted separately by the agencies using splits of samples collected for PCB analyses.

Arsenic and silver have been detected above preliminary cleanup levels in the upland portion of the site. However, limited arsenic data in the adjacent streets is within the range of background concentrations (Ecology 1994) and below 3.1 ppm. Silver was detected above water quality criteria in groundwater in a limited area of the T-117 upland and appears to be directly related to an isolated historical photography finishing process and not waste oil. Due to these factors, arsenic and silver are not included in this sampling program for the adjacent streets and residential properties.

This selection of analytes will be supported by a draft appendix of the revised EE/CA being prepared in parallel to this QAPP amendment. The appendix will address selection of chemicals of concern (COCs) and development of CULs. The appendix will include the following steps:

- ◆ Identification of operable units within the EAA based on conceptual site models (CSMs) specific to areas of the site (40 CFR 300.430(a)(1)(ii)(A))
- ◆ Identification of screening levels for each operable unit, considering CSMs, applicable or relevant and appropriate requirements, natural background, and practical quantification limits
- ◆ Identification of preliminary COCs for each operable unit, considering CSMs, screening levels and frequency of detection (WAC 173-340-703)
- ◆ Refinement of COCs based on CSMs within each operable unit and urban background concentrations
- ◆ Development of CULs for refined COCs, considering multiple chemicals (WAC 173-340-740(4)(a), -720(7)(a)).

### **B3 SAMPLE HANDLING AND CUSTODY**

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Detailed information regarding sample handling and custody requirements are presented in Section B3 of the 2008 T-117 Streets and Yards QAPP (Integral 2008).

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## **B4 ANALYTICAL METHODS**

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Detailed information regarding analytical method requirements is presented in Section B4 of the 2008 T-117 Streets and Yards QAPP (Integral 2008).

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## **B5 QUALITY CONTROL**

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Detailed information regarding QA/QC procedures for the field and the analytical lab are presented in Section B5 of the Streets and Yards QAPP (Integral 2008).

Field QA/QC samples will be collected in accordance with the Streets and Yards QAPP (Integral 2008) and will include the following:

- ◆ One filter blank per lot of filters used for field equipment wipe samples. Filter blank samples will be archived.
- ◆ One field equipment wipe sample per 20 samples collected per equipment type.
- ◆ For non-MIS soil samples, one field duplicate (i.e., field split) soil sample per 20 samples collected for analysis per sample type. Field duplicate samples are samples collected from the same homogenate as the original (i.e., 'parent') sample, and treated as separate samples, including a unique ID (see Section B2.2). Field duplicates will be submitted for PCB Aroclor analysis.
- ◆ For MIS soil samples – One triplicate (i.e., two additional sampling replicates) will be collected from one DU, one triplicate for the surface and one triplicate from the subsurface. The replicates will be collected from the DU per the MIS collection procedures (using separate layouts of subsampling grid locations), assigned unique sample IDs, and submitted to the laboratory as with the other MIS samples. DU14 will be targeted for the MIS triplicate if access is granted; DU05 may serve as an alternate location.
- ◆ For MIS soil samples – Because homogenization of the MIS samples will occur in the laboratory rather than in the field, the laboratory will collect one duplicate MIS subsample per 20 to be analyzed for PCB Aroclors (LDUP in Table 1) and additional LDUP subsamples will be provided for EPA dioxins/furans analysis.

## **B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE**

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Detailed information regarding instrument/equipment testing, inspection and maintenance is presented in Section B6 of the Streets and Yards QAPP (Integral 2008).

## **B7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY**

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Detailed information regarding instrument calibration and frequency is presented in Section B7 of the Streets and Yards QAPP (Integral 2008).

## **B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES**

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Detailed information regarding the inspection/acceptance requirements for supplies and consumables is presented in Section B8 of the Streets and Yards QAPP (Integral 2008).

## **B9 DATA MANAGEMENT**

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Detailed information regarding data management requirements is presented in Section B10 of the Streets and Yards QAPP (Integral 2008).

## **SECTION C: ASSESSMENT AND OVERSIGHT**

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Details of project assessment and oversight are presented in the original QAPP (Windward et al. 2003).

## **SECTION D: DATA VALIDATION AND USABILITY**

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EcoChem will perform a full validation of all results as described in the Streets and Yards QAPP (Integral 2008).

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## SECTION E: REFERENCES

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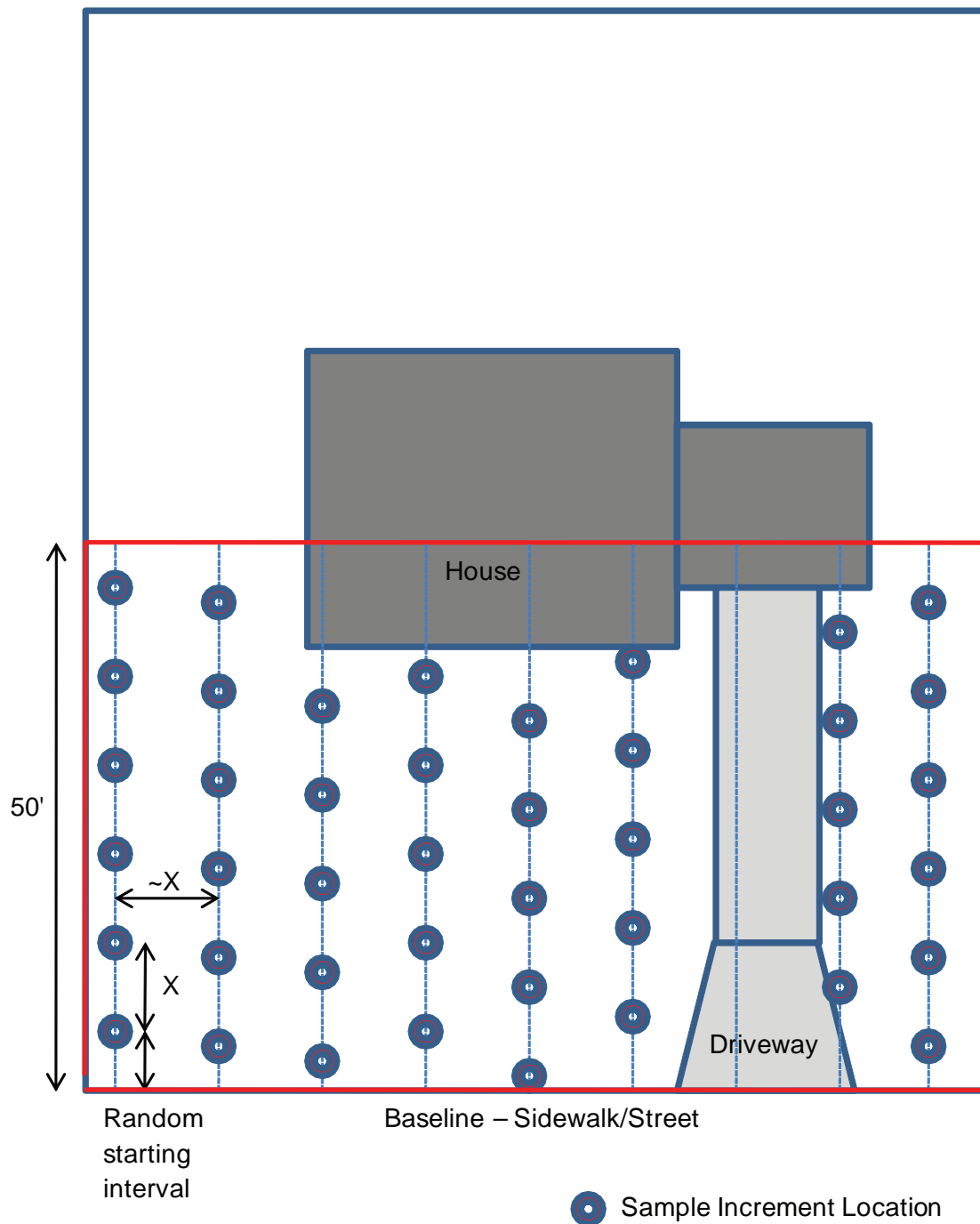
Windward, ENSR | AECOM, Integral, DOF. 2009. Terminal 117 Early Action Area. Dioxin investigation and PCB sediment removal boundary delineation for the revised EE/CA data report. Windward Environmental LLC, Seattle, WA; ENSR | AECOM, Seattle, WA; Integral Consulting, Inc., Mercer Island, WA; and Dalton, Olmsted & Fuglevand, Inc., Seattle, WA. In preparation.

