To: Mark Edens/Ecology

From: Iris Winstanley/Leidos

Date: May 26, 2015

Subject: Sherlock Database Update – May 2015

In 2011, Science Applications International Corporation (SAIC) prepared an evaluation of surface sediment and storm drain solids data that had been collected in the Lower Duwamish Waterway (LDW) and associated source control areas. This evaluation included a compilation of available surface sediment, stormwater, and storm drain solids data in an effort to gain a better understanding of the relationship between contaminants in stormwater and contaminant concentrations in sediments, and to identify areas where additional data are needed to assist Ecology with the prioritization of source control efforts.

As part of this effort, SAIC created a Microsoft Access database (referred to as "Sherlock") containing available physical and chemical parameter source tracing data collected throughout the LDW, and a subset of the database (referred to as "Watson") containing only the most recent and applicable data for statistical analysis and mapping purposes. The database contained sampling results received by SAIC as of November 1, 2011.

In 2013, Leidos (formerly SAIC) updated the Sherlock database to include data received between November 2011 and September 2013. In addition, a new Watson table, which includes only the most recent data for a given chemical and location, was provided as part of the Sherlock database. New data sources added to the Sherlock database were summarized in a memo dated January 2014.

Sherlock has been updated again in 2015, and this memorandum serves to document the changes and additions. New data sources added with this update include:

- **SPU Source Tracing Program (2012 to 2014)**

  SPU conducts source tracing and source control activities in city-owned storm drain lines. Since 2002, SPU has collected inline sediment trap samples, inline grab samples, and catch basin grab samples. Catch basin grab samples were collected from either a specific site or property (on site) or from public rights-of-way (ROW). In addition, SPU has collected opportunistic samples, such as surface soil and surface debris. Sampling was previously conducted by SPU under an interagency agreement with Ecology, however this agreement is no longer in effect and SPU's storm drain sampling activity has decreased. For this update, SPU provided spreadsheets containing SPU LDW storm drain sampling data, including data for "other SVOCs" collected in 2012 and not previously provided (65 samples); and data for samples collected in 2013/2014 (62 samples). Samples were analyzed for metals, PCB Aroclors, SVOCs, petroleum hydrocarbons, TOC, and grain size.

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- **NPDES Inspection Sampling Support (2013)**

  During 2013, Ecology's contractor (Leidos) conducted sampling of stormwater and storm drain solids in support of National Pollutant Discharge Elimination System (NPDES) inspections at 11 facilities in the LDW basin. The primary purpose of this sampling program was to characterize water and solids in stormwater conveyance systems at selected NPDES-permitted facilities in the LDW basin. Results were used to identify pollutants present in the stormwater systems that have the potential to discharge to the LDW; determine if contaminant concentrations in water and solids collected in the stormwater conveyance systems exceed water quality and/or sediment management standards; to provide data to evaluate whether industrial facilities should be required to monitor for additional contaminants of concern not currently required under the Industrial Stormwater General Permit (ISGP); and to recommend additional locations for sampling and analysis. A total of 15 stormwater grab samples (including one field duplicate) and 27 storm drain solids grab samples were collected between April and June 2013. Water samples were analyzed for PCB congeners, total and dissolved metals, SVOCs, pesticides, total and dissolved organic carbon, total suspended solids, pH, specific conductance, alkalinity, and anions. Two samples were analyzed for PCB Aroclors. Storm drain solids samples were analyzed for PCB Aroclors, dioxins/furans, pesticides, metals, SVOCs, VOCs, total petroleum hydrocarbons (TPH), and total organic carbon.

- **Terminal 108 – Bank Soil Sampling (2013)**

  In 2013, the Port of Seattle's contractor (AECOM) collected five bank soil samples and four sediment trap samples at Terminal 108, in the RM 0.1-0.9 East (Duwamish/Diagonal Way) source control area. Bank soil sample data were included in this version of Sherlock (Graddon 2014). Bank soil sampling locations were estimated based on a map provided by R. Kuroiwa on 2/14/2013. Sediment trap sample results were not included because information on sample locations was not available.

