# Survey of Phthalates in Washington State Waterbodies, 2021

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Water Resource Inventory Areas (WRIAs) and 8-digit Hydrologic Unit Code (HUC) numbers for the study area:

| Study Location | WRIA | HUC |
|---|---|---|
| Lake Ozette | 20 | 17100101 |
| Lake Stevens | 7 | 17110011 |
| Lower Columbia River | 25 | 17080003 |
| Mayfield Lake | 26 | 17080005 |
| Mid-Columbia River | 31 | 17070101 |
| Newman Lake | 57 | 17010305 |
| Potholes Reservoir | 41 | 17020015 |
| Puyallup River | 10 | 17110014 |
| Sammamish Lake | 8 | 17110012 |
| Skagit River | 5 | 17110008 |
| Snake River | 35 | 17060107 |
| Snohomish River | 7 | 17110011 |
| South Fork Palouse River | 34 | 17060108 |
| Spanaway Lake | 12 | 17110019 |
| West Medical Lake | 43 | 17020013 |
| Yakima River | 37 | 17030003 |

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# Survey of Phthalates in Washington State Waterbodies, 2021

by

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# Acknowledgments

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# Abstract

In 2021, the Washington State Department of Ecology (Ecology) carried out a statewide survey of phthalate concentrations in rivers and lakes, as well as marine water sediments. The study was designed to evaluate current levels of phthalates from a wide range of waterbody types and contamination potential. An extended suite of 16 phthalates and three non-phthalate plasticizers was analyzed for this study to provide data on previously untested phthalates and non-phthalate plasticizers in Washington.

This study sampled surface water and sediment from 16 rivers, lakes, and reservoirs once during the spring high-flow/run-off period and again in the fall to capture low-flow conditions. Suspended particulate matter (SPM) samples from a subset of three of the river study locations were collected via centrifugation in the winter. Twenty-one marine sediment samples from throughout the Puget Sound, and 10 from Elliott Bay, were sampled in the spring for this study's analysis.

In general, few target analytes were detected:

- Di(2-ethylhexyl) phthalate (DEHP) was the most frequently detected analyte, with concentrations of 0.558 – 3.38 ug/L in surface water, 64.2 – 156 ug/kg dw in SPM, and 49.6 – 217 ug/kg dw in marine sediments.
- Di(2-ethylhexyl) adipate (DEHA) was found in three surface water samples (0.624 – 0.949 ug/L) and in one freshwater sediment sample (129 ug/kg dw).
- Diisononyl phthalate (DINP) was tentatively identified in two freshwater sediment samples (1,120 – 2,150 NJ ug/kg dw) and three marine sediment samples (601 – 698 ug/kg dw).
- Marine sediments also contained dicyclohexyl phthalate (DcHP) (1 sample, 66.5 ug/kg dw) and butyl benzyl phthalate (BBP) (2 samples – tentatively identified, 38.8 – 86.2 NJ ug/kg dw).

This report provides the first measure of several novel phthalates and non-phthalate plasticizers in Washington State's environment. Based on the low detection frequency of the majority of analytes at levels relevant to ecotoxicity, additional long-term or ambient monitoring should be considered a low priority.

# Introduction

## Background

Phthalates are a group of chemicals used extensively in consumer products primarily to impart flexibility in plastics. This group of chemicals are a priority for Washington State due to their widespread exposure to humans and the environment, as well as their toxicity to humans and animals. The Washington State Department of Ecology (Ecology) has addressed phthalates through a number of toxics reduction efforts, including the state's Safer Products for Washington program, The Children's Safe Products Act, and a Phthalates Action Plan (Ecology, 2020; RCW 70.A.430.020). The Phthalates Action Plan is currently being drafted to synthesize what is known about phthalates in the state and make recommendations for state actions to reduce human and environmental exposure.

Concerns over phthalate exposure arise from their endocrine disrupting effects, as well as their potential effects on developmental and reproductive systems, ability to alter immune responses, and toxicity to the liver and kidney (ATSDR, 2019). People and animals are exposed to phthalates primarily through diet, as well as through inhalation, dermal, and oral routes (ATSDR, 2019). Di(2-ethylhexyl) phthalate (DEHP) and other phthalates bioconcentrate in aquatic organisms, but because they rapidly metabolize they do not biomagnify up food chains. Several low molecular weight phthalates have been found to have acute or chronic effects to algae, invertebrates, and fish (Staples et al., 1997), while higher molecular weight phthalates generally exhibit lower aquatic toxicity (Staples et al., 1997).

Phthalates are high volume production chemicals used in many consumer and industrial products. DEHP has been widely used as a plasticizer in polyvinyl chloride (PVC), though manufacturers have recently moved to replacement compounds like diisononyl phthalate (DINP) and diisodecyl phthalate (DIDP) in some applications because of their potential for lower release to the environment (Bergé et al., 2013). Commonly used low molecular weight phthalates, like dimethyl phthalate (DMP) and diethyl phthalate (DEP) are typically incorporated into cosmetics, fragrances, and personal care products, while di-n-buthyl phthalate (DnBP) is used in epoxy resins, cellulose esters, and adhesives (Bergé et al., 2013).

## Environmental Sources and Pathways

Phthalates are physically incorporated into products and not chemically bound; therefore, they can leach out of products over time. They are released to the environment through the manufacture, use, and disposal of phthalate-containing products (Net et al., 2015), including releases from municipal waste and directly from products themselves (EPA, 2012).

The dominant environmental pathways of phthalates include atmospheric deposition, particularly in urban areas, where vehicle emissions and volatilization from building materials are concentrated (Wang et al., 2008), wastewater treatment plant discharges (Gani and Kazmi, 2016), and stormwater carrying phthalates that originated from PVC, paints, and buildings (Bergé et al., 2013). A workgroup in Washington State addressing phthalates in sediments concluded that the primary pathway to waterbodies in the state's urban water environment was through phthalates off gassing from PVC products, attaching to particulates in the air, and then stormwater carrying the redeposited phthalate-containing particulates to aquatic sediments (SPWG, 2007). This appears to increase in areas with higher concentrations of fine particulates in the air.

# Study Design

In 2021, Ecology carried out a study to evaluate current concentrations of 16 phthalates and 3 non-phthalate plasticizers in rivers and lakes across the state, as well as in marine (saltwater) sediments from Puget Sound. This study was designed to expand our knowledge of phthalates in the environment by sampling a broad range of waterbodies throughout the state and by measuring previously untested phthalates and non-phthalate plasticizers.

This study collected surface water and sediment samples from 16 rivers, lakes, and reservoirs once during spring high flow/run-off and again in the fall to capture low-flow conditions. Suspended particulate matter (SPM) samples from a subset of three of the river study locations were collected in the winter. Ecology's Environmental Assessment Program (EAP) Puget Sound Sediment Monitoring Program collected 21 marine sediment samples from throughout the Puget Sound and 10 sediment samples from Elliott Bay during their annual sampling event in the spring for this study's analysis. The marine sediment analyses were funded as part of a Puget Sound Partnership near term action (NTA) grant.

Site selection for this study included obtaining phthalates data across a range of waterbody types, hydrological conditions, and contamination potential, while obtaining spatial coverage throughout the state. Several sites were chosen because they had not been previously sampled and phthalate presence was unknown. Table 1 describes the freshwater study locations and provides the number and type of samples collected at each site. Figure 1 displays the freshwater study locations and Figure 2 shows where marine sediments were collected in Puget Sound.

**Table 1. Freshwater Study Location Descriptions and Sample Types Collected.**

| Study Location | Elevation | Max/Mean Depth (ft) | Watershed Area (sq mi) | Watershed Land Use | Contamination Potential* | No. of Water Samples: Spring/ Fall | No. of Sed. Samples: Spring/ Fall | No. of SPM Samples: Winter |
|---|---|---|---|---|---|---|---|---|
| **Lakes** | | | | | | | | |
| Ozette | 29 | 320/130 | 78 | F | Low | 2/2 | 1/1 | |
| Stevens | 210 | 160/63 | 7 | U/F | Medium | 2/2 | 1/1 | |
| Mayfield | 450 | 190 | 1400 | F/R | Medium | 2/2 | 1/1 | |
| Newman | 2,124 | 30/19 | 28.6 | F/R | Medium | 2/2 | 1/1 | |
| Potholes Res. | 1,046 | 140/18 | 3,920 | A/S | Low | 2/2 | 1/1 | |
| Sammamish | 26 | 105/58 | 98 | U/F | Medium | 2/2 | 1/1 | |
| Spanaway | 320 | 28/16 | 17 | U/F | High | 2/2 | 1/1 | |
| West Medical | 2,420 | 35/22 | 1.8 | A/S | High | 2/2 | 1/1 | |
| **Rivers** | | | | | | | | |
| Low-Columbia | 5 | --- | 256,900 | Mixed | Medium | 2/2 | 1/1 | |
| Mid-Columbia | 343 | --- | 104,000 | Mixed | Medium | 2/2 | 1/1 | |
| Puyallup | 50 | --- | 943 | U/F | Medium | 1/1 | 0/0 | 1 |
| Skagit | 180 | --- | 3,093 | A/F/U | Medium | 1/2 | 0/0 | |
| Snake | 760 | --- | 107,500 | A/S/U | Low | 2/1 | 1/0 | 1 |
| Snohomish | 40 | --- | 1,714 | A/F/U | Medium | 1/2 | 1/1 | 1 |
| S.F. Palouse | 2,320 | --- | 132 | A/S/U | High | 1/1 | 1/1 | |
| Yakima | 900 | --- | 3,479 | A/S/U | Medium | 1/1 | 1/1 | |

S.F. = South Fork
F = forested
U = urban
R = residential
S = shrubsteppe
A = agriculture
"0" in the column "No. of Sed. Samples" indicates that fine depositional sediments could not be found and therefore no sample was taken.
**Contamination potential is the author's qualitative assessment based on degree of development and potential sources or pathways in the watershed.*

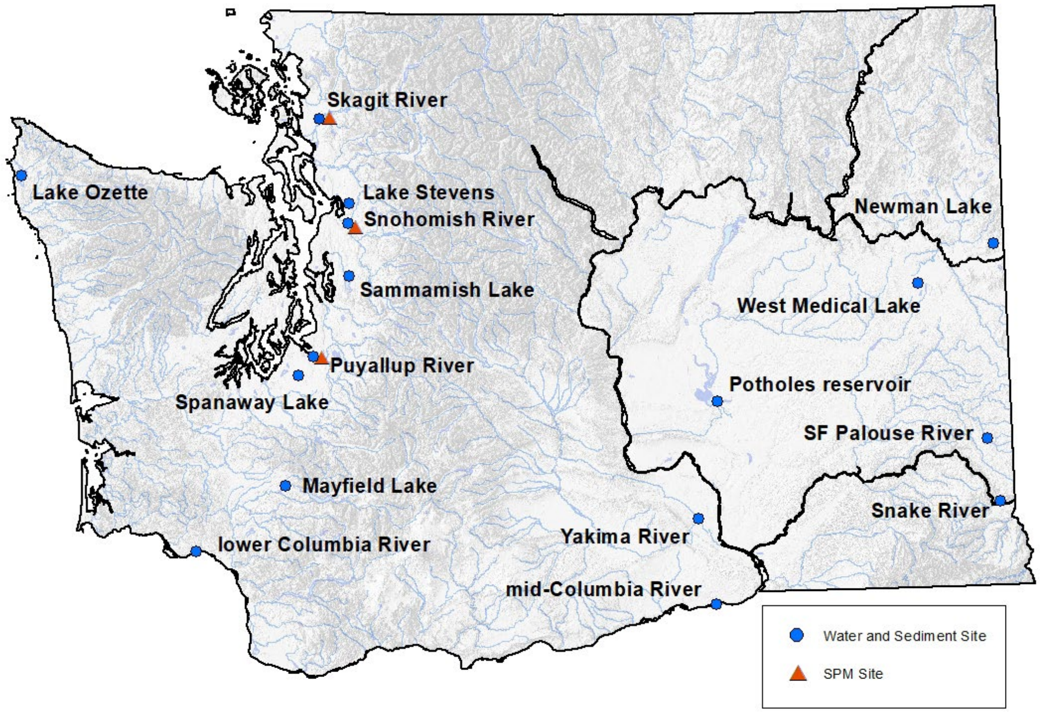


**Figure 1. Freshwater Study Locations.**

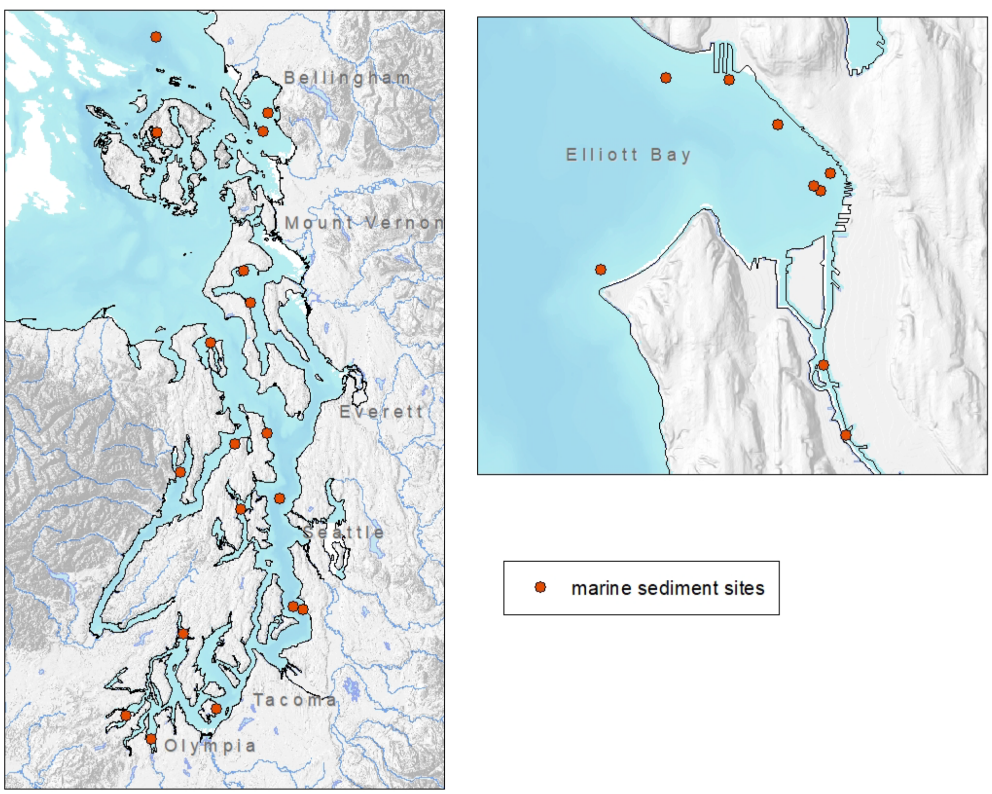


**Figure 2. Marine Water Study Locations.**

# Methods

## Sample Collection

All sample collections for this study followed the field procedures described in detail in the QAPP (Mathieu, 2021), unless otherwise noted below. The following sections briefly describe sampling methods for surface water, sediments, and SPM. Field crews followed decontamination methods outlined in the QAPP and wore clean nitrile gloves for each sample collection. Chain of custody procedures and holding times outlined in the QAPP were maintained, except where noted below.

