Addendum 3 to Quality Assurance Project Plan

Wenatchee River PCB and DDT Source Assessment

January 2021

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Hobbs, W., 2014. Quality Assurance Project Plan: Wenatchee River PCB and DDT Source Assessment. Washington State Dept. of Ecology, Olympia, WA. Publication 14-03-117. https://apps.ecology.wa.gov/publications/summarypages/1403117.html

Contact Information

Publications Coordinator
Environmental Assessment Program
Washington State Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600
Phone: 360-407-6764

Washington State Department of Ecology – ecology.wa.gov

Headquarters, Olympia	360-407-6000
Northwest Regional Office, Bellevue	425-649-7000
Southwest Regional Office, Olympia	360-407-6300
Central Regional Office, Union Gap	509-575-2490
Eastern Regional Office, Spokane	509-329-3400

Addendum 3 to
Quality Assurance Project Plan

Wenatchee River PCB and DDT Source Assessment

by William Hobbs

January 2021

Approved by:

Signature:	Date:
Cole Provence, Client, WQP, CRO	
Signature:	Date:
Mark Peterschmidt, Client's Unit Supervisor, WQP, CRO	
Signature:	Date:
Keith Primm, Client's Acting Section Manager, WQP, CRO	
Signature:	Date:
William Hobbs, Author / Project Manager, EAP	
Signature:	Date:
James Medlen, Author's Unit Supervisor, EAP	
Signature:	Date:
Jessica Archer, Author's Section Manager, EAP	
Signature:	Date:
George Onwumere, Section Manager for Project Study Area, EAP	
Signature:	Date:
Alan Rue, Director, Manchester Environmental Laboratory, EAP	
Signature:	Date:
Arati Kaza, Ecology Quality Assurance Officer	

Signatures are not available on the Internet version.
CRO: Central Regional Office
EAP: Environmental Assessment Program
WQP: Water Quality Program

Table of Contents

The numbered headings in this document correspond to the headings used in the original QAPP. Only relevant sections are included. Therefore, some numbered headings are missing and the text begins at 3.0.

3.0 Background

3.1 Introduction and Problem Statement

The Wenatchee River has had some of the highest fish tissue concentrations of polychlorinated biphenyls (PCBs) measured in Washington State over the last ~20 years. As a result of both PCBs and dichloro-diphenyl-trichloroethane (DDT) contamination in resident fish, there are currently eight listings for water quality impairment in the river under the federal Clean Water Act, Section 303(d). Furthermore, a consumption advisory has been placed on mountain whitefish from the lower Wenatchee River by the Washington Department of Health (DOH). Fish advisories are based on the same data, but not the same thresholds for impairment as the 303(d) list.

The specific objectives of the original Quality Assurance Project Plan (QAPP) and addendum were to: (1) conduct an initial synoptic survey to assess the spatial distribution of PCBs, DDT, and DDT analogues DDD and DDE in the mainstem of the Wenatchee River, and (2) identify and characterize sources of these compounds to the Wenatchee River, based on the results of the synoptic survey (Hobbs, 2014).

The objective of the second addendum to the original QAPP was to further delineate the PCB sources during high and low-flow times of the year. The decision was made to focus on the sources of PCBs, as the sources and pathways of DDT contamination to the Wenatchee River are different and should be addressed under a separate study (Hobbs and Friese, 2016).

Sampling results from the most recent study of PCB sources identified two chemically-distinct sources to the Wenatchee River, one located near the City of Cashmere and the second near the confluence of the Wenatchee River and the Columbia River (Figure 1; Hobbs, 2018). The recommendations from the 2018 study were to investigate these PCB sources in detail. This third addendum to the QAPP describes a plan to investigate the upstream source of PCBs near the City of Cashmere. The potential PCB source near the Wenatchee – Columbia River confluence will be addressed in a separate project.