# **FIGURES**

\\192.168.2.11\gism\A0006\_Lower-Duamish\_Various\A0006\_15B\working\_maps\ArchivedSamples\_and\_New2\_1.mxd JP @ 04-16-2009



**Figure A1.**  
Adjacent Streets PCB Boundary Refinement  
Sample Types and Locations



# **TABLES**

Table B1. Soil Sample Identification and Sampling Scheme for Adjacent Streets Boundary Refinement.

SAMPLE LOCATION	SAMPLE ID	APPROXIMATE SAMPLE INTERVAL (ft bgs)	PCB AROCLORS	QA
<b>MIS Yard Samples</b>				
DU01	DU01-0.0-0.2	0.0-0.2	X	
	DU01-0.2-0.5	0.2-0.5	X	
DU02	DU02-0.0-0.2	0.0-0.2	X	
	DU02-0.2-0.5	0.2-0.5	X	
DU03	DU03-0.0-0.2	0.0-0.2	X	
	DU03-0.0-0.2	0.0-0.2	X	LDUP
	DU03-0.2-0.5	0.2-0.5	X	
	DU18-0.2-0.5	0.2-0.5	X	LDUP
DU04	DU04-0.0-0.2	0.0-0.2	X	
	DU04-0.2-0.5	0.2-0.5	X	
DU05	DU05-0.0-0.2	0.0-0.2	X	
	DU05-0.2-0.5	0.2-0.5	X	
DU06	DU06-0.0-0.2	0.0-0.2	X	
	DU06-0.2-0.5	0.2-0.5	X	
DU07	DU07-0.0-0.2	0.0-0.2	X	
	DU07-0.2-0.5	0.2-0.5	X	
DU08	DU08-0.0-0.2	0.0-0.2	X	
	DU08-0.2-0.5	0.2-0.5	X	
DU09	DU09-0.0-0.2	0.0-0.2	X	
	DU09-0.2-0.5	0.2-0.5	X	
DU10	DU10-0.0-0.2	0.0-0.2	X	
	DU10-0.2-0.5	0.2-0.5	X	
DU11	DU11-0.0-0.2	0.0-0.2	X	
	DU11-0.0-0.2	0.0-0.2	X	LDUP
	DU11-0.2-0.5	0.2-0.5	X	
	DU11-0.2-0.5	0.2-0.5	X	LDUP
DU12	DU12-0.0-0.2	0.0-0.2	X	
	DU12-0.2-0.5	0.2-0.5	X	
DU13	DU13-0.0-0.2	0.0-0.2	X	
	DU13-0.2-0.5	0.2-0.5	X	
DU14	DU14-0.0-0.2	0.0-0.2	X	
	DU14-0.2-0.5	0.2-0.5	X	
	DU64-0.0-0.2	0.0-0.2	X	MIS field replicate
	DU64-0.2-0.5	0.2-0.5	X	MIS field replicate
	DU74-0.0-0.2	0.0-0.2	X	MIS field replicate
	DU74-0.2-0.5	0.2-0.5	X	MIS field replicate
<b>MIS Street Samples</b>				
DU15	DU15-0.0-0.2	0.0-0.2	X	
	DU15-0.2-0.5	0.2-0.5	X	
DU16	DU16-0.0-0.2	0.0-0.2	X	
	DU16-0.2-0.5	0.2-0.5	X	
DU17	DU17-0.0-0.2	0.0-0.2	X	
	DU17-0.2-0.5	0.2-0.5	X	
DU18	DU18-0.0-0.2	0.0-0.2	X	
	DU18-0.2-0.5	0.2-0.5	X	
DU19	DU19-0.0-0.2	0.0-0.2	X	
	DU19-0.2-0.5	0.2-0.5	X	
<b>MIS Lab MS/MSD</b>				
DUXX	DUXX-0.0-0.2	0.0-0.2	X	Additional volume for lab MS/MSD
DUXX	DUXX-0.0-0.2	0.0-0.2	X	Additional volume for lab MS/MSD
DUXX	DUXX-0.2-0.5	0.2-0.5	X	Additional volume for lab MS/MSD
DUXX	DUXX-0.2-0.5	0.2-0.5	X	Additional volume for lab MS/MSD

Table B1. Soil Sample Identification and Sampling Scheme for Adjacent Streets Boundary Refinement.

SAMPLE LOCATION	SAMPLE ID	APPROXIMATE SAMPLE INTERVAL (ft bgs)	PCB AROCLORS	QA
<b>Discrete Parking Strip Sample</b>				
YS100	YS100-0.0-0.5	0.0-0.5	X	Collect additional volume for lab MS/MSD
	YS100-0.5-1.0	0.5-1.0	Archive	
	YS101-0.0-0.5	0.0-0.5	X	Field duplicate of YS100-0.0-0.5
<b>2008 Archive Samples</b>				
YC06	YC06b-0.5-1.0	0.5-1.0	X	
YC07	YC07c-0.5-1.0	0.5-1.0	X	
YC09	YC09c-0.5-1.0	0.5-1.0	X	
YC10	YC10c-0.5-1.0	0.5-1.0	X	
YC14	YC14c-0.5-1.0	0.5-1.0	X	
P88	P88-1.5-2.0	1.0-2.0	X	
P90	P90-1.5-2.0	1.0-2.0	X	
P91	P91-1.5-2.0	1.0-2.0	X	
P93	P93-1.5-2.0	1.0-2.0	X	
<b>Street Borings</b>				
P101	P101-0.0-1.0	0-1	X	
	P103-0.0-1.0	0-1	X	Field duplicate of P101-0.0-1.0
	P101-1.0-2.0	1-2	Archive	
	P101-2.0-4.0	2-4	Archive	
P102	P102-0.0-1.0 1	0-1	Archive	
	P102-1.0-2.0	1-2	Archive	
	P102-2.0-4.0	2-4	Archive	

See Figure A1 for sample locations.

Shaded cells indicate anticipated field QA duplicate samples. Actual sample locations and intervals may vary based on field conditions.

The sample IDs and sample intervals may be modified as discussed in Section B of the QAPP.

Archive - The sample will be collected and submitted to the analytical laboratory for archival storage, pending the results of analyzed samples.

bgs - below ground surface.

ft - feet.

LDUP - laboratory MIS processing duplicate sample.

MIS - multi-incremental sampling.

MS/MSD - laboratory matrix spike and matrix spike duplicate for MIS samples; actual samples will be selected by the laboratory during MIS subsample preparation.

X - Sample to be analyzed.

XX - These samples will be selected and subsampled by the laboratory.