### *Surface water*

Field staff collected discrete water samples at the freshwater study locations via stainless steel Kemmerer, pole sampler, or bridge sampler, depending on the site conditions. A near-surface grab was collected from about one meter below the water surface at all sites. A second lower-surface water sample was attempted at all sites at one meter above the sediment (bottom) surface of the river or lake. Surface water samples were collected at all sites with the following exceptions:

- The Puyallup River, Skagit River (spring only), and Snohomish River (spring only) were flowing too fast for the samplers to deploy at depth; therefore, only a near-surface sample was collected.
- The water depth was too shallow for a bottom water sample at the South Fork Palouse River and Yakima River; therefore, only near-surface samples were collected.
- Poor weather during fall sampling made the Snake River site inaccessible by boat; therefore, the sampling location was moved slightly to obtain a grab from the shoreline via pole sampler.

Surface water samples were placed in coolers on ice in the field until returning to Ecology Headquarters, where they were stored in the temperature-controlled walk-in cooler before shipment to the laboratory.

### *Freshwater sediments*

Field crews attempted to collect bottom sediments from each freshwater study location. Fine depositional sediments were not found and therefore not sampled at the following sites: Puyallup River, Skagit River, and the Snake River.

Sediment samples were successfully collected from the lower Columbia River in both seasons, and from the Snake, Snohomish, and Yakima River sites in the spring only. However, grain size analysis indicated that depositional sediments were not obtained and mostly consisted of medium to coarse-sized sand.

A petite ponar was used for freshwater sediment sample collection at almost all sites. Manual hand grabs with stainless steel spoons were collected at the South Fork Palouse River. Sediment samples consisted of a composite of three grabs from each site within a 10-meter radius. Based on sampling protocols, sediment grab samples were only retained when the sampler was not overfilled and the sediment/water interface was intact. Field crews siphoned off overlying water, collected the top 0-2 cm of sediment with stainless steel spoons, and transferred to a large stainless steel mixing bowl. After three successful grabs, the sediments were mixed into a uniform consistency and color. Well-mixed sediments were transferred to jars and put on ice in coolers until brought to Ecology Headquarters.

Sediments were centrifuged at Ecology Headquarters and overlying water was decanted prior to sending the samples to the laboratory for analysis. All spring sediment samples were stored frozen and delivered to MEL within holding times. The fall sediment samples were not frozen after centrifuging and decanting, and six samples were sent to MEL 1-4 days past the 14-day holding time for unfrozen sediments. Analytical results for the six samples were qualified as estimates as a result.

## *Suspended particulate matter*

Field crews collected suspended particulate matter (SPM) samples using EAP's centrifuge trailer unit following protocols described in previous Ecology studies (Hobbs et al., 2019; Gries and Osterberg, 2011; Gries and Sloan, 2008). River water was pumped via Teflon-lined tubing into continuous flow-through centrifuges to collect enough SPM for analysis of phthalates and ancillary parameters. The intake pump was affixed to nearby infrastructure or a large buoy to draw water from a depth of 60% below the surface, at least 2 meters from the bank, within the main channel, and avoiding any eddies or back currents.

River water was pumped through two flow-through centrifuges (Alfa-Laval Corporate AB, MAB 103B), which separated and concentrated the SPM, and outflow water was routed back towards the river downstream of the intake line. Flow was regulated inside the centrifuge trailer unit to maintain a rate of around 3 L/min to each of the two centrifuges, maximizing solids removal efficiency (Gries and Sloan, 2008). Suspended sediment concentration samples were collected from the river water intake and outflow (post-centrifuge) to assess efficiency. The efficiency of the centrifuges at retaining SPM were 98%-100% based on the formula[1] from Gries and Osterberg (2011).

Total pump times for each site are presented in Table 2. After pumping, field crews shut off the centrifuges, checked the amount and condition of accumulated SPM, and decanted overlying water in the centrifuges using pre-cleaned glass syringes. Syringes and tubing were rinsed in ambient water before decanting. SPM was scraped from the bottom and sides of the two centrifuge bowls using stainless steel spoons and spatulas, and then transferred to one stainless steel mixing bowl. Field crews then mixed the composited SPM until the color and consistency

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[1] % Efficiency = $[(SSC_{inflow}-SSC_{outflow})/TSS_{inflow}]*100$

appeared uniform and subsampled the SPM into separate jars for analysis of phthalates and ancillary parameters. Sufficient material was obtained for all analyses at all sites and field replicate analyses at the Skagit River site. SPM was taken from both centrifuges and combined into one composite field replicate.

All samples were held on ice in coolers upon sample collection, and then transported to Ecology Headquarters. Project staff centrifuged the SPM and decanted the overlying water at Ecology Headquarters before freezing the samples at -20° C. Samples were then shipped to the laboratory for analysis.

We could not access our planned SPM collection site at the Skagit River due to the river being above flood stage. An alternate site five miles downriver at Edgewater Park in Mount Vernon was used instead. The site offered ideal access for centrifuge operations.

**Table 2. Centrifuge Conditions and Parameters.**

| Parameter | Puyallup | Snohomish | Skagit |
|---|---|---|---|
| Collection Date | 12/6/2021 | 12/8/2021 | 12/9/2021 |
| Total Pump Time (hrs) | 7:55 | 9:15 | 11:06; 12:06* |
| Volume Pumped (L) | 1,340 | 1,950 | 1,915; 2,143* |
| Average flow rate (L/minute) | 3.07 | 3.25 | 3.15 |
| Inflow TSS am (mg/L) | 167 | 16 | 46 |
| Inflow TSS pm (mg/L) | --- | 47 | 45 |
| Outflow TSS am (mg/L) | 1 U | 1 U | 1 |
| Outflow TSS pm (mg/L) | --- | 1 U | 1 U |

* One centrifuge did not start right away; after troubleshooting the centrifuge was started one hour later than the first.
U = not detected at or above the reported value.

## *Marine water sediments*

EAP's Puget Sound Sediment Monitoring program collected all marine sediment samples following their Quality Assurance Monitoring Plan (QAMP) (Dutch et al., 2018) and QAMP addendum (Dutch, 2021). Samples were collected via a double 0.1 $m^2$ stainless steel modified van Veen grab sampler. Field crews collected the top 2-3 cm of sediment with stainless steel spoons, placed in a stainless steel bucket until enough material was collected, then mixed the composited sediment with a stainless steel spoon or paint mixer until a well-mixed texture and color were achieved. Subsampled material for this study was collected in laboratory-provided glass jars and stored on ice in coolers until transport to Ecology walk-in refrigerators.

At Ecology Headquarters, project staff centrifuged the samples and decanted the overlying water. Samples were then frozen at -20° C and shipped to the laboratory for analysis.

## Laboratory Analysis

Table 3 provides the analytical methods for this study. Manchester Environmental Laboratory (MEL) provided all analyses, with the exception of grain size. Eurofins Laboratory analyzed grain size in the freshwater sediments. MEL reported loss on ignition weights for freshwater suspended particulate matter dried at 104 °C, 550 °C, and 950 °C.

MEL followed the QAPP special method requirements for the development of new phthalate analytes, providing initial demonstration of capabilities (IDCs) and lower limits of quantitation (LLOQs) for aqueous and solid matrices to the project officer and Ecology's Quality Assurance Officer. Prior to sampling, the project manager requested additional method development by MEL to bring the LLOQs down to the reporting limits outlined in the QAPP.

**Table 3. Analytical Methods Used in This Study.**

| Parameter | Matrix | Sample Prep/Clean-up Method | Analytical Method |
|---|---|---|---|
| Phthalates | water | EPA 3541/EPA 3620C florisil | EPA 8270E (GC/MS) |
| TSS | water | Gravimetric, dried 103-105 C | SM2540D |
| DOC | water | --- | SM5310B |
| TOC | water | --- | SM5310B |
| Phthalates | sediment/ SPM | EPA 3541/EPA 3620C florisil | EPA 8270E (GC/MS) |
| TOC | sediment | --- | EPA 440.0 |
| Grain Size | sediment | --- | PSEP 1986 |
| LOI | SPM | --- | ASTM D7348 |

# Data Quality

MEL reviewed all laboratory results for this project to ensure analyses were conducted in accordance with the method and provided written case narratives describing the analytical methods used, holding times, initial and ongoing calibrations, and results of quality control (QC) tests analyzed with each batch. MEL or the contract laboratory (for grain size) conducted all QC tests outlined in the QAPP and described in the methods, with the exception of the requested QC of matrix spikes and matrix spike duplicates for phthalates analyses in water.

The project manager assessed the usability of the data after reviewing MEL case narratives, final data packages, and field logs. All data were deemed usable as qualified for the study, with the following exceptions:

- The source blank water provided by MEL for the spring sampling event was contaminated with DEHP. MEL confirmed that the source water was contaminated and provided blank water from an uncontaminated source for the fall sampling event. The project manager rejected the spring field blank data, as they were not usable for assessing the spring water samples.
- Low surrogate recovery for phthalates associated with the spring mid-Columbia River hypolimnion (bottom) water sample resulted in rejection of all data reported for that sample, except for DEHP and DEP. MEL reanalyzed the sample with similar results and attributed the issue to matrix effects. However, the lab could not rule out the possibility of an unknown extraction problem for that sample.
- The project manager rejected DINP results from the top and bottom Lake Ozette water samples collected in the fall due to contamination observed in the field blank collected at the study location. DINP concentrations in the upper and lower Lake Ozette water samples were reported as 3.15 and 2.7 ug/L; the field blank contained 2.4 ug/L of DINP. DINP was not detected in any other water sample during the fall event.

## Method Blanks

Detections of DEHP in method blanks affected the ability to report DEHP concentrations in several batches of data. When concentrations in the sample extract were less than ten times that of the method blank extract, the sample was qualified “U”, as a non-detect, at the raised reporting limit. MEL used a high-purity diatomaceous earth material for the sediment method blanks. The following sample results contained presence of phthalates but were censored as non-detects due to the raised LLOQ as a result of method blank contamination:

- Five surface water samples collected in spring: Lake Sammamish top, Snohomish River top, Lake Stevens bottom and bottom replicate, and mid-Columbia River top (sample IDs: 2106032-07, -13, -20, 23 and 2106033-16).
- Four freshwater sediments collected in fall: Spanaway Lake, Lake Sammamish, Lake Stevens, and mid-Columbia River (sample IDs: 2110030-04, -07, -08, -17).
- Five marine sediment samples: Station #194 (sample ID: 2106023-27) and station #s 29, 40030, 40030-REP, and 44 (sample IDs: 2104029-03, -12, -13, -19).

## Field Replicates and Field Blanks

Field replicates were collected immediately following the field sample at a rate of 10% of samples. All field replicates for water, sediment, and SPM samples were within the measurement quality objectives (MQOs) outlined in the QAPP (≤ 40%), with the exception of DEHP in one water sample pair collected from the mid-Columbia River in the fall. The native sample was undetected at 0.5 ug/L and the associated field replicate sample contained 4.76 ug/L. The associated samples were qualified "UJ" and "J" as estimates, respectively.

As discussed above, no field blank data was available to assess the spring water sampling due to phthalate contamination of the source water provided. A new water source was provided for the fall and winter sampling events. No analytes were present in the fall field blanks, with the exception of DINP tentatively identified at 2.4 NJ ug/L. The associated field samples (top and bottom Lake Ozette) also contained DINP tentatively identified at similar concentrations (3.15 and 2.7 NJ ug/L, respectively), and the DINP results were rejected for those samples, as mentioned above. DINP was not detected in any other water sample during the fall.

Field staff collected an initial field blank at the first SPM sampling site (Puyallup River) using blank water provided by MEL. Two target analytes were present in this field blank (DEP and DnBP) but not detected in the field sample, and no further action was taken. DEHP – the only analyte detected in the field samples – was not detected in this field blank. Field blanks were also collected prior to sampling the Snohomish River and Skagit River; however, due to insufficient volume of lab-provided blank water, Ecology Headquarters DI water was used. The Headquarters DI water has not been tested for phthalates and these field blanks were rejected by the project manager. A centrifuge system equipment blank using only MEL-provided blank water contained DEHP at 0.576 ug/L and no other target analytes. DEHP concentrations in the field samples were well over 10 times the amount in the equipment blank and no qualification was made.

# Results and Discussion

The 2021 sampling results are summarized by matrix in the following sections, along with a comparison of historical data, where available. Full analytical results are provided in Appendix B.