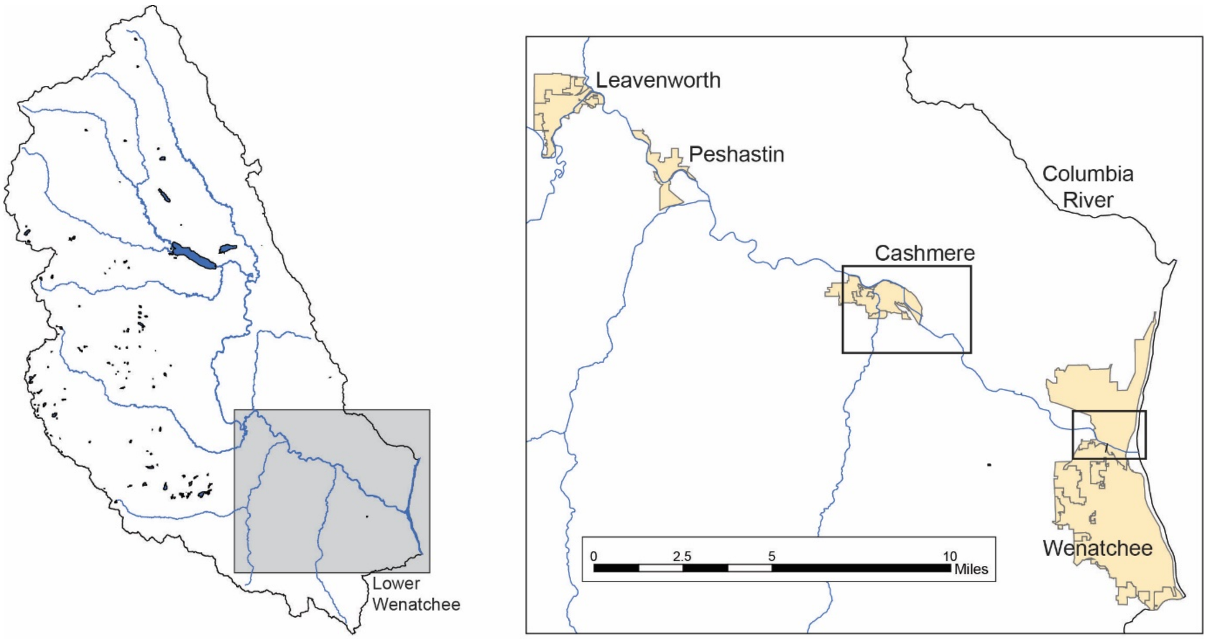

Figure 1. Map of the Wenatchee River watershed and study areas.

3.2 Study Area and Surroundings

3.2.2 Summary of previous studies and existing data

The main findings from the previous work that are relevant to this follow-up study are:

- There are two chemically-distinct PCB sources impacting the Wenatchee River:
  - The upstream (Cashmere) source has been isolated to 500 feet (150 m) of river bank adjacent to Riverside Park (Figure 2). Riverside Park is constructed on the former Cashmere Landfill. The PCB source has a congener profile similar to the technical mixture Aroclor 1254 and is likely entering the river through groundwater.
  - The location of the downstream (confluence) source is less certain. There seems to be an influence of Columbia River water flowing back into the lower Wenatchee River. It is possible that sediments in the backwater channels in this confluence area are contributing PCBs. The PCB source in this area resembles Aroclor 1248 and contains congeners indicative of microbial dechlorination.
- PCB loads over the period 2014 to 2017 have been variable. However, the chemical profile of each PCB source is consistent over time and also between high- and low-flow periods (Figure 3).

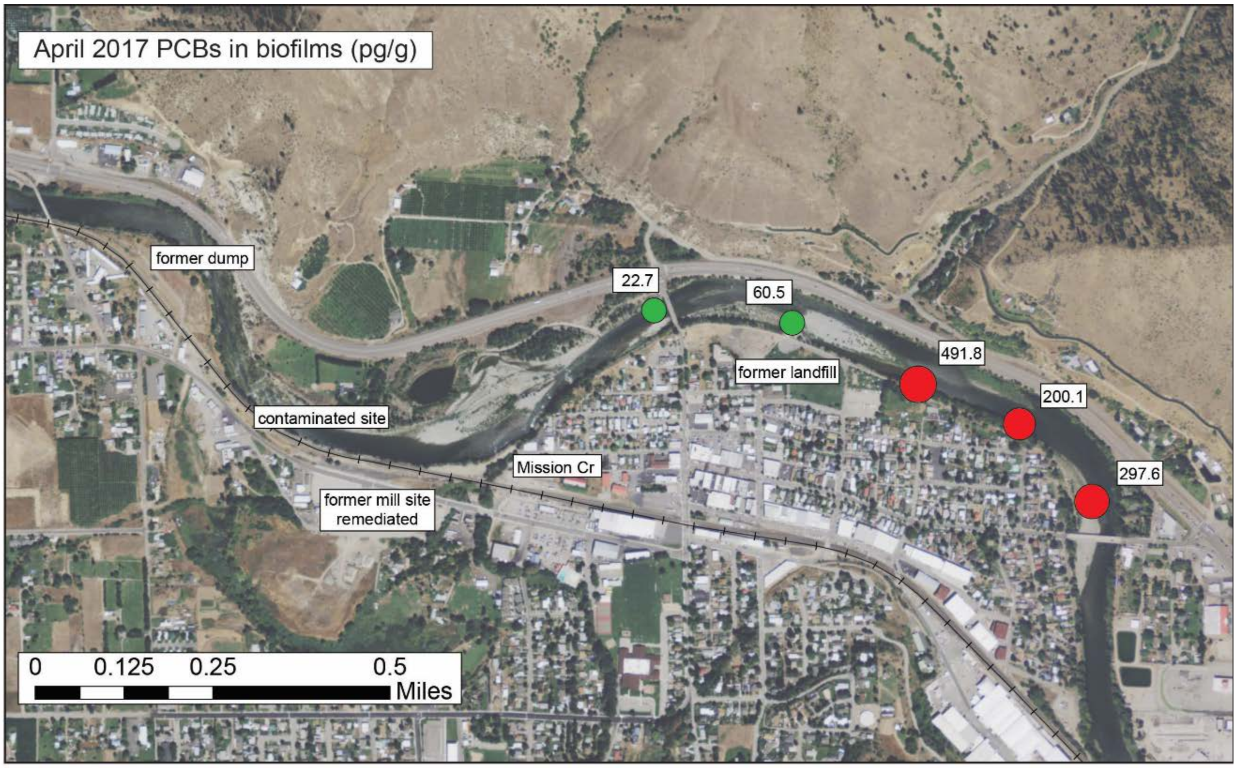

Figure 2. Previous results of PCBs in biofilms.