**ATTACHMENT 1**  
**Field Forms**







7900 SE 28th Street, Ste 410  
Mercer Island, WA 98040  
(206) 230-9600  
FAX (206) 230-9601

PROJECT T117 EAA Adjacent Streets Boundary Investigation  
ADDRESS \_\_\_\_\_  
MIS Sample ID: \_\_\_\_\_  
Decision Unit ID: \_\_\_\_\_  
Depth: \_\_\_\_\_  
SAMPLERS \_\_\_\_\_  
DATE/TIME April 2009 Page of

Number of Increment Samples: \_\_\_\_\_ Sample Date April 2009  
(Note number of increment samples \_\_\_\_\_ Time (Start): \_\_\_\_\_  
rejected and reasons why, if any) \_\_\_\_\_ Time (End): \_\_\_\_\_

**SKETCH / NOTES:**

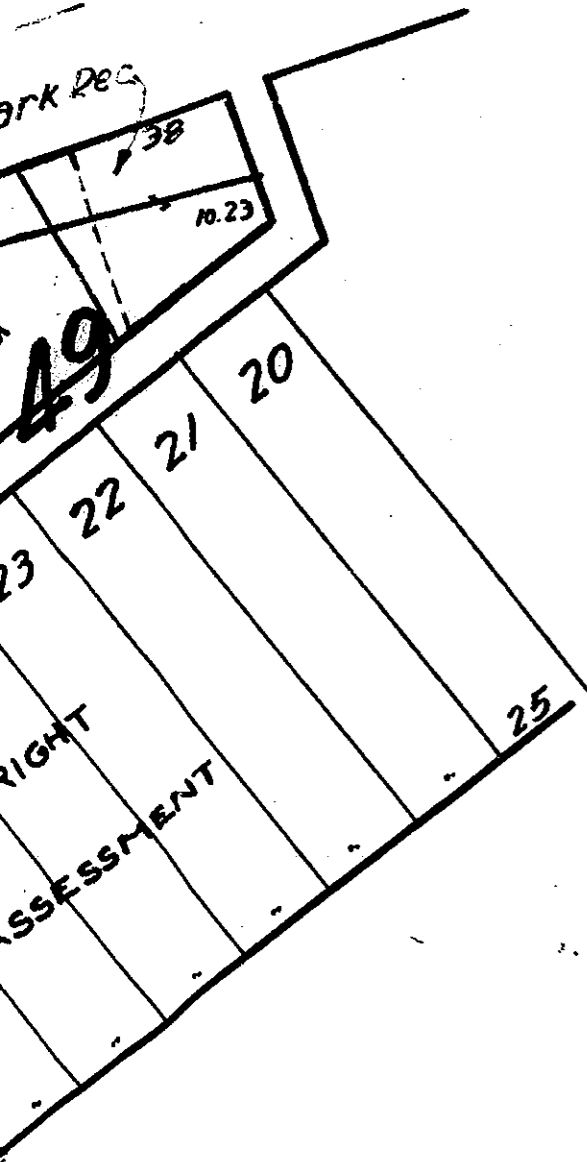
**NORTH:**

- Sketch residential yard and approximate layout of random sampling grid.
- Describe type and number of tools used.
- Note decontamination procedures/frequency.
- Note sample interval distance (X).
- Describe location and reason for excluded increment samples  
(e.g., inaccessible due to obstructions, located in areas under porches,  
beneath hedges, under heavy vegetation, etc.)

**ATTACHMENT 2**  
**1947 City Drawings of 14th Avenue South et. al. Paving**







CONT'D. TO RIGHT.  
GLOVERDALE ST.

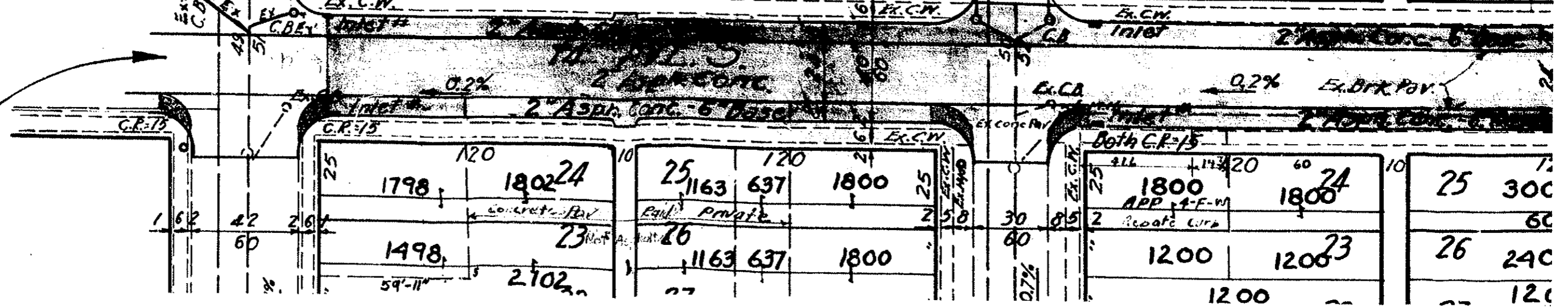
25	12	37	25
	11	38	"
	10	39	"
	9	40	3000
	8	41	3000
	7	42	3000
	6	43	3000
	5	44	2400
	4	45	600 600
	3	46	1800 1800
	2	47	1800 1800
	1	48	1800 1800

DONOVAN ST.

25	12	37	
	1	38	
	10	39	
	9	40	3000
	8	41	3000
	7	42	3400
	6	43	3120
	5	44	2400
	4	45	1200
	3	46	3600
	2	47	3240
	1	48	3000

SEE TO RIGHT  
FOR ASSESSMENT

CONTINUATION





DALLAS AVE.  
8" CONC. Pav.

SULLIVAN ST.

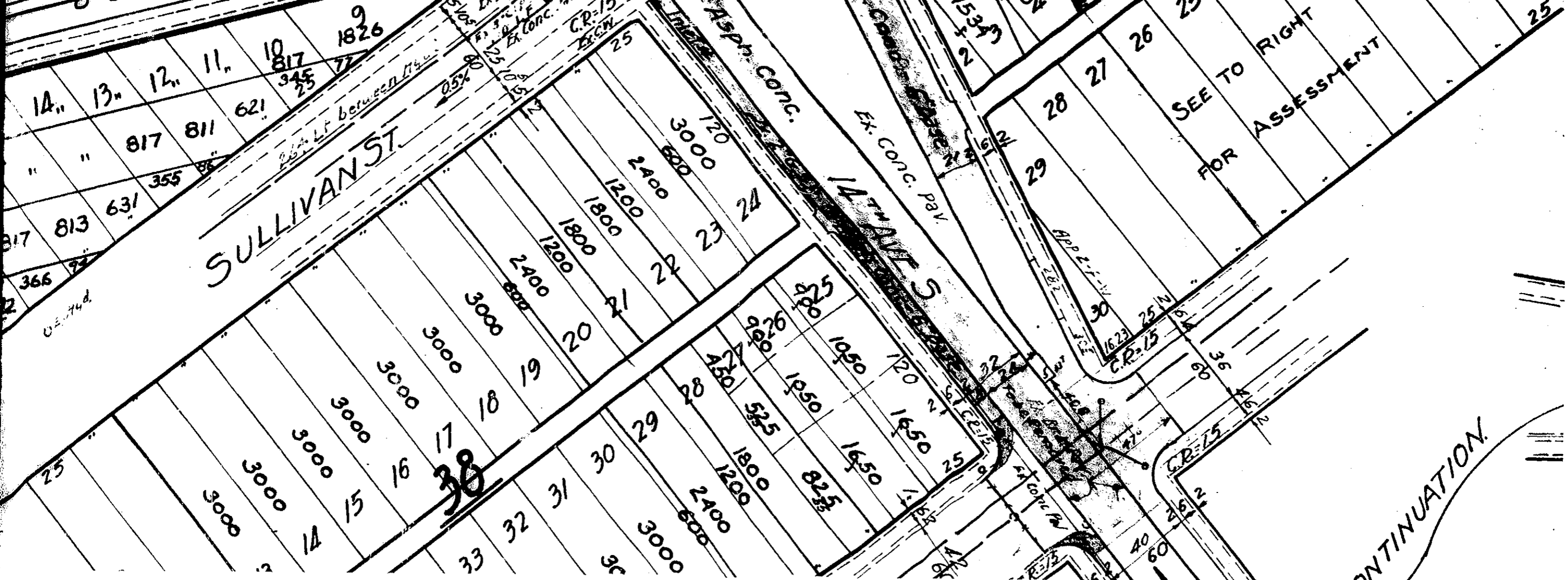
CONTINUATION.