## Lake and River Surface Water

Sixteen phthalates and three non-phthalate plasticizers were analyzed in surface water collected from all freshwater study locations in the spring and fall. Of the 19 analytes, only DEHP and di(2-ethylhexyl) adipate (DEHA) were detected in the surface waters, and only during the spring sampling event. All other analytes were not detected at or above the reporting limit of 0.5 ng/L. Figure 3 displays the surface water results across the state.

DEHP was detected in 10 out of 27 samples (37%). Detected concentrations of DEHP ranged from 0.558 - 3.38 ug/L, with a median of 0.948 ug/L. Newman Lake water samples had the highest concentration of DEHP, with detections in both the top and bottom waters (3.38 and 0.711 ug/L, respectively). Newman Lake's watershed is forested with a high density of residences along the shoreline. DEHP is widely used as a plasticizer in PVC products and is typically the most predominant phthalate found in surface water (Net et al., 2015).

DEHA was detected in three samples at concentrations ranging from 0.624 - 0.949 ug/L. Both the top and bottom samples collected from the lower Columbia River contained DEHA, as well as the bottom sample collected from Lake Ozette. DEHA is a high production volume compound replacement for low molecular weight phthalates (Subedi et al., 2017). It is used as a plasticizer in clear plastic wraps and has the potential to migrate from those materials (Stuer-Lauridsen et al., 2001). Due to the high usage of DEHA in consumer products, it has been found in indoor dust (Subedi et al., 2017) and adsorbed onto particulate matter in rivers (Nagorka and Koschorreck, 2020), but is rarely analyzed or detected in surface water. DEHA is not persistent in air, and therefore long-range atmospheric deposition is unlikely to be a source.

No patterns were apparent between phthalate detections or concentrations and ancillary parameters (DOC, SSC, or TOC[2]), nor was any spatial pattern evident. Detections of DEHP in surface water occurred throughout the state, and mostly outside of the urban area surrounding Puget Sound. Most of the study locations with detections of DEHP were downstream of wastewater treatment plants (WWTPs), indicating a potentially important pathway. However, the S.F. Palouse River did not contain any phthalates in the fall water sample, when WWTP effluent can make up the majority of flow. The statewide spatial pattern is further complicated by low detection frequencies, partially due to method blank contamination in some of the western Washington urban waterbody samples.

[2] Dissolved organic carbon, suspended sediment concentration, or total organic carbon.

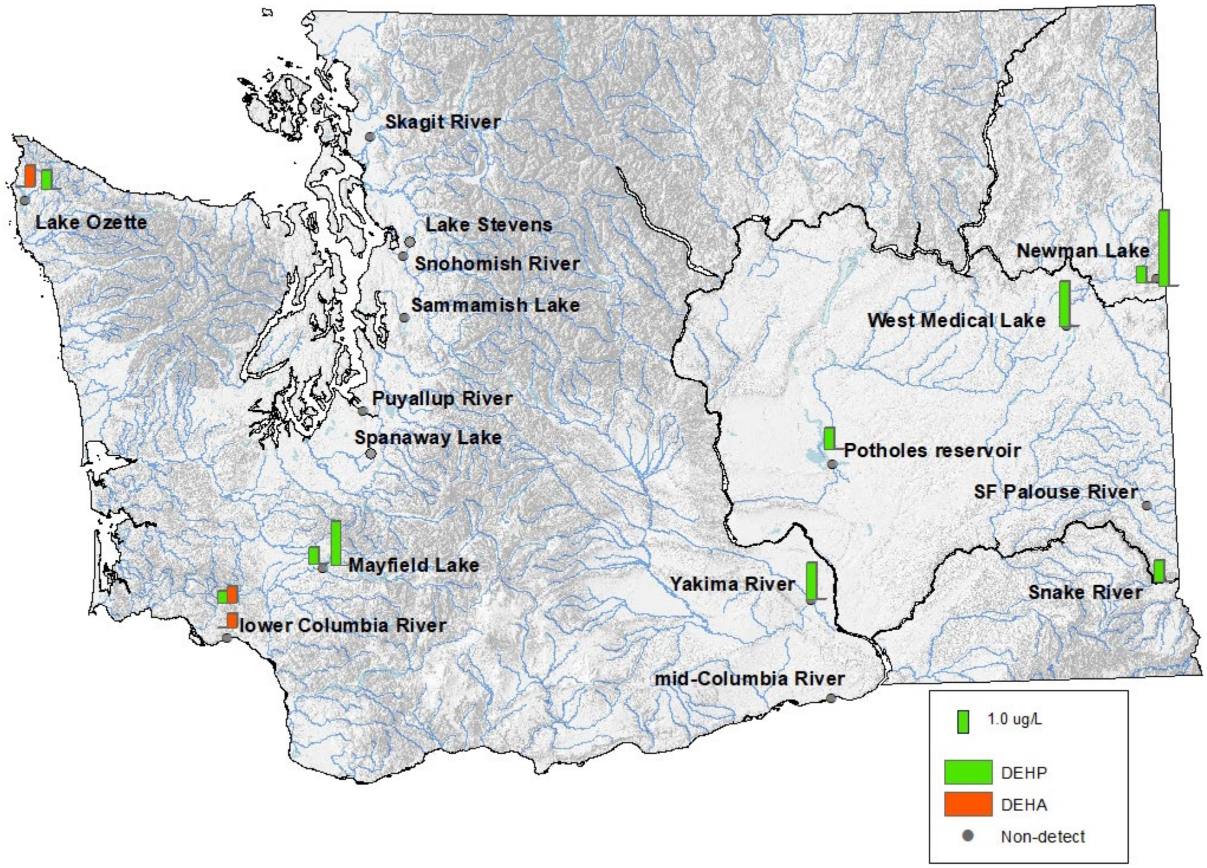


**Figure 3. Surface Water Phthalate Concentrations (ug/L) across the 2021 Sampling Sites.**

### *Comparison to other Washington studies*

DEHP has been detected in surface water during several previous studies in the Puget Sound area. In the Lake Whatcom watershed, DEHP concentrations in surface water collected in 1998 ranged from 0.045 – 4.4 ug/L (Serdar et al., 1999). In Puget Sound tributary samples collected in 2009-2010, concentrations of DEHP were mostly non-detects (NDs), with a detection in the Puyallup River of 0.07 ug/L (Gries and Osterberg, 2011). The Puyallup River surface water also contained DnOP at a concentration of 0.16 ug/L. The current 2021 study did not detect any phthalates in the Puyallup River at the same sampling location.

## Lake and River Sediments

A total of 27 freshwater sediment samples were collected in the spring and fall of 2021. Figure 4 displays the freshwater sediment phthalate results. The freshwater sediment samples contained very few detections of phthalates. DEHA was detected once, in sediment collected from the mid-Columbia River in the fall, at 129 ug/kg dw. DINP was tentatively identified – qualified as "NJ" – in two sediment samples, from Lake Spanaway and Lake Stevens, in the fall. DINP concentrations were 2,150 and 1,120 NJ ug/kg, respectively, which were the highest concentrations of any phthalate across matrices analyzed for this study. Positive identification of

DINP is analytically difficult because DINP is a mixture of isononyl esters and phthalic acid in varying degrees.

No other analytes were detected in the freshwater sediments. Lab blank contamination prevented detections of DEHP at four sites in the fall (Spanaway Lake, Lake Sammamish, Lake Stevens, and mid-Columbia River). Grain size and TOC appeared to have little correlation to detections or concentrations in the sediment, though low detection frequency makes it difficult to identify relationships. Percent fines in the lake and reservoir samples ranged from 63 – 95%, and the two lake sites with phthalate detections had percent fines of 77 – 80%. The mid-Columbia River samples contained the highest percent fines of all river sites, with a percent fine portion of 87% in the sample that contained a detection of DEHA. Percent fines were very low in the other river samples.

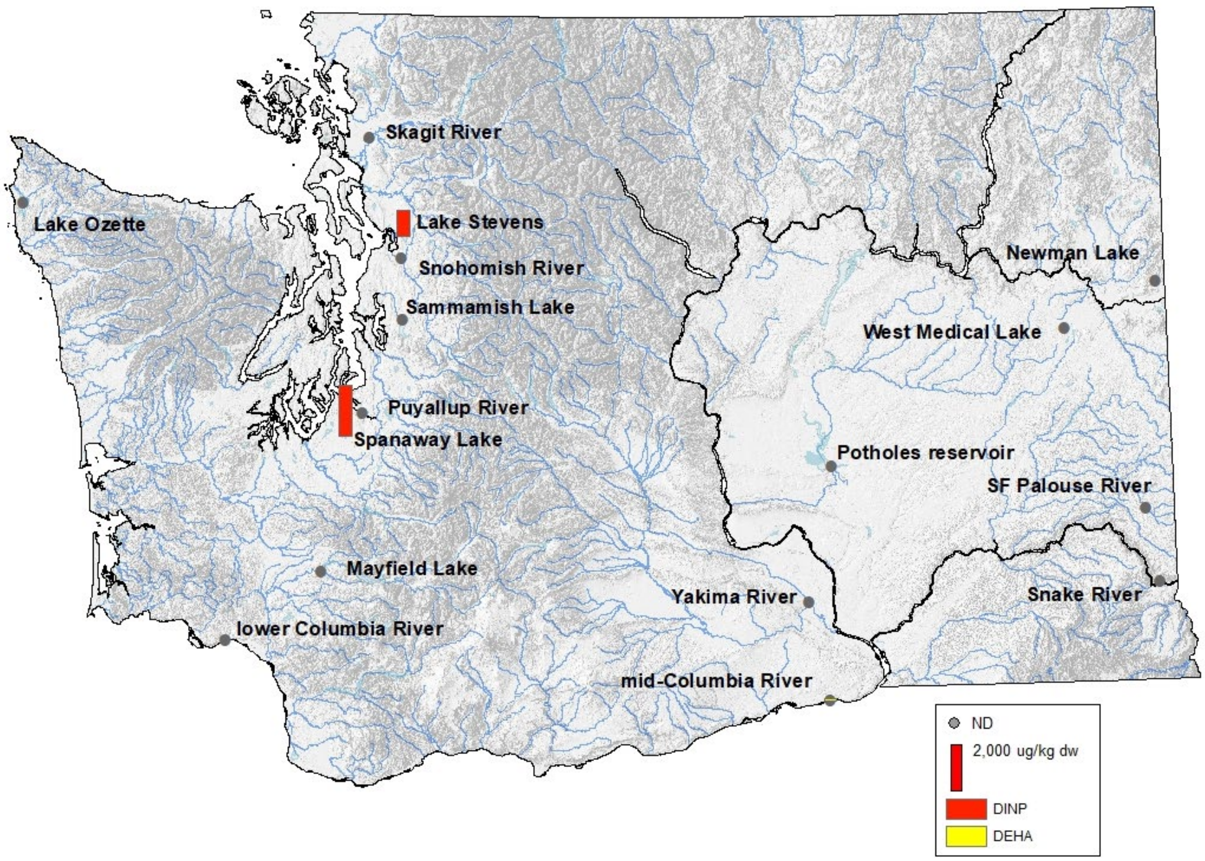


**Figure 4. Freshwater Sediment Phthalate Concentrations (ug/kg dw) across the 2021 Sampling Sites.**

## *Comparison to other Washington studies*

The lack of detections in lake and river sediments may suggest an improvement in ambient levels of phthalates. A previous Ecology study detected DEHP in sediment samples collected from the same sampling coordinates in Potholes Reservoir and Lake Sammamish in the 1990s (Serdar et al., 1994). At the Potholes site, Serdar et al. (1994) reported DEHP at a concentration of 180 ug/kg dw, while DEHP was undetected in this study at reporting limits of 97 – 114 ug/kg dw. Similarly, the Lake Sammamish sample from the 1990s had DEHP concentration of 390 ug/k dw and our study's Lake Sammamish samples were undetected at 156 – 174 ug/kg, though method blank contamination accounted for one of the non-detects in this study (156 ug/kg UJ).

# River Suspended Particulate Matter

Suspended particulate matter (SPM) was collected from three river sites in December. DEHP was detected in samples collected from the Puyallup River, Skagit River, and Snohomish River, at concentrations of 156, 64.2, and 152 ug/kg dw, respectively. Figure 5 displays the detected concentrations at the three sites. No other analytes were detected, and reporting limits were relatively low (32 – 40 ug/kg). Figure 5 shows the phthalate concentrations for river SPM.