Green dots are considered within the variability of upstream background concentrations.
Red dots are an order of magnitude higher, suggesting the influence of PCB inputs to the river.

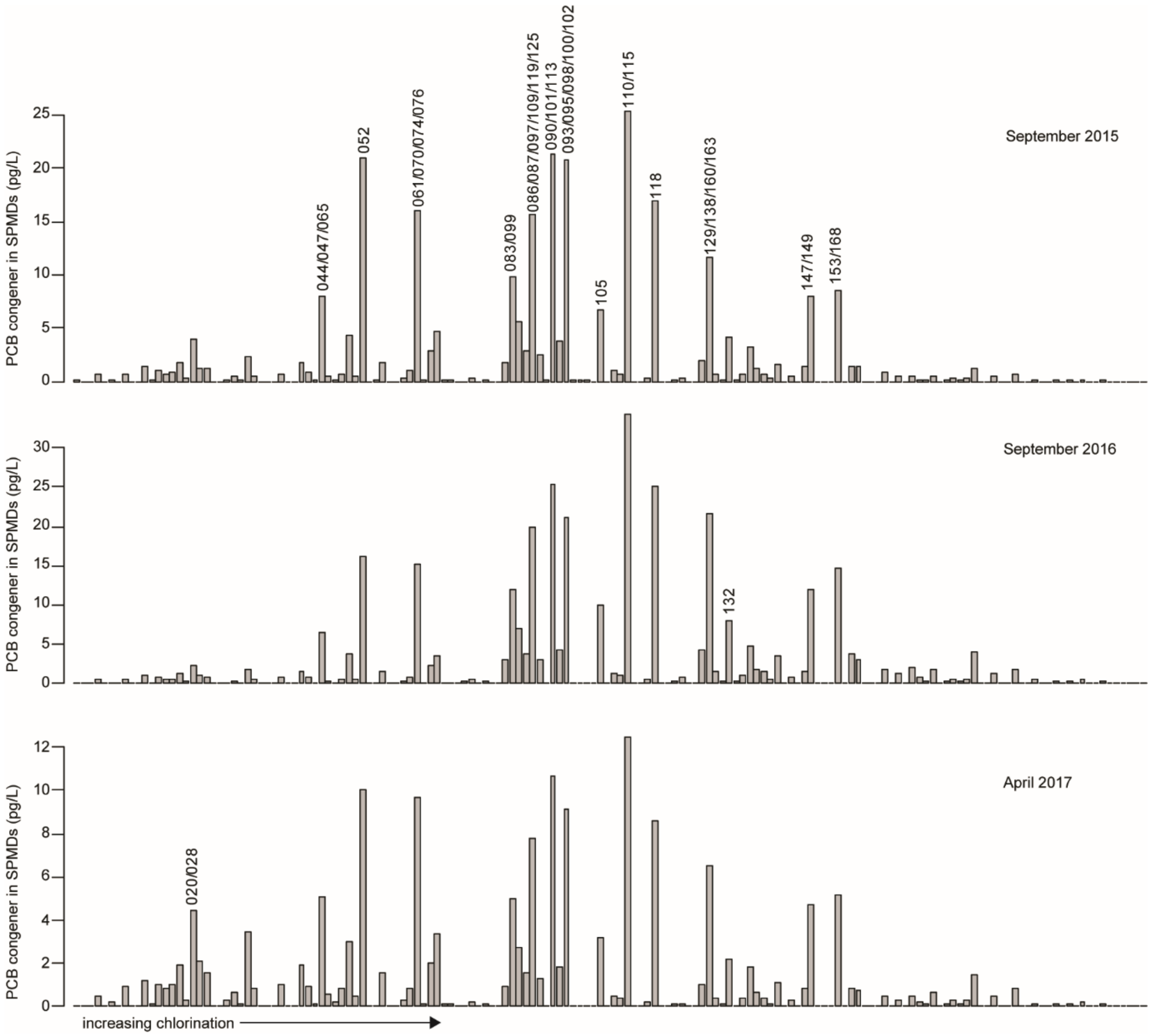

Figure 3. PCB congener distribution for SPMDs sampled in 2015-2017.
Samples are taken at the same location in Cashmere (45WR09.5) during both low (2015 and 2016) and high (2017) flow periods.