An overview table listing these and other data added to the Sherlock database is attached to this memorandum. Due to budget issues, not all available data have been added to the current version of Sherlock. Some datasets are shown on the attached spreadsheet as "in progress." For these, electronic data have been obtained and partially formatted for upload, but formatting and review have not been completed due to lack of funds. These will be completed and added to Sherlock as soon as additional funds are available. The overview table also lists data that Leidos is aware of or that will be available in the near future, but that are not currently available to Leidos in electronic format. These datasets will be added in a future iteration, as budget allows.

Terminology

The following terminology is used in this Technical Memorandum, and in the Sherlock database:

Surface Sediment refers to a sample collected from the top 10 centimeters of the waterway bed; storm drain solids may become sediments after they are discharged through an outfall and settle to the river bottom. Larger storm drain solids particles will settle nearer to the outfall, while smaller particles may be transported some distance downstream prior to settling. Tidal effects, particularly near the downstream end of the LDW and in slips/inlets, may result in "blurring" of this effect.

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Storm drain (SD) solid means any sample of solid material collected in a storm drain structure or pipe, including catch basins, maintenance holes, oil/water separators, or vaults. Storm drain solids, as defined in this report, include samples collected by various methods, including grab samples, sediment trap samples, and filtered suspended solids samples.

Bank soil samples have been collected along the banks of the waterway from locations at or above the mean higher high water line. Contaminants in bank soils may be transported to the LDW by soil erosion or by stormwater runoff (sheet flow).

Surface debris samples have been collected in some locations as surrogates for SD solids in situations where insufficient sampleable material was available in the stormwater conveyance structure.

Limitations and Assumptions

Sherlock includes surface sediment and storm drain sample data that have been collected since January 1, 2000. Surface sediment, bank soil, and storm drain solids data provided to SAIC/Leidos by Ecology between October 2013 and March 2015 are listed in the overview table; these were added to Sherlock as possible within the budget constraints.

In general, the source control area boundaries used to assign each sample location in Sherlock match closely with SCA boundaries defined in Data Gaps Reports that have been completed to date, and include public and private storm drain basins but not CSO basins, except as they overlap with public and private storm drain basins. In addition, source control area boundaries include properties adjacent to the LDW and generally use East Marginal Way S (on the east side of the LDW) and West Marginal Way SW (on the west side of the LDW) to bound areas that are not within a public storm drain basin.

All storm drain solids samples within the boundaries of a source control area, as defined in this report, were assigned to that source control area. This includes samples with stormwater drainage to a public or private storm drain or to a combined sewer.

Surface sediment samples and bank soil samples were assigned to a source control area based on the northern and southern source control area boundaries along the adjacent shoreline and to the edge of but not including the navigation channel.

Current Sherlock Database Structure

The updated Sherlock Access database is generally consistent with the original Sherlock Access database, with several improvements. The following tables are included in the Access database:

Table Name	Function
Results-Solids	All solids data. Table has Unique ResultID field for each result (regardless of if duplicate).
Results-Water	All water data. Table has Unique ResultID for both Water and Solids data.
Sample_Locations	Unique Sample Locations for solids and water data. Each has unique coordinates.
Watson-Results-Solids	Results of "Watson" query for Solids Samples for the most recent parameter data at each location.
Watson-Results-Water	Results of "Watson" query for Water samples for the most recent parameter data at each location.

State plane X and Y coordinates were usually available in electronic format. When necessary, coordinates were georeferenced from available maps and digitized. Database fields in the Results-Solids table are listed below:

Field Name	Description
ResultID	Unique integer value for each record
LocID	Unique integer value for each sample location; additional location information is provided in the Location table
LocationName	Descriptive sample location name
StudyID	Name of data source
DocNum	Source document number from LDW document library
SampleID	Unique sample name
CollectionDate	Date sample was collected
Matrix	Sample matrix (sediment, SD solids, soil, or surface debris)
SampleType	Collection method (see table below)
SampleDescription	Additional description for sample type (e.g., catch basin, inline, right-of-way, ditch, baseflow).
Clean	Data provided by SPU that reflects whether sample was collected before or after SD cleaning (e.g., Never Been Cleaned, KCIA SD#2 Clean1). For non-SPU data, indicates whether sample was collected before or after SD cleaning, if known.
ParameterClass	Analyte group name (e.g., metals, HPAHs, PCBs, phthalates)
Parameter	Analyte name
Result	Analytical result
Units	Units of result
Qualifier	lab or validation qualifier
Detect	"Y" if analyte was detected, "N" if it was a non-detect
Duplicate	"Yes" indicates sample is a field duplicate
Fraction	"Total" if presented as such in the original data source
Basis	Wet or dry weight for solids samples
Remediated	"Y" if sample was collected prior to remediation
Notes	Additional notes if available (by data source) or created by SAIC/Leidos
EnterDate	Date on which data was originally entered into Sherlock
ChangeDate	Date on which data were revised; usually accompanied by an explanation in the Notes field
SL-Low	Lower screening level; generally LAET or SQS
SL-High	Higher screening level; generally 2LAET or CSL
EF-Low	Exceedance factor using lower screening level
EF-High	Exceedance factor using higher screening level
SL-Basis	Source of screening level
Draft	"Yes" indicates data is draft

Matrix, sample type and grab type fields were updated with this version of Sherlock. The following identifiers were used:

Matrix	SampleType Field	SampleDescription Field
Soil	Bank Soil Grab	
Sediment	Surface Sediment Grab	Blank (default) or backfill
SD Solids	Filtered Suspended Solids	Blank (default – generally assumed to be storm flow), baseflow, or tidal flow
SD Solids	Centrifuged Solids	
SD Solids	Filter Sock Solids	
SD Solids	Sediment Trap	Blank (default), or bedload
SD Solids	SD Solids Grab	Inline, catch basin, onsite catch basin, ROW catch basin, ditch, OWS, sump/vault, or SW treatment system
SD Solids	Other Solids Grab	Tank
Surface Debris	Surface Debris Grab	

The Results-Water table includes applicable fields from the Results-Solids table, with the following additions unique to water samples:

Field Name	Description
SampleType	Stormwater, baseflow water, or tide water
SampleMethod	Water sampling method (e.g., composite or grab)
Fraction	Indicates whether data are for total or dissolved fractions

The Locations table includes the following fields:

Field Name	Description
LocID	Unique location ID
LocationName	Location name used in Sherlock for this sampling location
AlternativeName	Other names for this sampling location
LocationDescription	More specific location description, as applicable
X	1983 NAD WA State Plane North X-Coordinate
Y	1983 NAD WA State Plane North Y-Coordinate
Longitude	Longitude (decimal)
Latitude	Latitude (decimal)
SCA	Source control area
RiverMile	For surface sediment samples, the approximate river mile location (within 0.1 mile); e.g., 2.0 to 2.1 refers to a location between RM 2.0 and RM 2.1, as measured from the southern tip of Harbor Island
RM_From	For surface sediment samples, the downstream side and upstream sides, respectively, of the RiverMile field above
RM_To	
ChannelLocation	For surface sediment samples, indicates whether the sample location is east of, west of, or within the navigation channel
Outfall	For SD solids and stormwater samples, indicates destination outfall name or outfall number, if known
SewerType	For SD solids and stormwater samples, indicates whether the sample location is within a public SD (SD) or CSO structure (CS), or in a structure that discharges directly to the LDW (Direct), if known

Field Name	Description
LocationType	Indicates whether the sample location is river, bank, or upland
Notes	Other pertinent information about the sample location, as appropriate

Parameter names include compound group sums such as total PCBs, total high molecular weight PAHs (HPAHs), total low molecular weight LPAH (LPAHs), and TEQ-based concentrations for cPAHs, PCB congeners, and dioxin/furan congeners. Sums were calculated following Ecology guidance (Ecology 2008). TEQ values were calculated using the toxicity equivalence factors (TEF) from *Evaluating the Toxicity and Assessing the Carcinogenic Risk of Environmental Mixtures Using Toxicity Equivalency Factors* (Ecology 2007) and substituting one-half the detection limit for non-detected concentrations. For a given sample, where chemicals were analyzed by multiple methods, the 'best result' was selected for the purposes of calculations: a detected value was selected over a non-detected value, a higher detected value was selected over a lower detected value, and a lower non-detected value was selected over a higher non-detected value.