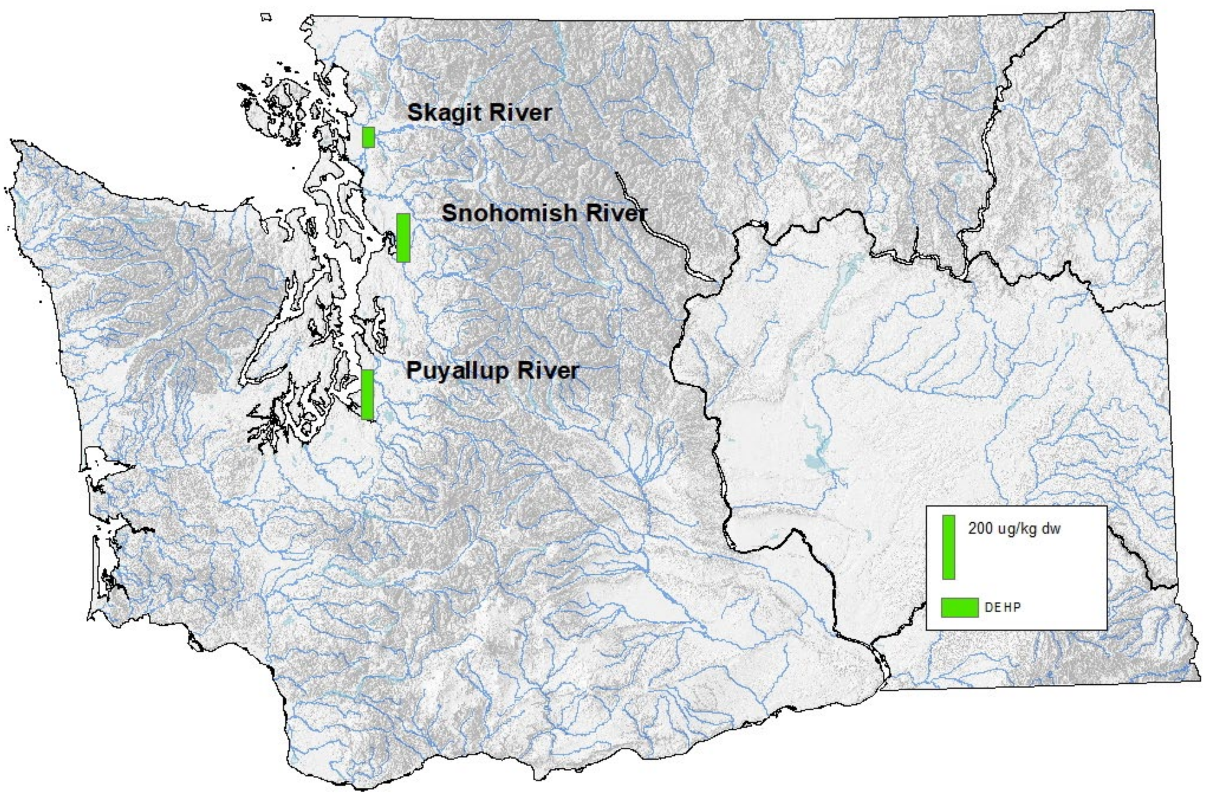


**Figure 5. SPM Phthalate Concentrations (ug/kg dw) Measured at the Three Sampling Sites in 2021.**

## *Comparison to other Washington studies*

Gries and Osterberg (2011) also collected SPM from the same rivers in 2009 for analysis of six phthalates. Table 4 compares phthalates results from the current study to the 2009 concentrations. Sediments from both sampling years contained similar TOC. In both sampling years, DEHP was the only phthalate detected. DEHP concentrations reported in 2021 SPM samples were an order of magnitude lower than those measured in 2009 at the Puyallup River and Skagit River, suggesting a potential reduction in SPM-associated DEHP at those sites. In SPM collected from the Snohomish River, DEHP concentrations were very similar between the 2009 and 2021 samples.

**Table 4. Phthalate Concentrations in SPM Collected in 2009 and 2021.**

| Location | Collection Date | BBP (ug/kg) | DEHP (ug/kg) | DnBP (ug/kg) | DEP (ug/kg) | DMP (ug/kg) | DnOP (ug/kg) |
|---|---|---|---|---|---|---|---|
| Puyallup River* | 12/13/2009 | 43 UJ | **1000** | 33 UJ | 21 U | 21 U | 43 U |
| Puyallup River | 12/6/2021 | 32.1 U | **156** | 32.1 U | 32.1 U | 32.1 U | 32.1 U |
| | | | | | | | |
| Skagit River* | 12/16/2009 | 53 UJ | **510** | 54 UJ | 27 U | 27 U | 53 U |
| Skagit River | 12/9/2021 | 39.4 U | **64.2** | 39.4 U | 39.4 U | 39.4 U | 39.4 U |
| | | | | | | | |
| Snohomish River* | 12/22/2009 | 57 UJ | **170 J** | 40 UJ | 28 U | 28 U | 57 U |
| Snohomish River | 12/8/2021 | 40.5 U | **152** | 40.5 U | 40.5 U | 40.5 U | 40.5 U |

* 2009 data from Gries and Osterberg (2011).
All concentrations are in dry weight.
See Appendix A for full spelling of analyte names.

The absence of several novel phthalates and non-phthalate plasticizers in the SPM from the three Washington rivers is in contrast to the findings of a long-term SPM monitoring program in German rivers (Nagorka and Koschorreck, 2020). In the German study, the number of non-phthalate plasticizers and novel phthalates detected increased between 2005/06 and 2017 as DEHP decreased due to changes in market share. In SPM collected from German rivers, several analytes from this study were frequently detected, at concentrations above our reporting limits: DiBP, DIDP, DINP, DMP, DBP, DEHA, and TOTM[3]. Several other phthalates were also detected in their study, but at concentrations below our reporting limits and thus may be present in Washington SPM at levels we couldn't measure: DcHP, DHpP, DHP, BBP, and DEHAz[4].

[3] See Appendix A for full spelling of acronyms.
[4] See Appendix A for full spelling of acronyms.

## Marine Water Sediments

Sediment samples from marine water were collected from 21 stations throughout the Puget Sound and 10 stations within Elliott Bay. Of the 31 marine sediment samples analyzed for this study, seven contained one or more phthalate or non-phthalate plasticizer (detection frequency of 23%). DEHP was detected in all seven samples. All but one of the samples with detected phthalates were collected from Elliott Bay. The only detection outside of Elliott Bay was in a sample collected from North Samish Bay, near Bellingham. DEHP concentrations in the detected samples ranged from 49.6 – 217 ug/kg dw, with a median of 90.2 ug/kg dw.

DINP was tentatively identified in three samples collected from Elliott Bay, at higher concentrations than measured for DEHP. Concentrations of DINP ranged from 601 NJ – 698 NJ ug/kg dw. BBP was tentatively identified in one sample collected from Elliott Bay, at 86.2 NJ ug/kg dw. Dicyclohexyl phthalate (DcHP) was detected in one sample as well, at 66.5 ug/kg dw. No other analytes were detected in the marine sediment samples.

Figure 6 shows the detected concentrations of DEHP, BBP, and DcHP in marine sediments and in SPM in three Puget Sound tributaries. All three rivers appear to contribute to the transport of particulate-associated DEHP towards Puget Sound. During this study, no marine sediments were collected in the bays they flow to, but previous sampling of sediments in Commencement Bay and Port Gardner/Everett Harbor show DEHP was frequently detected at concentrations similar to the river SPM samples. DEHP was detected in Skagit Bay in the 1990s, but not detected in the most recent sampling events in the bay in 2007 and 2016 (EIM, accessed on 07/06/22). DEHP is the most frequently detected phthalate of the six phthalates analyzed in marine sediments by Ecology's Puget Sound Sediment Monitoring Program throughout the Puget Sound (Partridge et al., 2018).

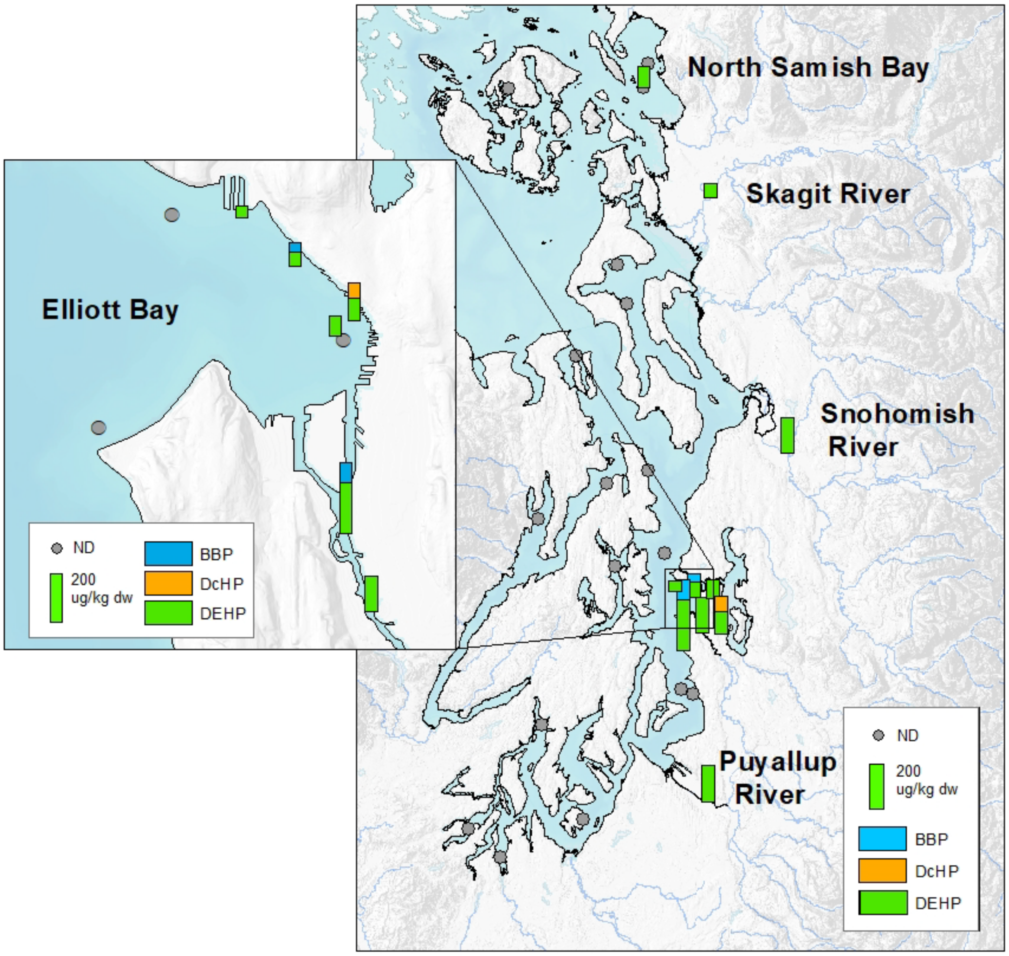


**Figure 6. Concentrations of DEHP, BBP, and DcHP (ug/kg dw) in Marine Water Sediment and Nearby Freshwater SPM.**

As shown in Figure 7, DINP was detected in both marine sediments and nearby lake sediments. The marine sediment detections of DINP occurred in the industrial section of the Duwamish Waterway and just offshore of the Smith Cove Waterway in Northern Elliott Bay. The marine sediments contained about half the concentration as the freshwater lake sediments, but in both matrices DINP had the highest concentrations of all analytes. DINP has been found at higher concentrations than other phthalates in sediments of urban areas, which has been suggested to be due to its higher environmental persistence and rising use following DEHP restrictions (Björklund et al., 2009).

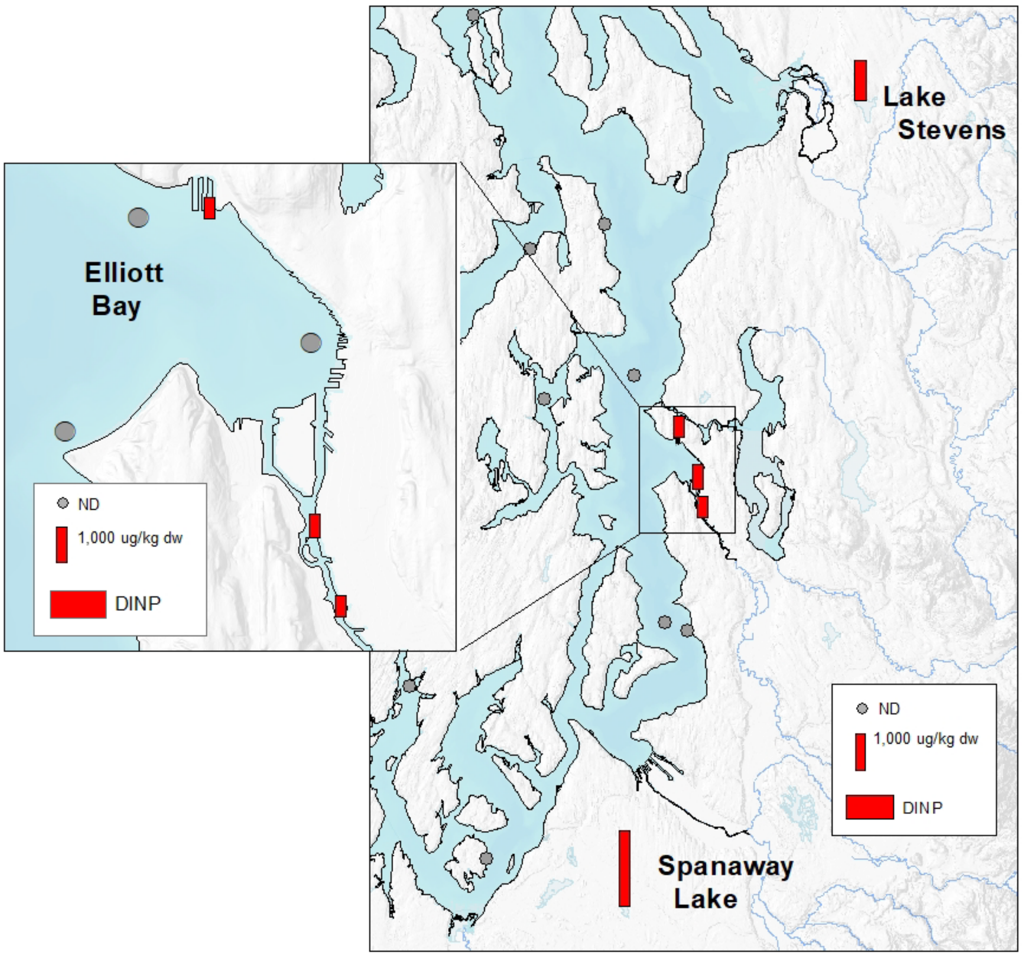


**Figure 7. Marine Water and Freshwater Sediment DINP Concentrations (ug/kg dw).**

# Ecological Relevance

Due to the lack of ecotoxicity thresholds in the United States, results from this study were compared to lowest predicted no-effects concentrations (PNECs) estimated from the European Union's NORMAN Ecotoxicology database.[5] The EU PNECs are based on either experimental ecotoxicity data or quantitative structure-activity relationship (QSAR) predictions where empirical data is lacking. A measured environmental concentration that exceeds a lowest PNEC is considered by European Union member states to warrant further review for regulatory concern. These values are not considered robust thresholds; rather they are agreed-upon values by NORMAN experts to be used for preliminary prioritization of chemicals. When available, additional thresholds are used in this report, such as the sediment management standards (SMS) values for sediment cleanup objectives (SCO) and cleanup screening levels (CSLs) (Ecology, 2013; WAC 173-204).