Because the PCB congener profile has been consistent over time and between high-flow and low-flow hydrologic regimes, there appears to be a constant source. For this reason, it is suspected that the PCBs are being contributed to the river near the City of Cashmere through groundwater from an upland contaminated source. A second possibility is that there is an unidentified source in the river bank/bed, such as a transformer that is intact and contributing PCBs to the river. To date, five decommissioned transformers have been located in this section of the river; two were intact but no evidence of PCBs was found in material inside the transformers (Hobbs, 2018).

Through the previous investigations on the Wenatchee River Basin the use of PCB concentrations in the biofilms attached to the river substrate have proven a valuable tool for source assessment (Hobbs et al., 2019a). Biofilms (periphyton, microbial biomass and organic detritus) bind PCBs from the water column and act as a natural passive sampler; they also represent the base of the food web and provide the entryway of PCBs into higher trophic levels.

4.0 Project Description

4.2 Project Objectives

The objectives of this follow-up study are to:

- Complete a detailed survey of the source area for debris (e.g. old transformers) that may be an instream source.
- Investigate groundwater-surface water interactions in the source area.
- Sample groundwater seeps, install temporary piezometers, or sample existing groundwater wells within the footprint of the former landfill area.

4.3 Information Needed and Sources

Historical records of the investigation and closure of the former landfill in Cashmere will be accessed through Ecology's Solid Waste Program, Central Regional Office. Engagement and collaboration with the City of Cashmere will be important for the success of this project and assist with historical knowledge of the landfill area.

The former landfill site (now Riverside Park) has been registered in Ecology's Toxic Cleanup Program database (Facility Site ID 335, Cleanup Site ID 4710; Appendix). Under the contaminants section of the site summary, halogenated organics (which may include PCBs) are noted as *suspected* in soils and *confirmed above cleanup level* in groundwater and surface water. Documents on the closure of the landfill and the cleanup levels should address the presence of halogenated organics.

It is possible that monitoring wells exist near or within the former landfill site; the existence of upland monitoring wells suitable for sampling under this project will be investigated.

4.4 Tasks Required

The tasks under the project plan are:

- Prepare and approve an addendum to the original QAPP (Hobbs, 2014).
- Complete a historical investigation (i.e. records and aerial photographs) of the former landfill area.
- During low-flow (~August through October) complete a detailed survey of the river bank and bed for further debris.
- Also, during low-flow complete a temperature survey of the surface sediments along the river edge and record observations on groundwater seeps from the bank.
- Continue to sample PCBs in biofilms in the source area to further delineate and confirm the area of concentrations above upstream background in the Wenatchee River.
- Installation of 4-5 in-stream piezometers in the second year of the project to sample PCBs in groundwater entering the river.
- Develop piezometers and continuously monitor temperature and water level over the 3-month low-flow period. Conduct 2-3 sampling events for contaminants during that time.

5.0 Organization and Schedule

5.2 Key individuals and their responsibilities

Table 1. Organization of project staff and responsibilities.

Staff	Title	Responsibilities
Cole Provence, WQP Central Regional Office Phone: 509-454-4174	EAP Client	Clarifies scope of the project. Provides internal review of the QAPP and addenda and approves the final documents.
Mark Peterschmidt, WQP Central Regional Office Phone: 509-575-2821	Unit Supervisor for the Client	Provides internal review of the QAPP and addenda and approves the final documents.
Keith Primm, WQP Phone: 509-406-0331	Acting Section Manager for Client	Reviews the draft QAPP and addenda and approves the final documents.
William Hobbs, EAP TSU - SCS Phone: 360-407-7512	Project Manager	Writes the QAPP. Oversees field sampling and transportation of samples to the lab. Analyzes and interprets data. Writes the draft report and final report.
James Medlen, EAP TSU - SCS Phone: 360-407-6194	Unit Supervisor for the Project Manager	Provides internal review of the QAPP and addenda, approves the budget and approves the final documents.
George Onwumere, EAP Central Regional Office Phone: 509-454-4244	Section Manager for the Study Area	Provides internal review of the QAPP and addenda and approves the final documents.
Jessica Archer, EAP SCS Phone: 360-407-6698	Section Manager for the Project Manager	Reviews the project scope and budget, tracks progress, reviews the draft QAPP and addenda and approves the final documents.
Alan Rue, EAP Phone: 360-871-8801	Director, Manchester Environmental Lab	Reviews and approves the final QAPP and addenda.
Arati Kaza Phone: 360-407-6964	Ecology Quality Assurance Officer	Reviews and approves the draft QAPP and addenda and approves the final documents.

EAP: Environmental Assessment Program; EIM: Environmental Information Management database;
QAPP: Quality Assurance Project Plan; WQP: Water Quality Program; TSU: Toxic Studies Unit;
SCS: Statewide Coordination Section

5.3 Proposed project schedule

The proposed project schedule assumes no further delays due to compliance with Ecology's Safe Start Plan with respect to the COVID pandemic, see section *7.5 Possible challenges and contingencies*.