Units were reported as milligrams per kilogram (mg/kg) for most chemicals in sediment and storm drain solids, and as ug/L for most chemicals in the whole water samples.

Qualifiers were reported as given. No assumptions were made about the validation level of data from each source. Data qualified as U, UJ, or Y all represented non-detected concentrations and were assigned a "N" value in the Detect field. Non-detected values may have been listed at the method reporting limit (MRL) or method detection limit (MDL). Results with J qualifiers denoting estimated concentrations were listed at the reported value.

Due to overlap between datasets incorporated into the Access database, and inconsistencies in labeling of field replicates between projects, several of the samples entered into the Access database were duplicates. Most of these duplicates are believed to have been removed from the database. However, it is likely that some remain.

An electronic copy of the Sherlock Access database is provided on CD. Since the 2013 update, 16,852 records were added to the Results-Solids table (currently 216,134 records) and 24,995 records were added to the Results-Water table (currently 24,995 records). There are 2,077 unique sample locations.

Watson Dataset

The Sherlock Access database was built to serve as the master copy for all LDW data. Just as Sherlock has been updated with the sources described in Section 2.1, a corresponding version of Watson was also created. Watson contains only the most recent samples at locations where multiple samples were collected over time. Separate versions of Watson were created for solids and water samples.

The updated Watson data tables are included in the Sherlock database.