## *Water*

Figure 8 presents a comparison of this study's phthalate reporting limits and detected concentrations with available lowest PNECs. Of detected analytes in water, both DEHA and DEHP concentrations were close to and slightly above PNECs, indicating a potential for these analytes to pose adverse effects.

The majority of phthalates and non-phthalate plasticizers were undetected in water at reporting limits around 0.5 ug/L. At these reporting limits, we can consider that 9 out of 18 analytes are well below PNECs, even if present in samples below what could be measured in this study. Reporting limits for DEP, DMEP, and DMP, in particular, were 2-3 orders of magnitude below levels at which adverse effects have been observed or modeled. Reporting limits were also sufficiently low for DcHP, DEHA, DiBP, DBEP, DEHP, DAP, DBP and BBP for this study to assess potential concern with those analytes.

Seven of the analytes had PNECs below our reporting limits and thus our ability to assess the ecological relevance of those analytes is hampered. We cannot assess whether the following analytes would pose an ecotoxicity concern if they are present below reporting limits of this study: TOTM, DIDP, DINP, DHpP, DHP, DEHAz, and DPP.

[5] Accessed on 05/19/22 from https://www.norman-network.com/nds/ecotox/lowestPnecsIndex.php.

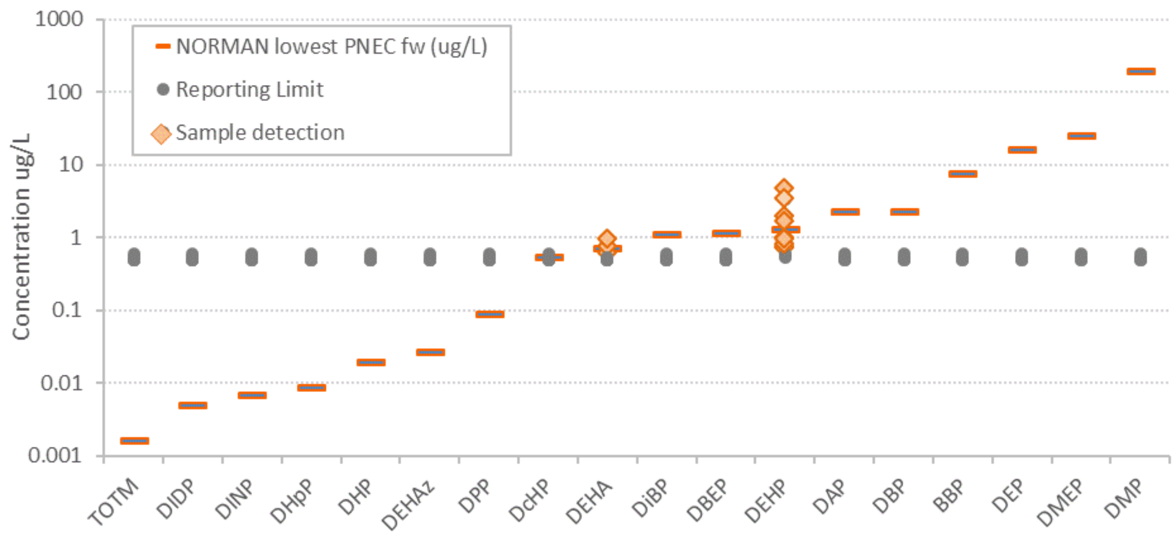


**Figure 8. Effects Thresholds for Phthalates in Freshwater Compared to this Study's Results.**

## *Freshwater sediment and SPM*

A comparison of this study's freshwater sediment and SPM results with freshwater sediment effects thresholds is given in Figure 9. In contrast to surface water, analytical reporting limits varied widely for sediment and SPM due to differences in percent solids. The majority of the analytes had reporting limits that were low enough to compare to PNECs for at least some of the samples and were found unlikely to cause adverse effects. Four analytes – which are current use phthalates and non-phthalate plasticizers – had PNECs below our reporting limits and thus we were unable to compare to the thresholds.

DEHP was detected in the three SPM samples, at concentrations well below both the lowest PNEC and the two sediment management standard values, indicating that adverse effects to aquatic organisms is not expected for these sediments. The one detection of DEHA in sediment was also well below the freshwater sediment PNEC value for that compound.

No freshwater sediment effects thresholds were found for DINP, the only other compound detected in freshwater sediments. Sediment toxicity testing found no adverse aquatic effects for DINP up to the highest concentrations in the 700 – 3,000 mg/kg dw range (EC, 2015). Additional research into ecotoxicological effects of DINP in freshwater sediments would be needed to determine whether this compound poses a hazard.

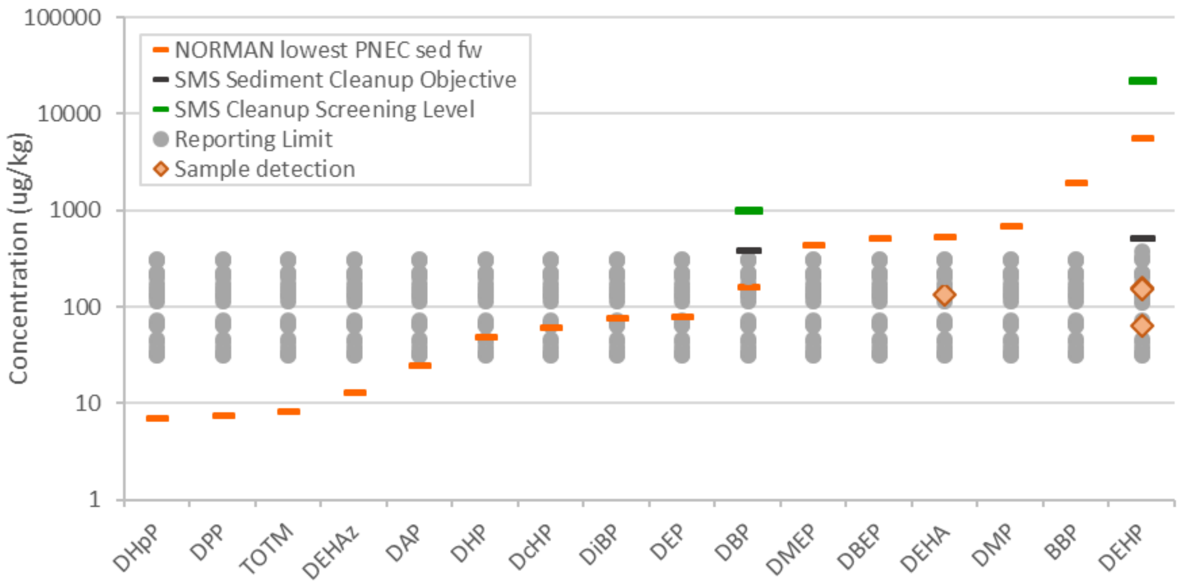


**Figure 9. Effects Thresholds for Freshwater Sediments Compared to this Study's Results.**

## *Marine water sediment*

NORMAN lowest PNECs were not available for marine sediment, and therefore ecological relevance of the majority of the analytes is not discussed here. Washington's sediment management standards includes SCOs and CSLs for six phthalates in marine sediment. Of the six phthalates, only DEHP was detected in the marine sediment samples, and BBP was tentatively identified in one sample. Organic carbon (OC)-normalized DEHP concentrations in sediments collected from Elliott Bay and North Samish Bay ranged from 4.3 – 12 mg/kg OC, below the SCO and CSL of 47 mg/kg OC and 78 mg/kg OC, respectively. The tentatively identified BBP detection of 4.6 mg/kg OC was close to, but below, the SCO (4.9 mg/kg OC), and well below the CSL (64 mg/kg OC).

# Summary and Conclusions

Results of this 2021 study support the following conclusions:

- DEHP was the most frequently detected phthalate in surface water, and mostly occurred in waterbodies outside of urban areas, though this is complicated by laboratory method blank censoring of several Western Washington sites. Surface water concentrations of DEHP in detected samples ranged from 0.558 – 3.38 ug/L. DEHA was detected in three surface water samples, at concentrations of 0.624 – 0.949 ug/L, during the spring sampling event, from the lower Columbia River and Lake Ozette. DEHA is used in flexible plastic wraps, hydraulic fluids, and aircraft lubricants; it is unclear what the pathway or source of DEHA would be to these two monitoring sites.
- Only DEHA was positively identified and quantified in freshwater sediment. It was detected in the mid-Columbia River at 129 ug/kg dw. DINP was tentatively identified in two samples – from Lake Spanaway and Lake Stevens – in the fall (2,150 and 1,120 NJ ug/kg dw, respectively). Laboratory blank contamination prevented DEHP detections in several freshwater sediment samples.
- DEHP was the only analyte present in SPM collected from a subset of three of the rivers. Concentrations of DEHP in the SPM ranged from 64.2 – 156 ug/kg dw. Concentrations of DEHP were about an order of magnitude lower than previously measured in SPM collected at two of the sites (Puyallup River and Skagit River) by Ecology in 2009. DEHP concentrations in Snohomish River SPM were very similar in both 2009 and 2021 collections.
- Of the 31 marine sediment samples, 7 contained one or more target analytes. Most detections were in sediments collected from Elliott Bay. DEHP was present in all detected samples (49.6 – 217 ug/kg dw). DcHP was detected in one sample collected in Elliott Bay near the downtown waterfront (66.5 ug/kg dw). DINP was tentatively identified in 3 samples at 601 – 698 NJ ug/kg dw. BBP was tentatively identified in one sample at 86.2 NJ ug/kg dw.
- The majority of phthalates were not detected in surface water at or above the reporting limit of 0.5 ug/L, nor in SPM, freshwater sediment, and marine sediment at varying reporting limits in the 30 - 300 ug/kg dw range. This is an encouraging finding in light of reports from Europe of increasing levels of novel phthalates and non-phthalate replacement plasticizers as markets replace DEHP and other low molecular weight phthalates.
- The majority of phthalates and non-phthalate plasticizers analyzed in this study do not appear to pose a threat to aquatic life. While most of the analytes were not present in samples, the levels at which they were not detected were generally lower than predicted no-effect concentrations, a level below which adverse effects are predicted to be unlikely.
- Reporting limits were too high to compare some of the analytes to toxicity effects thresholds in surface water and/or freshwater sediment: TOTM, DIDP, DINP, DHpP, DHP, DEHAz, DPP, DAP. Analytical methods capable of measuring much lower than the current method would be needed to assess ecological impacts of these analytes.

# Recommendations

Results of this 2021 study support the following recommendations.

- Based on the low detection frequency of the majority of the newly tested phthalates and non-phthalate plasticizers, additional monitoring of these compounds are considered a low priority for long-term or ambient environmental monitoring. Future monitoring of phthalates and non-phthalate plasticizers should be targeted to waterbodies where detections are more likely and on a schedule of every five years. Other considerations for future monitoring include expanding to aquatic biota matrices and sampling of microplastics at monitoring sites.
- If additional ecotoxicity research shows concern for harm at levels lower than measured in this study, then more sensitive methods should be identified prior to future sampling and testing. Blank contamination is an ongoing issue for common laboratory contaminants like DEHP, and should be considered when evaluating new methods with lower detection limits.
- Further work should be done to identify suitable methods for positive identification of DINP. This study found DINP was present in sediments at higher concentrations than DEHP, as reported in other areas, but because of the analytical uncertainty with positive identification, all results were qualified as "NJ." Assuming reliable methods for positive identification can be achieved, additional monitoring of DINP in sediments and SPM is recommended.

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# Glossary, Acronyms, and Abbreviations

## Glossary

**Effluent:** An outflowing of water from a natural body of water or from a man-made structure. For example, the treated outflow from a wastewater treatment plant.

**Hyperlimnion:** The upper layer of water in a stratified lake.

**Hypolimnion:** The layer of lower water in a stratified lake.

**Watershed:** A drainage area or basin in which all land and water areas drain or flow toward a central collector, such as a stream, river, or lake at a lower elevation.