To be paved by King Co  
8" x 8" T-O Plug  
8" C.I.P.C.I. 150  
8" Ch. Bend  
8" x 8" T-O Plug

vac. Ord. 92 South Park Res.

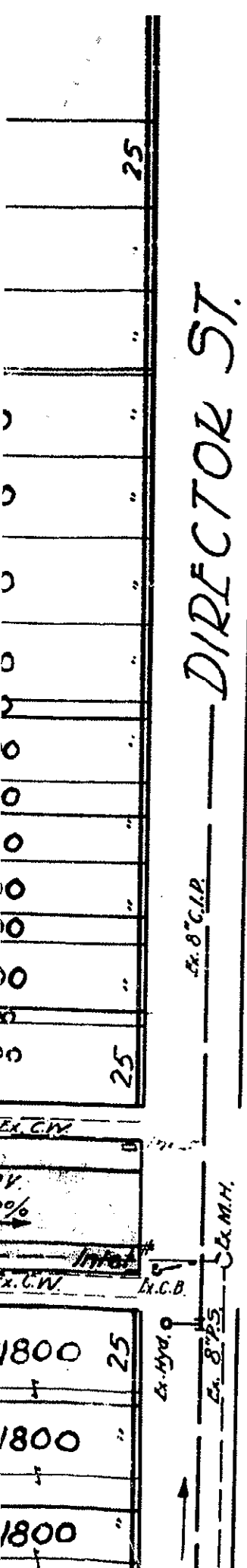
SEE TO RIGHT  
FOR ASSESSMENT

49



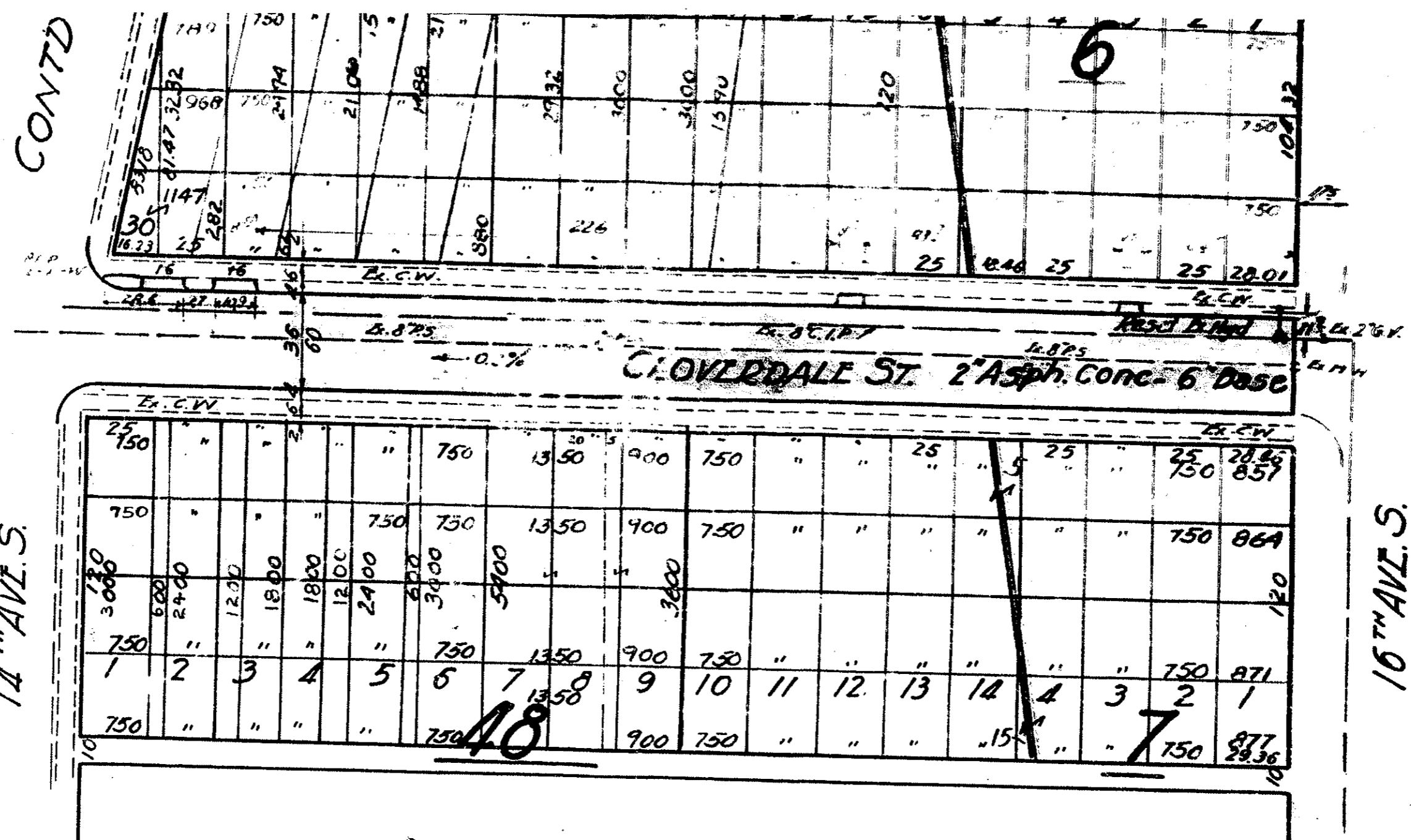
14" 13" 12" 11" 10" 9" 8" 7" 6" 5" 4" 3" 2" 1" 0" 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