Sherlock Update Status - May 2015

In Sherlock	DocNum	DocRef	DocName	DocDate	StudyID	SCA	Property	Location	Sample Type	Analytes	Sample Dates	Notes
YES-NEW	NA	SPU 2013	Spreadsheet received from B. Schmoyer (SPU)	12/30/13	SPU Source Tracing Update December 2013	Various	Various		SD solids (sediment trap, grabs)	SVOCs	1/25/2012 - 9/18/2012 (65 samples)	SPU 2012 data for "other SVOCs" not previously provided.
YES - NEW	10916	Leidos 2015	Lower Duwamish Waterway NPDES Inspection Sampling Support - 2013	01/01/15	NPDES Inspection Sampling 2013	Various	Various		Stormwater, SD solids (grab)	PCBs, metals, SVOCs, TPH, TOC, dioxins/furans, PCB congeners, pesticides	Feb through May 2013	Sampling conducted at 11 NPDES-permitted facilities in the LDW basin.
YES-NEW	NA	SPU 2015	Email from B. Robinson (SPU) to I. Winstanley (Leidos)	05/11/15	SPU Source Tracing Update May 2015	Various	Various		SD solids (sediment trap, grabs)	PCBs, metals, PAHs, phthalates, TPH, TOC	4/16/2013 - 6/30/2014 (62 samples)	Includes all SPU validated data from 2013 and 2014.
IN PROGRESS	NA	NA	Lower Duwamish Waterway NPDES Inspection Sampling Support - 2014/2015	NA	NPDES Inspection Sampling 2014-2015	Various	Various		Stormwater, SD solids (grab)	PCBs, metals, SVOCs, TPH, TOC, dioxins/furans, PCB congeners	Sep 2014 through Feb 2015	Sampling conducted at 13 NPDES-permitted facilities in the LDW basin. Data report in process; to be entered into Sherlock after report publication.
YES - NEW	10934	Graddon 2014	Email from Mindy Graddon (AECOM) to Roy Kuroiwa (POS) Re: LDW Source Control Status Report	02/20/14	NA	RM 0.1-0.9 East (EAA-1: Duwamish/Diagonal Way)	Terminal 108		Bank soil (5 samples)	PCBs, metals, PAHs, TOC	Dec 2012	Bank soil sample locations from Kuroiwa 2012 [9857].
NO			Port of Seattle line cleaning								Early 2015	Some hard copy data received but no sample locations. Not in EIM.
NO	10934	Graddon 2014	Email from Mindy Graddon (AECOM) to Roy Kuroiwa (POS) Re: LDW Source Control status Report	02/20/14	NA	RM 0.1-0.9 East (EAA-1: Duwamish/Diagonal Way)	Terminal 108		Sediment traps (4 samples)	PCBs, metals, PAHs, TOC	Nov 2013	Sample locations unknown; coordinates needed for Nov 2013 sediment trap data. Email refers to pending Feb 2014 stormwater solids data. Ecology to request the Feb 2014 data.
NO	NA	NA	Sampling of solids in six OWSs within the north basin. Described in SC Status Report (EAA-3: Slip 4).			RM 2.8 East (EAA-3: Slip 4)	KCIA		SD solids (OWS)	PCBs, metals, PAHs, phthalates, TPH	6 samples collected Oct 2012	Spreadsheet received containing sample results; no report. Check recent KCIA source tracing report (2015).
IN PROGRESS	NA	NA	Updated NBF-GTSP data (since December 2013 update)			RM 2.8 East (EAA-3: Slip 4)	NBF		SD solids (grabs, sediment traps, filters); stormwater	PCBs, metals, SVOCs, dioxins/furans		From Leidos NBF-GTSP database
NO	NA	Cardno 2015	Data Summary Report of Stormwater Solids Assessment, King County International Airport (Draft)	03/01/15		RM 2.8 East (EAA-3: Slip 4)	KCIA		SD solids (grabs, sediment traps)	PCBs, metals, dioxins/furans, PAHs, phthalates, phenols, TPH	Apr 2014 - Oct 2014	Draft report received; hard copy only. Not yet entered into Sherlock.
NO	NA	Integral 2013	Slip 4 Long-Term Monitoring Data Report - Year 1 (2013)	11/22/13		RM 2.8 East (EAA-3: Slip 4)	Slip 4		Surface sediment (grab)	PCBs, metals, SVOCs, TOC, grain size	7/22/13	Data report received; hard copy only. Not yet entered into Sherlock.
IN PROGRESS	10937, 10938	SLR 2014	Draft Data Gaps Report, First Phase of Remedial Investigation, 8th Avenue Terminals, Inc. Site; plus addendum memo	2/14/2014, 4/11/2014	8th Avenue Phase 1 RI	RM 2.8 East (EAA-3: Slip 4)	Crowley Marine/8th Avenue Terminals/DeNovo		Stormwater, storm drain solids, intertidal surface sediment	PCBs, metals, SVOCs, VOCs, dioxins/furans, TOC, grain size	Jun 2004 - Feb 2014	Pulled from EIM Study ID FS1940187; data partially processed for upload to Sherlock, however not complete due to budget constraints
NO	NA	NA	8th Avenue/DeNove Phase 2 RI - 2014		8th Avenue/DeNove Phase 2 RI - 2014	RM 2.8 East (EAA-3: Slip 4)	Crowley Marine/8th Avenue Terminals/DeNovo		Surface sediments (19 samples) plus four sediment cores.	PCBs, metals, SVOCs, dioxins/furans, grain size	Dec 2014	Preliminary data received; wil be entered into Sherlock when final.