## Acronyms and Abbreviations

| | |
|---|---|
| DOC | dissolved organic carbon |
| Ecology | Washington State Department of Ecology |
| EIM | Environmental Information Management database |
| EPA | U.S. Environmental Protection Agency |
| MEL | Manchester Environmental Laboratory |
| PBT | persistent, bioaccumulative, and toxic substance |
| RM | river mile |
| RPD | relative percent difference |
| RSD | relative standard deviation |
| SOP | standard operating procedures |
| SPM | suspended particulate matter |
| SSC | suspended sediment concentration |
| TOC | total organic carbon |
| WAC | Washington Administrative Code |
| WRIA | Water Resource Inventory Area |
| WWTP | Wastewater treatment plant |

**Units of Measurement**

| | |
|---|---|
| °C | degrees centigrade |
| cfs | cubic feet per second |
| dw | dry weight |
| ft | feet |
| g | gram, a unit of mass |
| mg/kg OC | milligram per kilogram on an organic carbon basis (parts per million) |
| ug/kg | micrograms per kilogram (parts per billion) |
| ug/L | micrograms per liter (parts per billion) |

# Appendices

## Appendix A. Analytes Measured

**Table A-1. Phthalate and Non-Phthalate Plasticizers Measured in This Study.**

| Name | Abbrevia-tion | CAS | Water Median LLOQ (ug/L) | Freshwater Sediment Median LLOQ (ug/kg dw) | Freshwater SPM Median LLOQ (ug/kg dw) | Marine Sediment Median LLOQ (ug/kg dw) |
|---|---|---|---|---|---|---|
| dimethyl phthalate | DMP | 131-11-3 | 0.51 | 106 | 39.8 | 47.4 |
| diethyl phthalate | DEP | 84-66-2 | 0.51 | 106 | 39.8 | 47.4 |
| diallyl phthalate | DAP | 131-17-9 | 0.51 | 106 | 39.8 | 47.4 |
| diisobutyl phthalate | DiBP | 84-69-5 | 0.51 | 106 | 39.8 | 47.4 |
| dibutyl phthalate | DBP | 84-74-2 | 0.51 | 106 | 39.8 | 47.4 |
| di(2-methoxyethyl) phthalate | DMEP | 117-82-8 | 0.51 | 106 | 39.8 | 47.4 |
| dipentyl phthalate | DPP | 131-18-0 | 0.51 | 106 | 39.8 | 47.4 |
| butyl benzyl phthalate | BBP | 85-68-7 | 0.51 | 106 | 39.8 | 47.4 |
| dicyclohexyl phthalate | DcHP | 84-61-7 | 0.51 | 106 | 39.8 | 47.4 |
| dihexyl phthalate | DHP | 84-75-3 | 0.51 | 106 | 39.8 | 47.4 |
| diheptyl phthalate | DHpP | 3648-21-3 | 0.51 | 106 | 39.8 | 47.4 |
| bis(2-butoxyethyl) phthalate | DBEP | 117-83-9 | 0.51 | 106 | 39.8 | 47.4 |
| di-n-octyl phthalate | DNOP | 117-84-0 | 0.51 | 106 | 39.8 | 47.4 |
| di(2-ethylhexyl) phthalate | DEHP | 117-81-7 | 0.51 | 106 | 39.8 | 47.4 |
| diisononyl phthalate | DINP | 28553-12-0 | 0.51 | 106 | 39.8 | 47.4 |
| diisodecyl phthalate | DIDP | 26761-40-0 | 0.51 | 106 | 39.8 | 47.4 |
| di(2-ethylhexyl) adipate * | DEHA | 103-23-1 | 0.51 | 106 | 39.8 | 47.4 |
| di(2-ethylhexyl) azelate* | DEHAz | 103-24-2 | 0.51 | 106 | 39.8 | 47.4 |
| tris(2-ethylhexyl) trimellitate * | TOTM | 3319-31-1 | 0.51 | 106 | 39.8 | 47.4 |

*non-phthalate plasticizer

# Appendix B. Analytical Results

## Table B-1. Spring Analytical Results in Water Samples.

| Study Location | Date | Collection Depth | DMP (ug/L) | DEP (ug/L) | DAP (ug/L) | DiBP (ug/L) | DnBP (ug/L) | DMEP ug/L) | DPP (ug/L) | BBP (ug/L) | DcHP (ug/L) | DHP (ug/L) | DHpP (ug/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spanaway L. | 5/26/2021 | T | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U |
| Spanaway L. | 5/26/2021 | B | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U |
| Puyallup R. | 5/26/2021 | T | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U |
| L. Sammamish | 5/26/2021 | T | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| L. Sammamish | 5/26/2021 | B | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U |
| Snohomish R. | 5/27/2021 | T | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U |
| Skagit R. | 5/27/2021 | T | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U |
| L. Stevens | 5/28/2021 | T | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U |
| L. Stevens | 5/28/2021 | B | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| Potholes Res. | 6/1/2021 | T | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U |
| Potholes Res. | 6/1/2021 | B | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U |
| W. Med. L. | 6/1/2021 | T | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U |
| W. Med. L. | 6/1/2021 | B | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U |
| Newman L. | 6/1/2021 | T | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U |
| Newman L. | 6/1/2021 | B | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| S.F. Palouse R. | 6/2/2021 | T | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ |
| Snake R. | 6/2/2021 | T | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| Snake R. | 6/2/2021 | B | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U |
| Mid Col. R. | 6/2/2021 | T | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ |
| Mid Col. R. | 6/2/2021 | B | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| Yakima R. | 6/3/2021 | T | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U |
| Mayfield L. | 6/3/2021 | T | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ |
| Mayfield L. | 6/3/2021 | B | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| L. Ozette | 6/9/2021 | T | 0.518 U | 0.518 U | 0.518 U | 0.518 U | 0.518 U | 0.518 U | 0.518 U | 0.518 U | 0.518 U | 0.518 U | 0.518 U |
| L. Ozette | 6/9/2021 | B | 0.592 U | 0.592 U | 0.592 U | 0.592 U | 0.592 U | 0.592 U | 0.592 U | 0.592 U | 0.592 U | 0.592 U | 0.592 U |
| L. Col. R. | 6/10/2021 | T | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U |
| L. Col. R. | 6/10/2021 | B | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U |

Full compounds names are included in Appendix A.

U: Compound not detected at or above reported value.

UJ: Compound not detected at or above estimated value.

Detected values are bolded and highlighted in green.

## Table B-2. Spring Analytical Results in Water Samples.

| Study Location | Date | Sample Collection Type | DBEP (ug/L) | DNOP (ug/L) | DEHP (ug/L) | DINP* (ug/L) | DIDP (ug/L) | DEHA (ug/L) | DEHAz (ug/L) | TOTM (ug/L) | SSC (mg/L) | TOC (mg/L) | DOC (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spanaway L. | 5/26/2021 | T | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.8 | 1.97 | 1.79 |
| Spanaway L. | 5/26/2021 | B | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 1 | 1.69 | 1.4 |
| Puyallup R. | 5/26/2021 | T | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 99 | 1.26 | 1.17 |
| L. Sammamish | 5/26/2021 | T | 0.5 U | 0.5 U | 0.659 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.9 | 2.15 | 2.08 |
| L. Sammamish | 5/26/2021 | B | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 1 | 1.95 | 1.63 |
| Snohomish R. | 5/27/2021 | T | 0.508 U | 0.508 U | 0.592 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 8 | 1.54 | 1.42 |
| Skagit R. | 5/27/2021 | T | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 10 | 0.828 | 0.78 |
| L. Stevens | 5/28/2021 | T | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 1 | 3.13 | 2.86 |
| L. Stevens | 5/28/2021 | B | 0.5 U | 0.5 U | 0.531 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 | 2.94 | 2.86 |
| Potholes Res. | 6/1/2021 | T | 0.532 U | 0.532 U | **0.978** | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 1 | 4.66 | 3.78 |
| Potholes Res. | 6/1/2021 | B | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 1 | 4.21 | 3.95 |
| W. Med. L. | 6/1/2021 | T | 0.505 U | 0.505 U | **1.99** | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.9 | 15.2 | 15.3 |
| W. Med. L. | 6/1/2021 | B | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.5 | 14.4 | 14.9 |
| Newman L. | 6/1/2021 | T | 0.503 U | 0.503 U | **3.38** | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 0.503 U | 2 | 5.93 | 5.32 |
| Newman L. | 6/1/2021 | B | 0.5 U | 0.5 U | **0.711** | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 5 | 5.13 | 4.76 |
| S.F. Palouse R. | 6/2/2021 | T | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 0.498 UJ | 8 | 5.43 | 5.48 |
| Snake R. | 6/2/2021 | T | 0.5 U | 0.5 U | **0.948** | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 2 | 2.66 | 2.51 |
| Snake R. | 6/2/2021 | B | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 5 | 2.63 | 2.4 |
| Mid Col. R. | 6/2/2021 | T | 0.505 UJ | 0.505 UJ | 0.554 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 0.505 UJ | 2 | 2.33 | 2.98 |
| Mid Col. R. | 6/2/2021 | B | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 3 | 2.36 | 2.85 |
| Yakima R. | 6/3/2021 | T | 0.498 U | 0.498 U | **1.68** | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 11 | 1.97 | 2.04 |
| Mayfield L. | 6/3/2021 | T | 0.493 UJ | 0.493 UJ | **1.99 J** | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.493 UJ | 0.7 | 1.54 | 1.59 |
| Mayfield L. | 6/3/2021 | B | 0.5 U | 0.5 U | **0.744** | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 2 | 0.972 | 0.97 |
| L. Ozette | 6/9/2021 | T | 0.518 U | 0.518 U | **0.817** | 0.518 U | 0.518 U | 0.518 U | 0.518 U | 0.518 U | 0.6 U | 4.59 | 4.78 |
| L. Ozette | 6/9/2021 | B | 0.592 U | 0.592 U | 0.592 U | 0.592 U | 0.592 U | **0.949** | 0.592 U | 0.592 U | 0.5 U | 4.01 | 4.3 |
| L. Col. R. | 6/10/2021 | T | 0.503 U | 0.503 U | **0.558** | 0.503 U | 0.503 U | **0.748** | 0.503 U | 0.503 U | 11 | 1.95 | 1.96 |
| L. Col. R. | 6/10/2021 | B | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | **0.624** | 0.538 U | 0.538 U | 10 | 1.99 | 1.97 |

*DINP (unbranched isomers)

Full compounds names are included in Appendix A.

U: Compound not detected at or above reported value.

UJ: Compound not detected at or above estimated value.

Detected values are bolded and highlighted in green.

## Table B-3. Fall Analytical Results in Water Samples.

| Sample ID | Study Location | Date | Collection Depth | DMP (ug/L) | DEP (ug/L) | DAP (ug/L) | DiBP (ug/L) | DnBP (ug/L) | DMEP (ug/L) | DPP (ug/L) | BBP (ug/L) | DcHP (ug/L) | DHP (ug/L) | DHpP (ug/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2110008-01 | L. Ozette | 10/7/2021 | T | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U |
| 2110008-02 | L. Ozette | 10/7/2021 | B | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U |
| 2110008-04 | Mayfield L. | 10/8/2021 | T | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U |
| 2110008-05 | Mayfield L. | 10/8/2021 | B | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U |
| 2110008-06 | L. Col. R. | 10/8/2021 | T | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U |
| 2110008-07 | L. Col. R. | 10/8/2021 | B | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U |
| 2110027-01 | Spanaway L. | 10/11/2021 | T | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U |
| 2110027-02 | Spanaway L. | 10/11/2021 | B | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U |
| 2110027-04 | Puyallup R. | 10/13/2021 | T | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U |
| 2110027-08 | L. Sammamish | 10/11/2021 | T | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U |
| 2110027-09 | L. Sammamish | 10/11/2021 | B | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| 2110027-10 | L. Stevens | 10/12/2021 | T | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U |
| 2110027-11 | L. Stevens | 10/12/2021 | B | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U |
| 2110027-12 | Skagit R. | 10/12/2021 | T | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U |
| 2110027-13 | Skagit R. | 10/12/2021 | B | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U |
| 2110027-15 | Snohomish R. | 10/12/2021 | T | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U |
| 2110027-16 | Snohomish R. | 10/12/2021 | B | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U |
| 2110029-01 | Potholes Res. | 10/19/2021 | T | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U |
| 2110029-02 | Potholes Res. | 10/19/2021 | B | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U |
| 2110029-03 | W. Med. L. | 10/19/2021 | T | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U |
| 2110029-04 | W. Med. L. | 10/19/2021 | B | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U |
| 2110029-07 | Newman L. | 10/19/2021 | T | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U |
| 2110029-08 | Newman L. | 10/19/2021 | B | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U |
| 2110029-09 | S.F. Palouse R. | 10/20/2021 | T | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U |
| 2110029-11 | Snake R. | 10/20/2021 | T | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U |
| 2110029-14 | Mid Col. R. | 10/21/2021 | T | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| 2110029-15 | Mid Col. R. | 10/21/2021 | B | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U |
| 2110029-16 | Yakima R. | 10/20/2021 | T | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U |

Full compounds names are included in Appendix A.

U: Compound not detected at or above reported value.

## Table B-4. Fall Analytical Results in Water Samples.

| Study Location | Date | Sample Collection Type | DBEP (ug/L) | DNOP (ug/L) | DEHP (ug/L) | DINP* (ug/L) | DIDP (ug/L) | DEHA (ug/L) | DEHAz (ug/L) | TOTM (ug/L) | SSC (mg/L) | TOC (mg/L) | DOC (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L. Ozette | 10/7/2021 | T | 0.495 U | 0.495 U | 0.495 U | REJ | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 1 U | 4.23 J | 3.96 |
| L. Ozette | 10/7/2021 | B | 0.51 U | 0.51 U | 0.51 U | REJ | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 1 U | 3.96 J | 3.89 |
| Mayfield L. | 10/8/2021 | T | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 1 | 1.44 J | 1.84 |
| Mayfield L. | 10/8/2021 | B | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 1 | 2.7 J | 6.16 |
| L. Col. R. | 10/8/2021 | T | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 0.498 U | 2 | 1.67 J | 2.04 |
| L. Col. R. | 10/8/2021 | B | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 2 | 2.06 J | 2.08 |
| Spanaway L. | 10/11/2021 | T | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 3 | 3.97 | 3.81 |
| Spanaway L. | 10/11/2021 | B | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 2 | 3.55 | 3.03 |
| Puyallup R. | 10/13/2021 | T | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 0.515 U | 18 | 1.63 | 1.38 |
| L. Sammamish | 10/11/2021 | T | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 1 U | 2.84 | 6.78 |
| L. Sammamish | 10/11/2021 | B | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 3 | 2.24 | 2.15 |
| L. Stevens | 10/12/2021 | T | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 0.524 U | 1 U | 3.69 | 3.52 |
| L. Stevens | 10/12/2021 | B | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 0.526 U | 1 U | 3.11 | 2.86 |
| Skagit R. | 10/12/2021 | T | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 0.493 U | 12 | 2.08 | 7.53 |
| Skagit R. | 10/12/2021 | B | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 0.51 U | 17 | 1.53 | 2.4 |
| Snohomish R. | 10/12/2021 | T | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 0.508 U | 4 | 2.13 | 2.98 |
| Snohomish R. | 10/12/2021 | B | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 0.513 U | 4 | 1.8 | 2.59 |
| Potholes Res. | 10/19/2021 | T | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 5 | 3.24 | 3.22 |
| Potholes Res. | 10/19/2021 | B | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 7 | 2.84 | 2.6 |
| W. Med. L. | 10/19/2021 | T | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 0.538 U | 4 | 16.3 | 17.3 |
| W. Med. L. | 10/19/2021 | B | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 0.562 U | 4 | 15.8 | 16.6 |
| Newman L. | 10/19/2021 | T | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 7 | 9.42 | 6.4 |
| Newman L. | 10/19/2021 | B | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 8 | 6.33 | 6.04 |
| S.F. Palouse R. | 10/20/2021 | T | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 0.532 U | 2 | 4.79 | 4.75 |
| Snake R. | 10/20/2021 | T | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 0.556 U | 20 | 2.33 | 1.98 |
| Mid Col. R. | 10/21/2021 | T | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 0.5 U | 1 U | 3.68 | 2.03 |
| Mid Col. R. | 10/21/2021 | B | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 0.495 U | 1 | 1.62 | 1.97 |
| Yakima R. | 10/20/2021 | T | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 0.505 U | 5 | 1.86 | 1.69 |

*DINP (unbranched isomers)

Full compounds names are included in Appendix A.