1826 1825 1824 1823 1822 1821 1820 1819 1818 1817 1816 1815 1814 1813 1812 1811 1810 1809 1808 1807 1806 1805 1804 1803 1802 1801 1800 1799 1798 1797 1796 1795 1794 1793 1792 1791 1790 1789 1788 1787 1786 1785 1784 1783 1782 1781 1780 1779 1778 1777 1776 1775 1774 1773 1772 1771 1770 1769 1768 1767 1766 1765 1764 1763 1762 1761 1760 1759 1758 1757 1756 1755 1754 1753 1752 1751 1750 1749 1748 1747 1746 1745 1744 1743 1742 1741 1740 1739 1738 1737 1736 1735 1734 1733 1732 1731 1730 1729 1728 1727 1726 1725 1724 1723 1722 1721 1720 1719 1718 1717 1716 1715 1714 1713 1712 1711 1710 1709 1708 1707 1706 1705 1704 1703 1702 1701 1700 1699 1698 1697 1696 1695 1694 1693 1692 1691 1690 1689 1688 1687 1686 1685 1684 1683 1682 1681 1680 1679 1678 1677 1676 1675 1674 1673 1672 1671 1670 1669 1668 1667 1666 1665 1664 1663 1662 1661 1660 1659 1658 1657 1656 1655 1654 1653 1652 1651 1650 1649 1648 1647 1646 1645 1644 1643 1642 1641 1640 1639 1638 1637 1636 1635 1634 1633 1632 1631 1630 1629 1628 1627 1626 1625 1624 1623 1622 1621 1620 1619 1618 1617 1616 1615 1614 1613 1612 1611 1610 1609 1608 1607 1606 1605 1604 1603 1602 1601 1600 1599 1598 1597 1596 1595 1594 1593 1592 1591 1590 1589 1588 1587 1586 1585 1584 1583 1582 1581 1580 1579 1578 1577 1576 1575 1574 1573 1572 1571 1570 1569 1568 1567 1566 1565 1564 1563 1562 1561 1560 1559 1558 1557 1556 1555 1554 1553 1552 1551 1550 1549 1548 1547 1546 1545 1544 1543 1542 1541 1540 1539 1538 1537 1536 1535 1534 1533 1532 1531 1530 1529 1528 1527 1526 1525 1524 1523 1522 1521 1520 1519 1518 1517 1516 1515 1514 1513 1512 1511 1510 1509 1508 1507 1506 1505 1504 1503 1502 1501 1500 1499 1498 1497 1496 1495 1494 1493 1492 1491 1490 1489 1488 1487 1486 1485 1484 1483 1482 1481 1480 1479 1478 1477 1476 1475 1474 1473 1472 1471 1470 1469 1468 1467 1466 1465 1464 1463 1462 1461 1460 1459 1458 1457 1456 1455 1454 1453 1452 1451 1450 1449 1448 1447 1446 1445 1444 1443 1442 1441 1440 1439 1438 1437 1436 1435 1434 1433 1432 1431 1430 1429 1428 1427 1426 1425 1424 1423 1422 1421 1420 1419 1418 1417 1416 1415 1414 1413 1412 1411 1410 1409 1408 1407 1406 1405 1404 1403 1402 1401 1400 1399 1398 1397 1396 1395 1394 1393 1392 1391 1390 1389 1388 1387 1386 1385 1384 1383 1382 1381 1380 1379 1378 1377 1376 1375 1374 1373 1372 1371 1370 1369 1368 1367 1366 1365 1364 1363 1362 1361 1360 1359 1358 1357 1356 1355 1354 1353 1352 1351 1350 1349 1348 1347 1346 1345 1344 1343 1342 1341 1340 1339 1338 1337 1336 1335 1334 1333 1332 1331 1330 1329 1328 1327 1326 1325 1324 1323 1322 1321 1320 1319 1318 1317 1316 1315 1314 1313 1312 1311 1310 1309 1308 1307 1306 1305 1304 1303 1302 1301 1300 1299 1298 1297 1296 1295 1294 1293 1292 1291 1290 1289 1288 1287 1286 1285 1284 1283 1282 1281 1280 1279 1278 1277 1276 1275 1274 1273 1272 1271 1270 1269 1268 1267 1266 1265 1264 1263 1262 1261 1260 1259 1258 1257 1256 1255 1254 1253 1252 1251 1250 1249 1248 1247 1246 1245 1244 1243 1242 1241 1240 1239 1238 1237 1236 1235 1234 1233 1232 1231 1230 1229 1228 1227 1226 1225 1224 1223 1222 1221 1220 1219 1218 1217 1216 1215 1214 1213 1212 1211 1210 1209 1208 1207 1206 1205 1204 1203 1202 1201 1200 1199 1198 1197 1196 1195 1194 1193 1192 1191 1190 1189 1188 1187 1186 1185 1184 1183 1182 1181 1180 1179 1178 1177 1176 1175 1174 1173 1172 1171 1170 1169 1168 1167 1166 1165 1164 1163 1162 1161 1160 1159 1158 1157 1156 1155 1154 1153 1152 1151 1150 1149 1148 1147 1146 1145 1144 1143 1142 1141 1140 1139 1138 1137 1136 1135 1134 1133 1132 1131 1130 1129 1128 1127 1126 1125 1124 1123 1122 1121 1120 1119 1118 1117 1116 1115 1114 1113 1112 1111 1110 1109 1108 1107 1106 1105 1104 1103 1102 1101 1100 1099 1098 1097 1096 1095 1094 1093 1092 1091 1090 1089 1088 1087 1086 1085 1084 1083 1082 1081 1080 1079 1078 1077 1076 1075 1074 1073 1072 1071 1070 1069 1068 1067 1066 1065 1064 1063 1062 1061 1060 1059 1058 1057 1056 1055 1054 1053 1052 1051 1050 1049 1048 1047 1046 1045 1044 1043 1042 1041 1040 1039 1038 1037 1036 1035 1034 1033 1032 1031 1030 1029 1028 1027 1026 1025 1024 1023 1022 1021 1020 1019 1018 1017 1016 1015 1014 1013 1012 1011 1010 1009 1008 1007 1006 1005 1004 1003 1002 1001 1000 999 998 997 996 995 994 993 992 991 990 989 988 987 986 985 984 983 982 981 980 979 978 977 976 975 974 973 972 971 970 969 968 967 966 965 964 963 962 961 960 959 958 957 956 955 954 953 952 951 950 949 948 947 946 945 944 943 942 941 940 939 938 937 936 935 934 933 932 931 930 929 928 927 926 925 924 923 922 921 920 919 918 917 916 915 914 913 912 911 910 909 908 907 906 905 904 903 902 901 900 899 898 897 896 895 894 893 892 891 890 889 888 887 886 885 884 883 882 881 880 879 878 877 876 875 874 873 872 871 870 869 868 867 866 865 864 863 862 861 860 859 858 857 856 855 854 853 852 851 850 849 848 847 846 845 844 843 842 841 840 839 838 837 836 835 834 833 832 831 830 829 828 827 826 825 824 823 822 821 820 819 818 817 816 815 814 813 812 811 810 809 808 807 806 805 804 803 802 801 800 799 798 797 796 795 794 793 792 791 790 789 788 787 786 785 784 783 782 781 780 779 778 777 776 775 774 773 772 771 770 769 768 767 766 765 764 763 762 761 760 759 758 757 756 755 754 753 752 751 750 749 748 747 746 745 744 743 742 741 740 739 738 737 736 735 734 733 732 731 730 729 728 727 726 725 724 723 722 721 720 719 718 717 716 715 714 713 712 711 710 709 708 707 706 705 704 703 702 701 700 699 698 697 696 695 694 693 692 691 690 689 688 687 686 685 684 683 682 681 680 679 678 677 676 675 674 673 672 671 670 669 668 667 666 665 664 663 662 661 660 659 658 657 656 655 654 653 652 651 650 649 648 647 646 645 644 643 642 641 640 639 638 637 636 635 634 633 632 631 630 629 628 627 626 625 624 623 622 621 620 619 618 617 616 615 614 613 612 611 610 609 608 607 606 605 604 603 602 601 600 599 598 597 596 595 594 593 592 591 590 589 588 587 586 585 584 583 582 581 580 579 578 577 576 575 574 573 572 571 570 569 568 567 566 565 564 563 562 561 560 559 558 557 556 555 554 553 552 551 550 549 548 547 546 545 544 543 542 541 540 539 538 537 536 535 534 533 532 531 530 529 528 527 526 525 524 523 522 521 520 519 518 517 516 515 514 513 512 511 510 509 508 507 506 505 504 503 502 501 500 499 498 497 496 495 494 493 492 491 490 489 488 487 486 485 484 483 482 481 480 479 478 477 476 475 474 473 472 471 470 469 468 467 466 465 464 463 462 461 460 459 458 457 456 455 454 453 452 451 450 449 448 447 446 445 444 443 442 441 440 439 438 437 436 435 434 433 432 431 430 429 428 427 426 425 424 423 422 421 420 419 418 417 416 415 414 413 412 411 410 409 408 407 406 405 404 403 402 401 400 399 398 397 396 395 394 393 392 391 390 389 388 387 386 385 384 383 382 381 380 379 378 377 376 375 374 373 372 371 370 369 368 367 366 365 364 363 362 361 360 359 358 357 356 355 354 353 352 351 350 349 348 347 346 345 344 343 342 341 340 339 338 337 336 335 334 333 332 331 330 329 328 327 326 325 324 323 322 321 320 319 318 317 316 315 314 313 312 311 310 309 308 307 306 305 304 303 302 301 300 299 298 297 296 295 294 293 292 291 290 289 288 287 286 285 284 283 282 281 280 279 278 277 276 275 274 273 272 271 270 269 268 267 266 265 264 263 262 261 260 259 258 257 256 255 254 253 252 251 250 249 248 247 246 245 244 243 242 241 240 239 238 237 236 235 234 233 232 231 230 229 228 227 226 225 224 223 222 221 220 219 218 217 216 215 214 213 212 211 210 209 208 207 206 205 204 203 202 201 200 199 198 197 196 195 194 193 192 191 190 189 188 187 186 185 184 183 182 181 180 179 178 177 176 175 174 173 172 171 170 169 168 167 166 165 164 163 162 161 160 159 158 157 156 155 154 153 152 151 150 149 148 147 146 145 144 143 142 141 140 139 138 137 136 135 134 133 132 131 130 129 128 127 126 125 124 123 122 121 120 119 118 117 116 115 114 113 112 111 110 109 108 107 106 105 104 103 102 101 100 99 98 97 96 95 94 93 92 91 90 89 88 87 86 85 84 83 82 81 80 79 78 77 76 75 74 73 72 71 70 69 68 67 66 65 64 63 62 61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0