NO	NA	AMEC 2013	2012-2013 Construction Season Completion Report	06/01/13		RM 2.8-3.7 East (EAA-4: Boeing Plant 2/Jorgensen Forge)	Boeing Plant 2	DSOA and SW Bank	Surface Sediment	PCBs, metals, TOC	Dec 2012 to Mar 2013	Pre-construction and End-Season 1 perimeter monitoring sample results received but available in hard copy only. Not yet entered.
NO	NA	NA	Draft RI Report, Boeing Isaacson/Thompson			RM 3.7-3.9 East (EAA-6: Boeing Isaacson/Central KCIA)	Boeing Isaacson/Thompson			Unknown	Draft RI Report due to Ecology in February 2013.	No data received as of July 2013. Received CD containing GIS shapefiles, but no data.
NO	NA	NA	Sampling of solids in south pump station vault. Described in SC Status Report (EAA-6: Boeing Isaacson/Central KCIA).			RM 3.7-3.9 East (EAA-6: Boeing Isaacson/Central KCIA)	KCIA		SD solids, south pump station vault	PCBs, metals, PAHs, phthalates, TPH	Sample collected Aug 2012	Spreadsheet received containing sample results; no report. Not clear if these data have been validated. Upload to Sherlock?
NO	6872	AMEC 2011	Final Remedial Investigation Report, 8801 East Marginal Way South	03/18/11		RM 3.9-4.3 East (Slip 6)	8801 Site		Stormwater, SD solids, sediment, seeps	PCBs, metals, SVOCs	Samples collected 2002 to 2010	No sample locations provided; need sample coordinates.
NO	9839	Hansen 2012	Email from Warren Hansen (Windward) to Ron Timm (Ecology) Re: IAA Tukwila - Upcoming sliplining project for north storm drain	09/19/12		RM 3.9-4.3 East (Slip 6)	8801 Site	Industrial Auto Auctions	SD solids	PCBs, metals, VOCs, TOC	8/21/2012	Data available in hard copy, but no sample location. Need map or coordinates.
NO	10696	Calibre 2014	2013 Annual Sampling Report, South Storm Drain System, Boeing Developmental Center	07/01/14	BDC 2103 Annual Sampling Report	RM 4.9 East (EAA-7: Norfolk CSO/SD)	BDC	South SD system	Surface sediment (backfill), SD solids (sediment trap)	PCBs, TOC	9/16/2013	Data available in hard copy only; not yet entered into Sherlock.
NO	NA	NA	Solids sample collected from an OWS at MFC by Boeing in August 2012. Described in SC Status Report (EAA-7: Norfolk CSO/SD).			RM 4.9 East (EAA-7: Norfolk CSO/SD)	Boeing MFC		SD solids (OWS)	Unknown	Sample was collected in Aug 2012	No data received as of May 2013. Possibly in BDC 2012 Annual Sampling Report?
NO	NA	Ortiz 2013	Sampling results for stormwater, stormwater solids, and sediments at Glacier Northwest/Reichhold	10/28/13		RM 1.3-1.6 West (Glacier Bay)	Glacier NW/Reichhold		Stormwater	Metals, SVOCs	2013	Spreadsheet contains draft data; enter into Sherlock? Also, email refers to SD solids and sediment data but these were not received.
NO	7285	SEE & TEC 2011	T-115 Year 1 Sand Cover Monitoring and Recontamination Study Report, Port of Seattle	11/08/11		RM 1.6-2.1 West (Terminal 115)	Terminal 115		SD solids (sediment traps, inline grabs), surface sediment	Metals, SVOCs, dioxins/furans (no PCBs)	Sediment samples collected 5/19/2011; sediment traps Oct 2010, Apr 2011, SD grabs April 2010, Oct 2010, Apr 2011	Data available in hard copy only. Requires manual entry. Check for availability of electronic data. Report also identifies area where dredging has occurred to identify "removed" sample locations. Year 3 data already entered into Sherlock, so Year 1 data may not be essential.
NO	NA	SEE 2013	T-115 Year 3 Final Sand Cover Monitoring Report, Terminal 115, Berth 1	10/29/13		RM 1.6-2.1 West (Terminal 115)	Terminal 115		Surface sediment		PAHs, dioxins/furans, TOC, grain size	Data report received; hard copy only. Not yet entered into Sherlock.
NO	9829	Williams 2012	Sediment cleanup at T117 to begin in spring 2013 (cited in SC Status Report)			RM 3.4-3.8 West (EAA-5: Terminal 117)	Terminal 117		NA	NA	Sediment cleanup in spring 2013	No data received as of December 2013.

Sherlock Update Status - May 2015

In Sherlock	DocNum	DocRef	DocName	DocDate	StudyID	SCA	Property	Location	Sample Type	Analytes	Sample Dates	Notes
NO	7697	King County 2011	Lower Duwamish Waterway Source Tracing in King County Combined Sewer System Sampling and Analysis Plan	08/01/11		Combined Sewer Area	NA	CSO discharge locations	SD solids (inline, sediment traps)	Metals, select organic compunds, TOC, percent solids	Field reconnaissance Jul 2011; sample collection Aug-Sep 2011; sed trap deployment summer 2011. Analysis through second quarter 2012. Data from all events available by 4th quarter 2012.	No data received as of May 2013.

Red font identifies data needed or questions for Ecology.