Table 2. Proposed schedule for completing field and laboratory work, data entry into the Environmental Information Management (EIM) database, and reports.

Field and laboratory work	**Due date**	**Lead staff**
Field work completed	November 2022	William Hobbs
Laboratory analyses completed	April 2023	
Environmental Information Management (EIM) database		
EIM Study ID	WHOB002	
Product	Due date	Lead staff
EIM data loaded	April 2023	TBD
EIM data entry review	May 2023	William Hobbs
EIM complete	June 2023	TBD
Final report		
Author lead / support staff	William Hobbs	
Schedule		
Draft due to supervisor	June 2023	
Draft due to client/peer reviewer	July 2023	
Final (all reviews done) due to publications coordinator	August 2023	
Final report due on web	October 2023	

5.4 Budget and funding

The detailed budget for the laboratory expenses is outlined in Table 3. Laboratory contracts for PCB congener analysis and lipids will be handled by Manchester Environmental Laboratory (MEL).

Table 3. Detailed project budget and funding.

	Number of samples	**Number of QA samples**	**Cost per sample ($)**	**In-house cost per sample ($)**	**Contract ($)**	**Subtotal ($)**
Biofilms (2021 or 2022)						
PCBs congeners by HRMS	10	1	1000	–	11,000	11,000
Lipids	10	1	25	–	275	275
C-N stable isotopes	10	10	15	–	300	300
Groundwater (2022)						
PCBs congeners by HRMS	15	3	1000	–	18,000	18,000
Metals	15	3	200	3,600	–	3,600
Hardness	15	3	25	450	–	450
Dissolved organic carbon	15	3	45	810	–	810
Total dissolved solids	15	3	15	270	–	270
Chloride	15	3	15	270	–	270
			Subtotal	$5,400	$29,575	$34,975
	Total (incl. MEL 25% contract fee)					$42,369

HRMS = high resolution mass spectrometry

6.0 Quality Objectives

6.2 Measurement quality objectives

6.2.1 Targets for precision, bias, and sensitivity

The measurement quality objectives (MQOs) for project results, expressed in terms of acceptable precision, bias, and sensitivity, are summarized in Table 4.

Table 4. Measurement quality objectives for water chemistry not covered in the original QAPP and addenda.

Parameter	Precision		Bias			Sensitivity
	Field duplicate samples	Matrix spike-duplicates	Verification standards (LCS)	Matrix spikes	Internal standards	Reporting limit
	Relative percent difference (RPD)		Recovery limits (%)			Concentration units
Total dissolved solids	<20%	<20%	80-120%	75-125%	NA	0.95 mg/L
Chloride	<20%	<20%	90-110%	75-125%	70-130%	0.10 mg/L
Arsenic (As)	<20%	<20%	85-115%	75-125%	70-130%	0.10 µg/L
Cadmium (Cd)	<20%	<20%	85-115%	75-125%	70-130%	0.02 µg/L
Chromium (Cr)	<20%	<20%	85-115%	75-125%	70-130%	0.10 µg/L
Iron (Fe)	<20%	<20%	85-115%	75-125%	NA	0.05 µg/L
Mercury (Hg)	<20%	<20%	80-120%	75-125%	NA	0.05 µg/L
Lead (Pb)	<20%	<20%	85-115%	75-125%	70-130%	0.20 µg/L

7.0 Study Design

7.1 Study Boundaries

The project will focus on the right bank of the Wenatchee River from about river mile 10.2 (Aplets Way bridge) downstream to 9.5 (Cotlets Way bridge) (Figure 4).