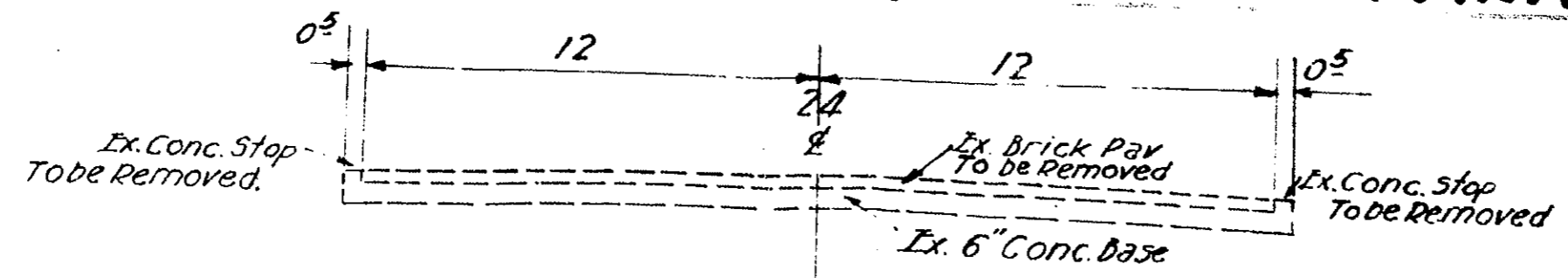
DIRECTOR ST.

14<sup>TH</sup> AVE. S.



SOUTH PARK ADD. VOL. 4-87

SOUTH PARK HTS. VOL. 8-52



TYPICAL SECTION OF EX. BRICK PAV. ON 14<sup>TH</sup> AVE. S.  
Sullivan St. to Director St.

**ATTACHMENT 3**  
**CAS SOP – Subsampling and Compositing of Samples**  
**(includes Multi-Increment Subsampling)**

STANDARD OPERATING PROCEDURE  
SUBSAMPLING AND COMPOSITING OF SAMPLES

GEN-SUBS  
Revision 3  
February 1, 2008

UNCONTROLLED

Approved By: \_\_\_\_\_  
Supervisor  
\_\_\_\_\_   
QA Manager  
\_\_\_\_\_   
Laboratory Manager

2/4/08  
Date  
2-4-08  
Date  
2/4/08  
Date

COLUMBIA ANALYTICAL SERVICES, INC.  
1317 South 13th Avenue  
Kelso, Washington 98626

© Columbia Analytical Services, Inc. 2008

Annual review of this SOP has been performed and the SOP still reflects current practice.  
Initials: \_\_\_\_\_ Date: \_\_\_\_\_  
Initials: \_\_\_\_\_ Date: \_\_\_\_\_  
Initials: \_\_\_\_\_ Date: \_\_\_\_\_

DOCUMENT CONTROL  
NUMBER: \_\_\_\_\_  
Initials: \_\_\_\_\_ Date: \_\_\_\_\_

## SUBSAMPLING AND COMPOSITING OF SAMPLES

### 1. SCOPE AND APPLICATION

- 1.1. This standard operating procedure describes procedures for obtaining subsamples used for laboratory analysis. The procedure also describes general practices for making composite samples from multiple individual samples. Procedures are given for aqueous, soil, sediment, vegetation and miscellaneous matrices. The SOP does not apply to tissue samples. Procedures for tissue samples are described in the GEN-TISP and MET-TDIG SOPs.
- 1.2. The SOP describes routine, or default, procedures for samples that do not require VOC analyses. Handling of VOC samples is described in SOP VOC-5035. Program or project-specific requirements may differ from those described in the SOP. Samples analyzed by EPA CLP procedures are specifically excluded from this procedure, and will be handled according to the applicable SOW.
- 1.3. Multi-increment samples require special handling and subsampling procedures. In addition to routine procedures, this SOP also includes instructions for handling and sampling from multi-increment samples submitted to the laboratory.
- 1.4. This procedure does not apply to situations where the entire sample (container) is used for the analysis.

### 2. METHOD SUMMARY

- 2.1. Obtaining a representative analytical subsample from the field sample submitted is essential to providing meaningful data. The subsample must be taken to most closely reflect the predominant composition of the sample. For aqueous and liquid samples, this is usually accomplished by shaking or inverting the sample. For soil, sediment, powders, and other solids the procedures are more involved. Procedures for subsampling are based on the information given in the references listed.
- 2.2. Some projects may employ multi-increment (MI) sampling in the field. The primary objective of MI sampling is to control the certain statistical errors associated with discrete sampling. Some studies have shown that MI sampling, using 30+ sample increments within a decision unit (a defined field sampling area) may provide a more representative view of contaminant concentrations than traditional discrete sampling approaches. References listed provide additional background on MI sampling. When this approach is taken it is important that laboratory procedures are consistent with field procedures when taking samples.
- 2.3. Unique sample matrices such as vegetation, wood and wood chips, mechanical parts and filters, etc. pose additional challenges to obtaining representative samples. For these samples the laboratory staff should consult with the Project Manager to determine the subsampling

strategy. These special situations will be handled on a case-by-case basis. Service requests should list any specific sample preparation required.

### **3. DEFINITIONS**

- 3.1. Sample – A portion of material taken from a larger quantity for the purpose of estimating properties or composition of the larger quantity (ASTM).
- 3.2. Subsample – A portion of a sample taken for the purpose of estimating properties or composition of the whole sample (ASTM).
- 3.3. Composite sample – A mixture of multiple samples or subsamples produced to result in one sample representative of multiple field samples.
- 3.4. Representative subsample – A subsample collected in such a manner that it reflects one or more characteristics of interest (as defined by the project objectives) of the laboratory sample from which it was collected (ASTM).
- 3.5. Multilayered sample – A sample consisting of two or more clearly differentiated components (ASTM).
- 3.6. Multi-increment (MI) sample – A field sample consisting of multiple bulk containers from one decision unit (defined in a MI sampling plan) submitted to the lab for subsampling into a representative sample for analysis.

### **4. INTERFERENCES**

- 4.1. When obtaining subsamples it is important to minimize any chances for sample contamination or cross-contamination between samples. Work should be performed in an organized and neat manner. Spilling of samples (from overfilled containers, etc) should be minimized and spills cleaned up. Equipment and laboratory tools used with samples should be cleaned between samples to prevent cross-contamination.
- 4.2. Analysis-specific interferences are described in the applicable analytical SOP.

### **5. SAFETY**

- 5.1. All appropriate safety precautions for handling solvents, reagents and samples must be taken when performing this procedure. This includes the use of personal protective equipment, such as, safety glasses, lab coat and the correct gloves.
- 5.2. Chemicals, reagents and standards must be handled as described in the CAS safety policies, approved methods and in MSDSs where available. Refer to the CAS Environmental, Health and Safety Manual and the appropriate MSDS prior to beginning this method.