T = top. B = bottom.

U: Compound not detected at or above reported value.

REJ = sample result was rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria.

## Table B-5. Spring Analytical Results in Freshwater Sediment Samples.

| Sample ID | Study Location | Date | DMP (ug/kg) | DEP (ug/kg) | DAP (ug/kg) | DiBP (ug/kg) | DnBP (ug/kg) | DMEP (ug/kg) | DPP (ug/kg) | BBP (ug/kg) | DcHP (ug/kg) | DHP (ug/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2106061-01 | Spanaway L. | 5/26/2021 | 306 U | 306 U | 306 U | 306 U | 306 U | 306 U | 306 U | 306 U | 306 U | 306 U |
| 2106061-03 | L. Sammamish | 5/26/2021 | 174 U | 174 U | 174 U | 174 U | 174 U | 174 U | 174 U | 174 U | 174 U | 174 U |
| 2106061-04 | Snohomish R. | 5/27/2021 | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U |
| 2106061-06 | L. Stevens | 5/28/2021 | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U |
| 2106061-08 | Potholes Res. | 6/1/2021 | 114 U | 114 U | 114 U | 114 U | 114 U | 114 U | 114 U | 114 U | 114 U | 114 U |
| 2106061-09 | W. Med. L. | 6/1/2021 | 159 U | 159 U | 159 U | 159 U | 159 U | 159 U | 159 U | 159 U | 159 U | 159 U |
| 2106061-10 | Newman L. | 6/1/2021 | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U |
| 2106061-11 | S.F. Palouse R. | 6/2/2021 | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U |
| 2106061-12 | Snake R. | 6/2/2021 | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U |
| 2106061-13 | Mid Col. R. | 6/2/2021 | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U |
| 2106061-15 | Yakima R. | 6/3/2021 | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U |
| 2106061-16 | Mayfield L. | 6/3/2021 | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U |
| 2106061-17 | L. Ozette | 6/9/2021 | 206 U | 206 U | 206 U | 206 U | 206 U | 206 U | 206 U | 206 U | 206 U | 206 U |
| 2106061-18 | L. Col. R. | 6/10/2021 | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U |

| Sample ID | Study Location | Date | DHpP (ug/kg) | DBEP (ug/kg) | DNOP (ug/kg) | DEHP (ug/kg) | DINP* (ug/kg) | DIDP (ug/kg) | DEHA (ug/kg) | DEHAz (ug/kg) | TOTM (ug/kg) | TOC (%) | Percent Fines (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2106061-01 | Spanaway L. | 5/26/2021 | 306 U | 306 U | 306 U | 306 U | 306 U | 306 U | 306 U | 306 U | 306 U | 13.3 | 63 |
| 2106061-03 | L. Sammamish | 5/26/2021 | 174 U | 174 U | 174 U | 174 U | 174 U | 174 U | 174 U | 174 U | 174 U | 5.97 | 78.76 |
| 2106061-04 | Snohomish R. | 5/27/2021 | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 0.44 | 8.48 |
| 2106061-06 | L. Stevens | 5/28/2021 | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 12.2 | 66.51 |
| 2106061-08 | Potholes Res. | 6/1/2021 | 114 U | 114 U | 114 U | 114 U | 114 U | 114 U | 114 U | 114 U | 114 U | 2.63 | 73.71 |
| 2106061-09 | W. Med. L. | 6/1/2021 | 159 U | 159 U | 159 U | 159 U | 159 U | 159 U | 159 U | 159 U | 159 U | 7.85 | 81.05 |
| 2106061-10 | Newman L. | 6/1/2021 | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 224 U | 8.2 | 60.34 |
| 2106061-11 | S.F. Palouse R. | 6/2/2021 | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 34.8 U | 1.72 | 28.21 |
| 2106061-12 | Snake R. | 6/2/2021 | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 33.4 U | 0.1 U | 0.57 |
| 2106061-13 | Mid Col. R. | 6/2/2021 | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 66.7 U | 1.87 | 65.36 |
| 2106061-15 | Yakima R. | 6/3/2021 | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 30.9 U | 0.3 | 13.41 |
| 2106061-16 | Mayfield L. | 6/3/2021 | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 71.4 U | 1.9 | 89.38 |
| 2106061-17 | L. Ozette | 6/9/2021 | 206 U | 206 U | 206 U | 206 U | 206 U | 206 U | 206 U | 206 U | 206 U | 3.5 | 75.59 |
| 2106061-18 | L. Col. R. | 6/10/2021 | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 32.3 U | 0.1 U | 0.18 |

*DINP (unbranched isomers)

Full compounds names are included in Appendix A.

U: Compound not detected at or above reported value.

## Table B-6. Fall Analytical Results in Freshwater Sediment Samples.

| Sample ID | Study Location | Date | DMP (ug/kg) | DEP (ug/kg) | DAP (ug/kg) | DiBP (ug/kg) | DnBP (ug/kg) | DMEP (ug/kg) | DPP (ug/kg) | BBP (ug/kg) | DcHP (ug/kg) | DHP (ug/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2110030-01 | L. Ozette | 10/7/2021 | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ |
| 2110030-02 | Mayfield L. | 10/8/2021 | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ |
| 2110030-03 | L. Col. R. | 10/8/2021 | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ |
| 2110030-04 | Spanaway L. | 10/11/2021 | 296 UJ | 296 UJ | 296 UJ | 296 UJ | 296 UJ | 296 UJ | 296 UJ | 296 UJ | 296 UJ | 296 UJ |
| 2110030-07 | L. Sammamish | 10/11/2021 | 149 UJ | 149 UJ | 149 UJ | 149 UJ | 149 UJ | 149 UJ | 149 UJ | 149 UJ | 149 UJ | 149 UJ |
| 2110030-08 | L. Stevens | 10/12/2021 | 209 UJ | 209 UJ | 209 UJ | 209 UJ | 209 UJ | 209 UJ | 209 UJ | 209 UJ | 209 UJ | 209 UJ |
| 2110030-10 | Snohomish R. | 10/12/2021 | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U |
| 2110030-11 | Potholes Res. | 10/19/2021 | 97 U | 97 U | 97 U | 97 U | 97 U | 97 U | 97 U | 97 U | 97 U | 97 U |
| 2110030-12 | W. Med. L. | 10/19/2021 | 131 U | 131 U | 131 U | 131 U | 131 U | 131 U | 131 U | 131 U | 131 U | 131 U |
| 2110030-14 | Newman L. | 10/19/2021 | 217 U | 217 U | 217 U | 217 U | 217 U | 217 U | 217 U | 217 U | 217 U | 217 U |
| 2110030-15 | S.F. Palouse R. | 10/20/2021 | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U |
| 2110030-17 | Mid Col. R. | 10/21/2021 | 64.4 U | 64.4 U | 64.4 U | 64.4 U | 64.4 U | 64.4 U | 64.4 U | 64.4 U | 64.4 U | 64.4 U |
| 2110030-18 | Yakima R. | 10/20/2021 | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U |

| Sample ID | Study Location | Date | DHpP (ug/kg) | DBEP (ug/kg) | DNOP (ug/kg) | DEHP (ug/kg) | DINP* (ug/kg) | DIDP (ug/kg) | DEHA (ug/kg) | DEHAz (ug/kg) | TOTM (ug/kg) | TOC (%) | Percent Fines (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2110030-01 | L. Ozette | 10/7/2021 | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 133 UJ | 3.7 J | 89.28 |
| 2110030-02 | Mayfield L. | 10/8/2021 | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 66.8 UJ | 1.8 J | 93.94 |
| 2110030-03 | L. Col. R. | 10/8/2021 | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 31.8 UJ | 0.1 UJ | 0.09 |
| 2110030-04 | Spanaway L. | 10/11/2021 | 296 UJ | 296 UJ | 296 UJ | 374 UJ | **2,150 NJ** | 296 UJ | 296 UJ | 296 UJ | 296 UJ | 13.9 J | 76.92 |
| 2110030-07 | L. Sammamish | 10/11/2021 | 149 UJ | 149 UJ | 149 UJ | 156 UJ | 149 UJ | 149 UJ | 149 UJ | 149 UJ | 149 UJ | 6.01 J | 93.55 |
| 2110030-08 | L. Stevens | 10/12/2021 | 209 UJ | 209 UJ | 209 UJ | 325 UJ | **1,120 NJ** | 209 UJ | 209 UJ | 209 UJ | 209 UJ | 11.9 J | 79.9 |
| 2110030-10 | Snohomish R. | 10/12/2021 | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 38.3 U | 0.95 J | 24.54 |
| 2110030-11 | Potholes Res. | 10/19/2021 | 97 U | 97 U | 97 U | 97 U | 97 U | 97 U | 97 U | 97 U | 97 U | 2.64 | 92.05 |
| 2110030-12 | W. Med. L. | 10/19/2021 | 131 U | 131 U | 131 U | 131 U | 131 U | 131 U | 131 U | 131 U | 131 U | 7.12 | 95.43 |
| 2110030-14 | Newman L. | 10/19/2021 | 217 U | 217 U | 217 U | 217 U | 217 U | 217 U | 217 U | 217 U | 217 U | 8.85 | 91.95 |
| 2110030-15 | S.F. Palouse R. | 10/20/2021 | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 42.9 U | 2.54 | 35.79 |
| 2110030-17 | Mid Col. R. | 10/21/2021 | 64.4 U | 64.4 U | 64.4 U | 109 U | 64.4 U | 64.4 U | **129** | 64.4 U | 64.4 U | 1.89 | 87.3 |
| 2110030-18 | Yakima R. | 10/20/2021 | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | 45.6 U | --- | --- |

*DINP (unbranched isomers)

Full compounds names are included in Appendix A.

U: Compound not detected at or above reported value.

UJ: Compound not detected at or above estimated value.

NJ: Compound was tentatively identified and the result is an estimated value.

Detected values are bolded and highlighted in green.

## Table B-7. Analytical Results in Freshwater Suspended Particulate Matter Samples.

| Sample ID | Study Location | Date | DMP (ug/kg) | DEP (ug/kg) | DAP (ug/kg) | DiBP (ug/kg) | DnBP (ug/kg) | DMEP (ug/kg) | DPP (ug/kg) | BBP (ug/kg) | DcHP (ug/kg) | DHP (ug/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2112036-01 | Puyallup R. | 12/6/2021 | 32.1 U | 32.1 U | 32.1 U | 32.1 U | 32.1 U | 32.1 UJ | 32.1 U | 32.1 U | 32.1 U | 32.1 U |
| 2112036-03 | Skagit R. | 12/9/2021 | 39.4 U | 39.4 U | 39.4 U | 39.4 U | 39.4 U | 39.4 UJ | 39.4 U | 39.4 U | 39.4 U | 39.4 U |
| 2112036-02 | Snohomish R. | 12/8/2021 | 40.5 U | 40.5 U | 40.5 U | 40.5 U | 40.5 U | 40.5 UJ | 40.5 U | 40.5 U | 40.5 U | 40.5 U |

| Sample ID | Study Location | Date | DHpP (ug/kg) | DBEP (ug/kg) | DNOP (ug/kg) | DEHP (ug/kg) | DINP* (ug/kg) | DIDP (ug/kg) | DEHA (ug/kg) | DEHAz (ug/kg) | TOTM (ug/kg) | TOC (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2112036-01 | Puyallup R. | 12/6/2021 | 32.1 U | 32.1 U | 32.1 U | **156** | 32.1 U | 32.1 U | 32.1 U | 32.1 U | 32.1 U | 0.37 |
| 2112036-03 | Skagit R. | 12/9/2021 | 39.4 U | 39.4 U | 39.4 U | **64.2** | 39.4 U | 39.4 U | 39.4 U | 39.4 U | 39.4 U | 1.04 |
| 2112036-02 | Snohomish R. | 12/8/2021 | 40.5 U | 40.5 U | 40.5 U | **152** | 40.5 U | 40.5 U | 40.5 U | 40.5 U | 40.5 U | 1.31 |

*DINP (unbranched isomers)

Full compounds names are included in Appendix A.

U: Compound not detected at or above reported value.

Detected values are bolded and highlighted in green.