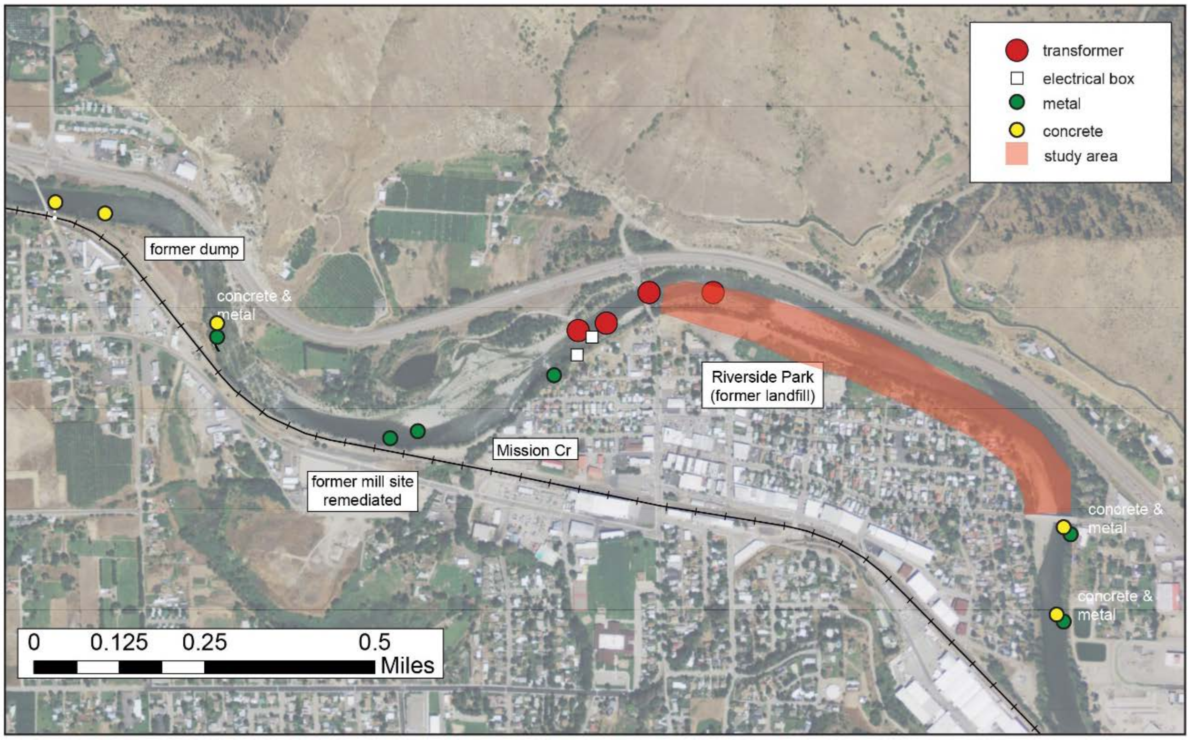

Figure 4. Study map showing existing debris in the river and area of investigation.

7.2 Field Data Collection

7.2.1 Sampling locations and frequency

The general area under investigation is highlighted in Figure 4. An initial survey of the river bank in the study area will be conducted to guide the possible locations of groundwater sampling. The survey will rely on temperature and conductivity of the sediment porewater and nearshore water to detect locations of groundwater seeping into the river. Further details of the sampling approach are discussed in section *8.0 Field Procedures*.

7.2.2 Field parameters and laboratory analytes to be measured

There is one new set of parameters that will be sampled and measured under this project. During the groundwater sampling, total dissolved solids, chloride, and the following dissolved metals: arsenic (As), cadmium (Cd), chromium (Cr), iron (Fe), mercury (Hg) and lead (Pb), will be measured to establish any differences in the provenance of groundwater within the study area. Metals (priority pollutant metals) were a confirmed contaminant in the groundwater of the former landfill (Appendix); data on these parameters in groundwater along the river bank will assist in investigating whether groundwater flowing through the former landfill contains contaminants that are being contributed to the river.

All other parameters are consistent with previous investigations.

7.5 Possible challenges and contingencies

All field work and lab work must comply with Ecology's Safe Start Plan (Ecology, 2020) in response to the COVID-19 pandemic. The proposed field work in this QAPP is classified as Phase 2 or 3 under the plan. Field activities must meet a "trifecta" where the employee's official residence, duty station and work site are all in the same phase of re-opening under the Governor's Safe Start guidelines. Currently, Chelan Co is in modified Phase 1 status and would therefore need to move into Phase 2 before field work could begin.

Until the planned field work for this project receives approval to proceed, the project remains in the planning stage. This impacts *Logistical Problems*, *Practical Constraints* and *Schedule Limitations* of this QAPP.

An additional *Practical Constraint* to consider for this study is the very coarse substrate of the Wenatchee River bed and bank in the area of investigation. Driving in-stream piezometers into the river bed may not be possible in the specific areas of interest. For this reason, we will explore existing upland groundwater monitoring wells, groundwater seeps from the bank and different diameters of in-stream piezometer.

8.0 Field Procedures

Field procedures for the sampling of biofilms have been described in the original QAPP (Hobbs, 2014) and in reports and publications (Hobbs, 2018; Hobbs et al., 2019a).

8.2 Measurement and Sampling Procedures

8.2.1 Instream Piezometers and monitoring wells

The investigation of groundwater-surface water interactions within the study area will follow the *Standard Operating Procedure for installing, monitoring, and decommissioning hand-driven in-water piezometers* (EAP061; Sinclair and Pitz, 2013). Investigations of the groundwater-surface water interactions were conducted on the Wenatchee River during the *Wenatchee River Watershed Dissolved Oxygen and pH Total Maximum Daily Load, Water Quality Improvement Project* (Redding, 2007; Carroll and Anderson, 2009). Unfortunately, no instream piezometers were installed in the current study area to provide background on groundwater flow and the logistics of piezometer installation. The substrate of the river bed and bank in the area of investigation is very coarse (gravel, cobble and boulder).