## **6. SAMPLE COLLECTION, CONTAINERS, PRESERVATION AND STORAGE**

- 6.1. Refer to the analytical SOP for sample collection preservation and storage of samples. Subsamples and composite samples held for later analysis should be preserved and stored in the same manner as specified for field samples.
- 6.2. Projects for MI samples will include additional instructions not found in the analytical SOP. The analyst should consult with the Project Chemist, or refer to the Project Chemist's instructions, prior to working with these samples.

## **7. APPARATUS AND EQUIPMENT**

- 7.1. Laboratory balance capable of weighing the desired sample mass. There are various makes and models of balances available for use, with each department having balances appropriate for its use. For weighing solids and non-aqueous liquids (wastes), use a top-loader balance. Ensure that the mass to be placed on the pan is within the calibration-verified range of the balance.
- 7.2. Wiley laboratory mill, Model 4. Operate the Wiley mill following the manufacturer's recommendations.
- 7.3. Sieve shakers.
- 7.4. Shatter box.
- 7.5. Mechanical mixer and/or shaker.
- 7.6. Stainless steel mixing bowl.
- 7.7. Metal or disposable spoons and spatulas.
- 7.8. Aluminum foil.
- 7.9. Weighing boats, plastic or aluminum
- 7.10. Clean sample containers and lids (various sizes) as specified in the applicable test SOP.
- 7.11. Common laboratory glassware/apparatus (beakers, flasks, pipets, syringes, etc.).
- 7.12. Multi-Increment Samples
  - 7.12.1. Small spoon, spatula, or disposable plastic syringe

7.12.2. Volatile sample containers.

7.12.2.1. 250-500 milliliter (ml) narrow mouth, amber bottles (recommended)

7.12.2.2. 4-8 ounce (oz) amber jars with Teflon lined septum lids

7.12.3. Large stainless steel spoon or scoop

7.12.4. Large clean container (a large stainless steel bowl, Ziploc bags, or 5-gallon bucket)

7.12.5. #10 (2mm) sieve

7.12.6. Steel cookie sheet or other tray

7.12.7. Small spatula or spoon

**8. REAGENTS**

Not applicable.

**9. RESPONSIBILITIES**

It is the responsibility of the analyst to perform the analysis according to this SOP and to complete all documentation required for data review. Analysis and interpretation of the results are performed by personnel in the laboratory who have demonstrated the ability to generate acceptable results utilizing this SOP. This demonstration is in accordance with the training program of the laboratory. Final review and sign-off of the data is performed by the department supervisor/manager or designee.

**10. PREVENTIVE MAINTENANCE**

No preventive maintenance is required other than normal glassware and apparatus cleaning.

**11. PROCEDURE**

11.1. Aqueous samples - Subsampling

11.1.1. Examine the sample. Thoroughly mix all samples by vigorous shaking. Immediately open the container and obtain the subsample. Additional filtering of the subsample may be required by the analytical SOP.

11.1.2. If the sample is multi-layered (a water layer with a sand/sediment layer that cannot be mixed or non-aqueous liquid layer) the Project Chemist should be consulted on how to proceed with the sample. Additional analyses or sample preparations may be

necessary depending on the client's data needs. Document the condition of the sample and decision made on subsampling.

## 11.2. Aqueous samples - Compositing

11.2.1. The customer may require compositing based on flow rates to create a flow proportional composite. The compositing instructions are included with the Form V. Equal volume compositing is assumed if there are no specific instructions provided for compositing ratios.

11.2.2. Setup the necessary glassware and/or sample container receiving the composite sample. Ensure that proper measuring glassware is used, typically a graduated cylinder or volumetric flask for larger volumes and pipet or syringe for smaller volumes.

11.2.3. Working quickly, mix the individual samples (as described above), open the container(s) and obtain the composite aliquot. Add each aliquot to the composite container and cap between samples.

11.2.4. Once all composite aliquots are obtained, cap and mix the composite sample. Label the container appropriately. Complete all documentation necessary to describe the compositing procedure, including samples used, aliquot taken, etc.

## 11.3. General considerations – Non-liquid samples

11.3.1. The analyst must first understand what the sample matrix of interest is. The project information should be consulted. If the sample appears to be homogeneous (other than extraneous materials described below) particle size reduction is not necessary. Particle size reduction should be performed only when required by the project QAPP, project specifications, or client request. If particle size reduction is required, use the appropriate apparatus (Wiley mill, shatter box, etc.) to perform crushing, grinding, milling, or sieving, and document. Refer to ASTM D6323 for guidelines on performing particle size reduction.

11.3.2. Once the matrix of interest is known, examine the sample for presence of extraneous material. The default procedure is to remove these items, or not include in the representative subsample. However, the presence of these materials should be documented in lab records and the Project Manager should be consulted prior to subsampling. Some examples are given below.

- For soil, solid, and sediment samples this includes such material as larger rocks, sticks, leaves, pieces of metal, man-made materials, etc.
- For wood or bark samples this includes chunks of soil, mud, rocks, etc.

- For vegetation samples this includes chunks of soil, mud, rocks, sticks (not of the sample type, etc.).
- For sediment samples this includes rocks, twigs, vegetation, organisms, etc. For sediment/marine projects, organisms are typically analyzed under separate sampling and analysis plans.
- For mechanical parts, filters, etc., this includes chunks of soil, mud, rocks, sticks, etc.

11.3.3. Examine soil samples to determine if the sample contains significant amounts of water. If the amount of water is greater than approximately 30%, treat the sample as a sediment sample.

11.3.4. Samples which are especially heterogeneous, as well as various special matrices, may require additional preparation. These will be handled on a case-by-case basis after consultation with the appropriate supervisors and Project Manager. Unique matrices for TCLP and other leaching procedures should be handled according to the applicable SOP or reference method.

#### 11.4. Soil/solid samples - Subsampling

##### 11.4.1. Samples in jars

11.4.1.1. Using a spatula or other utensil, thoroughly mix and homogenize the sample, making sure to mix the entire contents of the jar. Additional steps may be needed to homogenize the sample (break up soil clumps, etc.). The sample should be mixed so there is a uniform color and texture.

11.4.1.2. Once mixed, remove the desired mass of sample for the analysis and document accordingly. Recap the jar and return to storage.

##### 11.4.2. Samples in sleeves (core samples) and large bulk containers.

11.4.2.1. Samples in sleeves are emptied into a metal or glass homogenizing container and thoroughly stirred using a spatula or other utensil. When homogenized the appropriate sample portions are placed in jars. Perform additional drying and grinding only when specified for the project. Client specifications for drying and grinding will be communicated by the Project Chemist.

11.4.2.2. When working with sleeves and resulting homogenized samples/subsamples, always double-check the sample ID on the sleeve against the sample numbers on the samples.

#### 11.5. Soil/solid samples - Compositing

11.5.1. Thoroughly mix each individual sample as described in 11.4 above.

11.5.2. Combine equal masses from each of the individual samples into a clean stainless steel mixing bowl. The amount used will depend upon the number of analyses to be performed on the composite and/or the amount available. The analyst preparing the composite will document the mass of each individual sample used for the composite, the date and time of compositing, and any other pertinent observations.

11.5.3. The sample is thoroughly homogenized using a spatula or other utensil and returned to clean glass jars. The sample container is labeled as a composite and with the sample identification, dated, and initialed.

11.5.4. The composite sample and remaining individual samples are returned to storage.

#### 11.6. Sediment samples - Subsampling

11.6.1. For organics the project should specify how to treat overlying water. EPA SW-846 methods for organic extractions specify to decant and discard overlying water. However, the Puget Sound Protocols have options for decanting and discarding this water, decanting and performing a separate water analysis, or mixing the water into the sample. The analyst should confirm which option is to be used on the sample. For projects not within the scope of the Puget Sound Protocols, the overlying water should be decanted and discarded for organics analysis. For metals and inorganics, mix the overlying water into the sample.