## Table B-8. Analytical Results in Marine Sediment Samples.

| Sample ID | Study Location ID | Study Location | Date | DMP (ug/kg) | DEP (ug/kg) | DAP (ug/kg) | DiBP (ug/kg) | DnBP (ug/kg) | DMEP (ug/kg) | DPP (ug/kg) | BBP (ug/kg) | DcHP (ug/kg) | DHP (ug/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2104029-01 | 13 | North Hood Canal | 4/27/2021 | 31.1 U | 31.1 U | 31.1 U | 31.1 U | 31.1 U | 31.1 UJ | 31.1 U | 31.1 U | 31.1 U | 31.1 U |
| 2104029-02 | 3 | Strait of Georgia | 4/20/2021 | 53.2 U | 53.2 U | 53.2 U | 53.2 U | 53.2 U | 53.2 UJ | 53.2 U | 53.2 U | 53.2 U | 53.2 U |
| 2104029-03 | 29 | Shilshole | 4/16/2021 | 62.2 U | 62.2 U | 62.2 U | 62.2 U | 62.2 U | 62.2 UJ | 62.2 U | 62.2 U | 62.2 U | 62.2 U |
| 2104029-04 | 40021 | Crescent Harbor | 4/21/2021 | 59.8 U | 59.8 U | 59.8 U | 59.8 U | 59.8 U | 59.8 UJ | 59.8 U | 59.8 U | 59.8 U | 59.8 U |
| 2104029-05 | 38 | Point Pully | 4/6/2021 | 74.8 U | 74.8 U | 74.8 U | 74.8 U | 74.8 U | 74.8 UJ | 74.8 U | 74.8 U | 74.8 U | 74.8 U |
| 2104029-06 | 40022 | Brownsville | 4/15/2021 | 86 U | 86 U | 86 U | 86 U | 86 U | 86 UJ | 86 U | 86 U | 86 U | 86 U |
| 2104029-07 | 40025 | West Sound | 4/19/2021 | 55.7 U | 55.7 U | 55.7 U | 55.7 U | 55.7 U | 55.7 UJ | 55.7 U | 55.7 U | 55.7 U | 55.7 U |
| 2104029-08 | 40026 | Dabob Bay | 4/14/2021 | 93 U | 93 U | 93 U | 93 U | 93 U | 93 UJ | 93 U | 93 U | 93 U | 93 U |
| 2104029-09 | 40027 | Admiralty Inlet | 4/26/2021 | 32.4 U | 32.4 U | 32.4 U | 32.4 U | 32.4 U | 32.4 UJ | 32.4 U | 32.4 U | 32.4 U | 32.4 U |
| 2104029-10 | 40028 | Totten Inlet | 4/5/2021 | 73.7 U | 73.7 U | 73.7 U | 73.7 U | 73.7 U | 73.7 UJ | 73.7 U | 73.7 U | 73.7 U | 73.7 U |
| 2104029-11 | 40029 | North Samish Bay | 4/19/2021 | 51.1 U | 51.1 U | 51.1 U | 51.1 U | 51.1 U | 51.1 UJ | 51.1 U | 51.1 U | 51.1 U | 51.1 U |
| 2104029-12 | 40030 | Sinclair Inlet | 4/15/2021 | 87.5 U | 87.5 U | 87.5 U | 87.5 U | 87.5 U | 87.5 UJ | 87.5 U | 87.5 U | 87.5 U | 87.5 U |
| 2104029-14 | 40032 | Inner Case Inlet | 4/7/2021 | 36.8 U | 36.8 U | 36.8 U | 36.8 U | 36.8 U | 36.8 UJ | 36.8 U | 36.8 U | 36.8 U | 36.8 U |
| 2104029-15 | 40034 | Kilisut Harbor | 4/27/2021 | 30.1 U | 30.1 U | 30.1 U | 30.1 U | 30.1 U | 30.1 UJ | 30.1 U | 30.1 U | 30.1 U | 30.1 U |
| 2104029-16 | 40036 | Des Moines | 4/6/2021 | 31.4 U | 31.4 U | 31.4 U | 31.4 U | 31.4 U | 31.4 UJ | 31.4 U | 31.4 U | 31.4 U | 31.4 U |
| 2104029-17 | 40037 | Saratoga Passage | 4/21/2021 | 71.2 U | 71.2 U | 71.2 U | 71.2 U | 71.2 U | 71.2 UJ | 71.2 U | 71.2 U | 71.2 U | 71.2 U |
| 2104029-18 | 40038 | North Central Basin | 4/15/2021 | 56.6 U | 56.6 U | 56.6 U | 56.6 U | 56.6 U | 56.6 UJ | 56.6 U | 56.6 U | 56.6 U | 56.6 U |
| 2104029-19 | 44 | E. Anderson Island | 4/8/2021 | 33 U | 33 U | 33 U | 33 U | 33 U | 33 UJ | 33 U | 33 U | 33 U | 33 U |
| 2104029-20 | 49 | Inner Budd Inlet | 4/5/2021 | 65.3 U | 65.3 U | 65.3 U | 65.3 U | 65.3 U | 65.3 UJ | 65.3 U | 65.3 U | 65.3 U | 65.3 U |
| 2104029-21 | 4 | Bellingham Bay | 4/19/2021 | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U |
| 2104029-22 | 40013 | Reads Bay | 4/20/2021 | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U |
| 2106023-05 | 174 | Elliott Bay | 6/8/2021 | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U |
| 2106023-11 | 180 | Elliott Bay | 6/8/2021 | 31.7 U | 31.7 U | 31.7 U | 31.7 U | 31.7 U | 31.7 U | 31.7 U | 31.7 U | 31.7 U | 31.7 U |
| 2106023-12 | 181 | Elliott Bay | 6/9/2021 | 37.1 U | 37.1 U | 37.1 U | 37.1 U | 37.1 U | 37.1 U | 37.1 U | 37.1 U | 37.1 U | 37.1 U |
| 2106023-14 | 182 | Elliott Bay | 6/7/2021 | 42.7 U | 42.7 U | 42.7 U | 42.7 U | 42.7 U | 42.7 U | 42.7 U | 42.7 U | **66.5** | 42.7 U |
| 2106023-23 | 190 | Elliott Bay | 6/9/2021 | 32 U | 32 U | 32 U | 32 U | 32 U | 32 U | 32 U | 32 U | 32 U | 32 U |
| 2106023-27 | 194 | Elliott Bay | 6/8/2021 | 58.7 U | 58.7 U | 58.7 U | 58.7 U | 58.7 U | 58.7 U | 58.7 U | 58.7 U | 58.7 U | 58.7 U |
| 2106023-29 | 196 | Elliott Bay | 6/7/2021 | 47.4 U | 47.4 U | 47.4 U | 47.4 U | 47.4 U | 47.4 U | 47.4 U | 47.4 U | 47.4 U | 47.4 U |
| 2106023-38 | 204 | Elliott Bay | 6/15/2021 | 42.3 U | 42.3 U | 42.3 U | 42.3 U | 42.3 U | 42.3 U | 42.3 U | **86.2 NJ** | 42.3 U | 42.3 U |
| 2106023-39 | 205 | Elliott Bay | 6/15/2021 | 46.8 U | 46.8 U | 46.8 U | 46.8 U | 46.8 U | 46.8 U | 46.8 U | 46.8 U | 46.8 U | 46.8 U |
| 2106023-40 | 40396 | Elliott Bay | 6/14/2021 | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U |

Full compounds names are included in Appendix A.

U: Compound not detected at or above reported value.

UJ: Compound not detected at or above estimated value.

NJ: Compound was tentatively identified and the result is an estimated value.

Detected values are bolded and highlighted in green

## Table B-9. Analytical Results in Marine Sediment Samples.

| Sample ID | Study Location ID | Study Location | Date | DHpP (ug/kg) | DBEP (ug/kg) | DNOP (ug/kg) | DEHP (ug/kg) | DINP* (ug/kg) | DIDP (ug/kg) | DEHA (ug/kg) | DEHAz (ug/kg) | TOTM (ug/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2104029-01 | 13 | North Hood Canal | 4/27/2021 | 31.1 U | 31.1 U | 31.1 U | 31.1 U | 31.1 U | 31.1 U | 31.1 U | 31.1 U | 31.1 U |
| 2104029-02 | 3 | Strait of Georgia | 4/20/2021 | 53.2 U | 53.2 U | 53.2 U | 53.2 U | 53.2 U | 53.2 U | 53.2 U | 53.2 U | 53.2 U |
| 2104029-03 | 29 | Shilshole | 4/16/2021 | 62.2 U | 62.2 U | 62.2 U | 66 U | 62.2 U | 62.2 U | 62.2 U | 62.2 U | 62.2 U |
| 2104029-04 | 40021 | Crescent Harbor | 4/21/2021 | 59.8 U | 59.8 U | 59.8 U | 59.8 U | 59.8 U | 59.8 U | 59.8 U | 59.8 U | 59.8 U |
| 2104029-05 | 38 | Point Pully | 4/6/2021 | 74.8 U | 74.8 U | 74.8 U | 74.8 U | 74.8 U | 74.8 U | 74.8 U | 74.8 U | 74.8 U |
| 2104029-06 | 40022 | Brownsville | 4/15/2021 | 86 U | 86 U | 86 U | 86 U | 86 U | 86 U | 86 U | 86 U | 86 U |
| 2104029-07 | 40025 | West Sound | 4/19/2021 | 55.7 U | 55.7 U | 55.7 U | 55.7 U | 55.7 U | 55.7 U | 55.7 U | 55.7 U | 55.7 U |
| 2104029-08 | 40026 | Dabob Bay | 4/14/2021 | 93 U | 93 U | 93 U | 93 U | 93 U | 93 U | 93 U | 93 U | 93 U |
| 2104029-09 | 40027 | Admiralty Inlet | 4/26/2021 | 32.4 U | 32.4 U | 32.4 U | 32.4 U | 32.4 U | 32.4 U | 32.4 U | 32.4 U | 32.4 U |
| 2104029-10 | 40028 | Totten Inlet | 4/5/2021 | 73.7 U | 73.7 U | 73.7 U | 73.7 U | 73.7 U | 73.7 U | 73.7 U | 73.7 U | 73.7 U |
| 2104029-11 | 40029 | North Samish Bay | 4/19/2021 | 51.1 U | 51.1 U | 51.1 U | **90.2** | 51.1 U | 51.1 U | 51.1 U | 51.1 U | 51.1 U |
| 2104029-12 | 40030 | Sinclair Inlet | 4/15/2021 | 87.5 U | 87.5 U | 87.5 U | 89.4 U | 87.5 U | 87.5 U | 87.5 U | 87.5 U | 87.5 U |
| 2104029-14 | 40032 | Inner Case Inlet | 4/7/2021 | 36.8 U | 36.8 U | 36.8 U | 36.8 U | 36.8 U | 36.8 U | 36.8 U | 36.8 U | 36.8 U |
| 2104029-15 | 40034 | Kilisut Harbor | 4/27/2021 | 30.1 U | 30.1 U | 30.1 U | 30.1 U | 30.1 U | 30.1 U | 30.1 U | 30.1 U | 30.1 U |
| 2104029-16 | 40036 | Des Moines | 4/6/2021 | 31.4 U | 31.4 U | 31.4 U | 31.4 U | 31.4 U | 31.4 U | 31.4 U | 31.4 U | 31.4 U |
| 2104029-17 | 40037 | Saratoga Passage | 4/21/2021 | 71.2 U | 71.2 U | 71.2 U | 71.2 U | 71.2 U | 71.2 U | 71.2 U | 71.2 U | 71.2 U |
| 2104029-18 | 40038 | North Central Basin | 4/15/2021 | 56.6 U | 56.6 U | 56.6 U | 56.6 U | 56.6 U | 56.6 U | 56.6 U | 56.6 U | 56.6 U |
| 2104029-19 | 44 | E. Anderson Island | 4/8/2021 | 33 U | 33 U | 33 U | 33.9 U | 33 U | 33 U | 33 U | 33 U | 33 U |
| 2104029-20 | 49 | Inner Budd Inlet | 4/5/2021 | 65.3 U | 65.3 U | 65.3 U | 65.3 U | 65.3 U | 65.3 U | 65.3 U | 65.3 U | 65.3 U |
| 2104029-21 | 4 | Bellingham Bay | 4/19/2021 | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U | 67.8 U |
| 2104029-22 | 40013 | Reads Bay | 4/20/2021 | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U | 39.8 U |
| 2106023-05 | 174 | Elliott Bay | 6/8/2021 | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U | 31.3 U |
| 2106023-11 | 180 | Elliott Bay | 6/8/2021 | 31.7 U | 31.7 U | 31.7 U | **49.6** | **608 NJ** | 31.7 U | 31.7 U | 31.7 U | 31.7 U |
| 2106023-12 | 181 | Elliott Bay | 6/9/2021 | 37.1 U | 37.1 U | 37.1 U | **80.4** | 37.1 U | 37.1 U | 37.1 U | 37.1 U | 37.1 U |
| 2106023-14 | 182 | Elliott Bay | 6/7/2021 | 42.7 U | 42.7 U | 42.7 U | **96.9** | 42.7 U | 42.7 U | 42.7 U | 42.7 U | 42.7 U |
| 2106023-23 | 190 | Elliott Bay | 6/9/2021 | 32 U | 32 U | 32 U | 32 U | 32 U | 32 U | 32 U | 32 U | 32 U |
| 2106023-27 | 194 | Elliott Bay | 6/8/2021 | 58.7 U | 58.7 U | 58.7 U | 73.6 U | 58.7 U | 58.7 U | 58.7 U | 58.7 U | 58.7 U |
| 2106023-29 | 196 | Elliott Bay | 6/7/2021 | 47.4 U | 47.4 U | 47.4 U | **85** | 47.4 U | 47.4 U | 47.4 U | 47.4 U | 47.4 U |
| 2106023-38 | 204 | Elliott Bay | 6/15/2021 | 42.3 U | 42.3 U | 42.3 U | **217** | **698 NJ** | 42.3 U | 42.3 U | 42.3 U | 42.3 U |
| 2106023-39 | 205 | Elliott Bay | 6/15/2021 | 46.8 U | 46.8 U | 46.8 U | **153** | **601 NJ** | 46.8 U | 46.8 U | 46.8 U | 46.8 U |
| 2106023-40 | 40396 | Elliott Bay | 6/14/2021 | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U | 30.3 U |

*DINP (unbranched isomers)

Full compounds names are included in Appendix A.

U: Compound not detected at or above reported value.

NJ: Compound was tentatively identified and the result is an estimated value.

Detected values are bolded and highlighted in green.