Before installing instream piezometers, we will use two different approaches for reconnaissance of potential piezometer locations: (1) a multi-parameter sonde to map the depth, temperature and specific conductance of the water along the right bank of the river (Stuart and Mathieu, 2015), and (2) a long-line hardened temperature probe to measure the near surface sediment/porewater temperature at several points along the shoreline (Sinclair and Pitz, 2013). Large thermal contrasts between the sediment porewater and overlying surface water can often be used to tentatively identify the presence of groundwater discharge conditions (Rosenberry and LaBaugh, 2008).

Four or five 1.5 inch steel piezometers will be installed to a depth of 4-5 feet below the river bed in the section of the river under investigation. The larger diameter piezometer will allow us to install thermistors and pressure transducers for the duration of the installation. Piezometers will be installed for about three months with 2-3 sampling events occurring over that period.

If we can locate suitable upland groundwater monitoring wells, samples may be taken for PCBs in groundwater. Monitoring wells will be purged and sampled using industry standard low-flow sampling techniques. Wells will be purged at a rate of less than 0.5 L/minute using dedicated tubing at each well. The wells will be purged through a continuous flow cell until field parameters stabilize (pH, temperature, specific conductance, dissolved oxygen, and oxidation reduction potential) as specified in SOP EAP078 (Marti, 2016).

8.2.2 PCBs in groundwater

Estimated concentrations of PCBs in the Wenatchee River surface water near the study area range from 38 to 346 pg/L. Direct measurement of PCBs in a small volume grab sample is difficult at such low concentrations, requiring some sort of pre-concentration technique. We will consider two different sampling approaches for measuring the PCB concentrations in groundwater from the instream piezometers: (1) a passive sampler (semi-permeable membrane device; SPMD) installed in the piezometer, and (2) purging a large volume of groundwater (~60L) through solid-phase extraction (SPE) media in the field.

The SPMD method is compatible with previous surface water sampling in the Wenatchee River (Hobbs, 2018). However, we may be limited by the diameter of the piezometer and length of the SPMD. The decision to use SPMDs is therefore dependent on the final installation of the instream piezometers.

The second approach to sampling for PCBs in groundwater, relies on the continuous low-level aquatic monitoring (C.L.A.M.) device that has been used previously in the Wenatchee River (Hobbs and Friese, 2016). The exception is that we will purge groundwater through a stainless steel SPE holder, as used by Hobbs et al. (2019b). The stainless steel SPE holder has been shown to reduce contamination introduced by the polyethylene housing typically used with the C.L.A.M. SPE disks.

A final decision on the sampling approach for PCBs in groundwater will be made following the installation and development of the instream piezometers.

8.3 Containers, preservation, holding times

Table 5 lists the additional parameters of interest for this study. Filtered samples will be field-filtered using a clean standard or high capacity in-line 0.45-micron membrane filter.

Table 5. Sample containers, preservation, and holding times.

Parameter	Matrix	Container	Preservative	Holding Time
Metals (As, Cr, Cd, Pb, Hg and Fe)	water	500 mL HDPE bottle; field filtered	1:1 HNO_3, cool to ≤6°C, pH≤ 2	6 months
Mercury	water	500 mL HDPE bottle; field filtered	1:1 HNO3, cool to ≤6°C, pH≤ 2	28 days
Chloride	water	125 mL HDPE	cool to ≤6°C	28 days
Total dissolved solids	water	500 mL HDPE	cool to ≤6°C	7 days
Hardness	water	125 mL HDPE	1:1 H_2SO_4, cool to ≤6°C, pH≤ 2	6 months

9.0 Laboratory Procedures

9.1 Lab and field procedures table

The laboratory methods for water chemistry for the additional parameters of interest for this study are described in Table 6.

Table 6. Laboratory measurement methods.

Analyte	Sample matrix	Number of samples	Expected range of results	Reporting limit	Sample prep method	Analytical (instrumental) method
Metals (As, Cd, Cr, and Pb)	water	18	0.02–100 µg/L	As 0.1 ,Cd 0.02, Cr 0.1, Pb 0.02 in ug/L	NA	EPA 200.8
Iron	water	18	0.05–100 mg/L	0.05 mg/L	NA	EPA 200.7
Mercury	water	18	0.05–5.00 µg/L	0.05 µg/L	MEL Hg Prep	EPA 245.1
Chloride	water	18	0.1–500 mg/L	0.1 mg/L	NA	EPA 300.0
Hardness	water	18	0.3–200 mg/L	0.3 mg/L	NA	EPA 200.7 and SM2340B
Total dissolved solids	water	18	0.95–5 mg/L	0.95 mg/L	NA	SM2540C

10.0 Quality Control Procedures

10.1 Table of field and laboratory quality control

Communication among the project manager, contract lab, and MEL during the initial stages of the project will ensure the water chemistry results are meeting the project quality control measures. See Table 7 for the types of quality control samples planned for the project

Table 7. Quality control samples, types, and frequency.