**Note:** If water is decanted and discarded and percent solids is to be applied or determined, a separate solids determination must be made on the decanted sample.

11.6.2. Thoroughly mix and homogenize the sample, making sure to mix the entire contents of the jar. Additional steps may be needed to homogenize the sample (break up soil clumps, etc.). The sample should be mixed so there is a uniform color and texture.

**Note:** Sediment samples may contain considerable amounts of organics matter. Ensure that samples are thoroughly mixed. Document the presence of substantial organic matter, shells, etc.

11.6.3. Once mixed, remove the desired mass of sample for the analysis and document accordingly. Recap the jar and return to storage.

11.6.4. The subsample is transferred to an appropriate, labeled container. The sample container is stored in the appropriate refrigerator in sample receiving and any empty sleeve can be stored at room temperature.

## 11.7. Sediment samples - Compositing

11.7.1. Thoroughly mix each individual sample as described in 11.6 above.

11.7.2. Combine equal masses from each of the individual samples into a clean stainless steel mixing bowl. The amount used will depend upon the number of analyses to be performed on the composite and/or the amount available. The analyst preparing the composite will document the mass of each individual sample used for the composite, the date and time of compositing, and any other pertinent observations.

Note: Equal masses are used unless otherwise instructed. It may be required to use the entire jar or other measure.

11.7.3. The sample is thoroughly homogenized using a spatula or other utensil and returned to clean glass jars. The sample container is labeled as a composite and with the sample identification, dated, and initialed.

11.7.4. The composite sample and remaining individual samples are returned to storage.

## 11.8. Multi-Increment Soil Sampling

11.8.1. Samples should be received prepared from the field as sample increments. Although unlikely, in cases where proper preparation of increments from *large bulk samples* does not occur in the field, the following steps will be taken.

11.8.1.1. When obtaining sample increments from a large bulk container (bucket, large jar, large bag, etc.) be sure to sample from the center and remove the soil a 1-2 inches deep. Using the large spoon or scoop, collect the sample increment according to the work plan. Scoop approximately 30-60 grams into a large, clean container and move on to the next sample increment location. Be cautious of oversize material, which means more mass may need to be taken from each increment to end with the 30-50 g sub-sample after sieving (a 5 kg field sample may not be uncommon). Increments can be sieved directly into the bucket, or they can be bagged and sieved later.

### 11.8.2. Subsampling

11.8.2.1. Subsampling can be accomplished either in the field or in a laboratory set up to conduct subsampling according to the following procedure.

11.8.2.2. After the 30-50 sample increments have been collected into the container (a 5 kg field sample may not be uncommon), use the #10 sieve

to sieve the soil into another clean container. Approximately 500–1000 g of material following sieving should be available.

11.8.2.3. Once the > 2mm fraction has been removed, spread the remaining soil evenly on the steel tray approximately ½ inch in depth. Roughly divide the tray into 30-50 sections and using the small spatula, collect approximately 1 g (approx. ½ tablespoon) from each of the sections.

11.8.2.4. Because fines tend to settle, scrape the spatula along the bottom of the tray to make sure that every particle size is equally represented in the sample. Place all scoops into a single sample jar (2 or 4 oz as appropriate). It may be beneficial to use a balance to ensure the proper sample mass is collected. The final sample mass per jar collected, 30-50 g (30 g = approx. 1 ounce), must meet the minimum amount of material to be analyzed by the lab for the specific test. Keep in mind that the laboratory must analyze the entire contents of the prepared (or submitted) jar, minus the portion for the percent solids determination.

Note: Alaska Methods AK102 and AK103 call for the extraction of from 10-30 g of sample material (soil). For MI purposes, the minimum required amount of material per analysis is 30 g.

11.8.2.5. Repeat the process into a second jar to obtain a second backup sample in the event that re-analysis is required.

11.8.2.6. The subsampling process must be repeated for each separate analysis to be performed on the sample.

### 11.8.3. Laboratory Analysis

The laboratory must analyze the entire contents of the prepared (or submitted) jar, minus the portion for the percent solids determination. The results may be less defensible if only a subsample or fraction of the jar contents is analyzed.

## 11.9. Vegetation samples

Since vegetation samples often are not amenable to standard mixing and homogenization techniques, or specific sections of the vegetation are targeted, these are handled on a case-by-case basis with instructions from the Project Chemist. The Project Chemist should obtain sample-specific instructions from the client. The Project Chemist will then communicate the specification to the lab personnel using the CAS Form V document for the project. If the client makes reference to specific procedures, methods, or technical references, the Project Chemist will make the document(s) available to the laboratory personnel.

#### 11.10. Paperboard samples

11.10.1. In general, prepare paperboard samples as described below. Project-specific instructions may replace these.

11.10.2. Look at SR, determine the jars you will need

- Metals = 8 oz jar.
- Voa = 8 oz jar.
- Dioxins = 8 oz jar.
- SVG = 32 oz jar.
- SVM = 32 oz jar.
- PHC (8315) = 8 oz jar.
- Gen Chem (not Biology) = 8 oz jar.
- Make sample labels according to test and put on appropriate jar.

11.10.3. If FDA Ext is on the Service Request for PHC you will need a 16 oz jar per sample. Do Not Composite into one sample. Each sample is a separate sample.

11.10.4. Prepare the FDA Ext first.

- Cut the sheet of paper into one 10" x 10" square.
- Cut the 10" x 10" into strips at the cut lines 7 ½, 5 and 2 ½.
- Cut the strips at the cut lines 7 ½, 5 and 2 ½. This will make 16 2" squares.
- Put each sample into its own jar and label accordingly. Ie (1,2 3, etc.) PHC will composite in the lab.

11.10.5. Put one sheet of paper into shredder, run the shredder back and forth to get all the sample out. Use tongs to remove any remaining sample in bottom of shredder (make sure to turn off before you do this)

11.10.6. Shred equal amounts of each sample (1 or more sheets) to create the composite sample. Homogenize sample thoroughly and aliquot into each jar needed for analysis. Put sample storage on lid of jar.

11.10.7. Dioxins get sent out to Houston. Label lid "Out".

11.10.8. Take all composites to Sample Storage for CAS labeling and shelving.

11.10.9. Update Composites as being done.... Open Starlims, double click on Ad Hoc by Test (Under Results entry), highlight samples composited and click the Update to Done button at the top of page. Do not add jars when asked. Just click the X on the right hand corner.

## 12. QA/QC REQUIREMENTS

Ongoing QC Samples required for each sample batch (20 or fewer samples) are described in the SOP for Sample Batches and in the determinative SOPs.

## 13. DATA REDUCTION AND REPORTING

13.1. All compositing and subsampling data must be recorded into the bench records by the analyst. In addition to sample volumes and masses, sample identifications, etc., this should include descriptions of unique samples or sample components.

13.2. It is the supervisor's responsibility to ensure that analytical data is reviewed and to ensure that all quality control requirements have been met.

## 14. TRAINING

Refer to the determinative SOPs and the SOP for Documentation of Training for standard procedures.

## 15. REFERENCES

- 15.1. *Guidance for Obtaining Representative Laboratory Analytical Subsamples from Particulate Laboratory Samples*, U.S. Environmental Protection Agency, EPA/600/R-03/027, November 2003
- 15.2. *Standard Guide for Laboratory Subsampling of Media Related to Waste Management Activities*, ASTM D 6323, Annual Book of ASTM Standards, 1999.
- 15.3. Test Methods for Evaluating Solid Waste, EPA SW-846, Final Update III, December 1996.
- 15.4. *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, January, 1996.
- 15.5. Draft Guidance on Multi-Increment Soil Sampling State of Alaska, Department of Environmental Conservation, March 2007