Parameter	Field	Laboratory			
	Replicates	Blank spikes	Method blanks	Analytical duplicates	Matrix spikes
Metals	10% of total samples	1/batch	1/batch	NA	1/batch
Chloride	10% of total samples	1/batch	1/batch	1/batch	1/batch
Hardness	10% of total samples	1/batch	1/batch	NA	2/batch
Total dissolved solids	10% of total samples	1/batch	1/batch	1/batch	NA

11.0 Data Management Procedures

11.2 Laboratory data package requirements

The laboratory data package will be generated or overseen by MEL. MEL will provide a project data package that will include: a narrative discussing any problems encountered in the analyses, corrective actions taken, changes to the referenced method, and an explanation of data qualifiers. Quality control results will be evaluated by MEL (discussed below in *Section 13.0 Data Verification*). A level 4 data package will be required from the contract lab.

The following data qualifiers will be used:

- "J" – The analyte was positively identified. The associated numerical result is an estimate.
- "UJ" – The analyte was not detected at or above the estimated reporting limit.
- "NJ" – The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

The qualifiers will be used in accordance with the method reporting limits such that:

- For non-detect values, the estimated detection limit (EDL) is recorded in the "Result Reported Value" column and a "UJ" in the "Result Data Qualifier" column.
- No results are reported below the EDL.
- Only results reported are for those congeners that have a value at least FIVE times the signal-to-noise ratio, and that meet ion abundance ratios required by the method.
- Detected values that are below the quantitation limits (QL) are reported and qualified as estimates ("J").

- Results that do not meet ion abundance ratio criteria are reported with “NJ.” If an Estimated Maximum Possible Concentration (EMPC) value is calculated and reported, the calculation is explained in the narrative, and an example calculation used for this value is provided.
- Results that contain interference from polychlorinated diphenyl ethers (PCDEs) are qualified with “NJ.”

13.0 Data Verification

13.2 Laboratory data verification

As previously described, MEL will oversee the review and verification of all laboratory data packages. All data generated by the contract lab must be included in the final data package, including but not limited to:

- A text narrative.
- Analytical result reports.
- Analytical sequence (run) logs.
- Chromatograms.
- Spectra for all standards.
- Environmental samples.
- Batch QC samples.
- Preparation benchsheets.

All of the necessary QA/QC documentation must be provided, including results from matrix spikes, replicates, and blanks.

13.3 Validation requirements, if necessary

A level 2B data validation will be requested for this project, but will include the conversion of contract laboratory flags to MEL-amended qualifiers. Data validation will be carried out by the MEL QA Coordinator. A level 4 data package will be required from the contract lab, should a level 4 data validation be necessary in the future.

15.0 References

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16.0 Appendix. TCP Site Report for former Cashmere Landfill

DEPARTMENT OF ECOLOGY
State of Washington

Cleanup Site Details

Cleanup Site ID: 4710

Cleanup Site ID: 4710 **Facility/Site ID:** 335 **UST ID:** N/A Site Page Site Documents View Map

Cleanup Site Name: CASHMERE LANDFILL Glossary

Alternate Names: CASHMERE LANDFILL

LOCATION

Address: DIVISION ST **City:** CASHMERE **Zip Code:** 98815 **County:** Chelan

Latitude: 47.52417 **Longitude:** -120.46783 **WRIA:** 45 **Legislative District:** 12 **Congressional District:** 8 **TRS:** 24N 19E 33

DETAIL

Status: Cleanup Started **NFA Received?** No **Is PSI site?** No

Statute: MTCA **NFA Date:** N/A **Current VCP?** No **Past VCP?** No

Site Rank: 1 - Highest Assessed Risk **NFA Reason:** N/A **Brownfield?** No

Site Manager: Central Region **Responsible Unit:** Central **Active Institutional Control?** No

CLEANUP UNITS

Cleanup Unit Name	Unit Type	Unit Status	Resp Unit	Unit Manager	Current Process
CASHMERE LANDFILL	Upland	Cleanup Started	CE	Central Region	No Process

ACTIVE INSTITUTIONAL CONTROLS

Instrument Type	Restriction Media	Restrictions/Requirements	Date	Recording Number	Recording County	Tax Parcel

There are no current Institutional Controls in effect for this site.

AFFECTED MEDIA & CONTAMINANTS

	MEDIA					
Contaminant	Soil	Groundwater	Surface Water	Sediment	Air	Bedrock
Conventional Contaminants, Organic	S	S	S			
Halogenated Organics	S	C	C			
Metals Priority Pollutants	S	C	C			
Pesticides-Unspecified	S	S	S			

Key:
B - Below Cleanup Level C - Confirmed Above Cleanup Level RA - Remediated-Above
S - Suspected R - Remediated RB - Remediated-Below

SITE ACTIVITIES

Activity	Status	Start Date	End Date/ Completion Date
Initial Investigation / Federal Preliminary Assessment	Completed		10/27/1985
Site Hazard Assessment/Federal Site Inspection	Completed	6/10/1987	3/19/1988
Site Hazard Assessment/Federal Site Inspection	Completed	3/1/1991	8/1/1991
Hazardous Sites Listing/NPL	Completed		8/27/1991

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