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Evaluation of Larval Pacific Lamprey Occupancy in Portland Harbor Superfund Area Restoration Sites: Rinearson Natural Area

2015 Annual Report

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Abstract –Within and around the Portland Harbor Superfund site on the Willamette River, habitat restoration actions focused on juvenile salmonids including Chinook salmon *Oncorhynchus tshawytscha* are being implemented which may also have effects on co-occurring Pacific lamprey *Entosphenus tridentatus*. Use of restored habitats by lampreys, particularly the larval life stage has not been extensively studied. As such, there is interest in monitoring the effectiveness of the restoration, in part, relative to larval Pacific lamprey as well as learning more about larval lamprey habitat preferences and use of different habitats. Determining the effects of restoration actions on Pacific lamprey requires evaluation of lamprey occurrence before and after project implementations. We evaluated occupancy, detection, and habitat use of larval Pacific lamprey and *Lampetra* spp. at confluence habitats (within the Willamette River mainstem) as well as within tributary habitats at the Rinearson Natural Area restoration site and a reference site, Cemetery Creek. A generalized random-tessellation stratified (GRTS) approach was used to delineate sample units, quadrats (30 m x 30 m square) within mainstem confluence areas and sample reaches (50 m long) within tributary habitats, in a random, spatially balanced order. Mainstem quadrats and tributary reaches were sampled for larvae by electrofishing. Both the Rinearson Natural Area restoration site and the Cemetery Creek reference site were occupied by larval Pacific lamprey. At the Rinearson Restoration site, larval lampreys were detected in 3 of 10 confluence quadrats sampled in the Willamette River, and one of seven tributary reaches sampled in Rinearson Creek. Detection probabilities at the Rinearson Natural Area were $d = 0.3$ in confluence quadrats and $d = 0.14$ in tributary reaches. At the Cemetery Creek reference site larval lampreys were detected in 5 of 10 confluence quadrats sampled, and zero of two tributary reaches sampled. Detection probabilities at the reference site were $d = 0.5$ in confluence quadrats and $d = 0$ in tributary reaches. Although larval Pacific lampreys were detected within a tributary reach in Rinearson Creek, the detection occurred approximately 30 m from the confluence with the Willamette River in habitat that appeared to be influenced by backwater from the Willamette River. Thus, it is likely the larvae collected in Rinearson Creek had washed in from the Willamette River and were not produced within Rinearson Creek. This information will serve as a baseline for monitoring and evaluation of larval lamprey occupancy in the Rinearson Natural Area pre- and post- habitat restoration actions at the site.

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Introduction

Pacific lamprey *Entosphenus tridentatus* in the Columbia River Basin (CRB) and other areas have experienced a great decline in abundance (Close et al. 2002) and have been given protected status within Oregon (Kostow 2002). Lamprey are culturally important to Native American tribes, are ecologically important within the food web, and are an indicator species whose decline provides further insight into the impact of human actions on ecological function (Close et al. 2002). Much information is lacking on the basic biology, ecology, and population dynamics that is required for effective conservation and management.

Pacific lampreys have a complex life history that includes a multiple year larval (ammocoete), migratory juvenile (macrophthalmia), and adult marine phase (Scott and Crossman 1973). Larvae and juveniles are strongly associated with stream and river sediments. Larvae live burrowed in stream and river sediments for multiple years after hatching, where they filter feed detritus and organic material (Sutton and Bowen 1994). Larvae metamorphose into juveniles from July to December (McGree et al. 2008) and major migrations are made downstream to the Pacific Ocean in the spring and fall (Beamish and Levings 1991). The sympatric western brook lamprey *Lampetra richardsoni* does not have a major migratory or marine life stage although adults may locally migrate upstream before spawning (Renaud 1997). For both species, the majority of the information on distribution and habitat preference of larvae comes from CRB tributary systems (Moser and Close 2003; Torgersen and Close 2004; Stone and Barndt 2005; Stone 2006) and coastal basins (Farlinger and Beamish 1984; Russell et al. 1987; Gunckel et al. 2009).

Larval lamprey are known to occur in sediments of low-gradient streams (<5th order [1:100,000 scale]; Torgersen and Close 2004) but their use of larger river habitats in relatively deeper areas is less known. Downstream movement of larvae, whether passive or active, occurs year-round (Nursall and Buchwald 1972; Gadomski and Barfoot 1998; White and Harvey 2003). Sea lamprey *Petromyzon marinus* ammocoetes have been documented in deepwater habitats in tributaries of the Great Lakes, within the lakes in proximity to river mouths (Hansen and Hayne 1962; Wagner and Stauffer 1962; Lee and Weise 1989; Bergstedt and Genovese 1994; Fodale et al. 2003), and in the large, connecting St. Marys River (Young et al. 1996). However, references to other species occurring in deepwater or lacustrine habitats are scarce (American brook lamprey *L. appendix*; Hansen and Hayne 1962). In the Pacific Northwest, observations of larval lamprey occurrence in large rivers have been made, for example during smolt monitoring operations at Columbia River hydropower facilities, impinged on screens associated with juvenile bypass systems (Moursund et al. 2003; CRITFC 2008), or through observation during dewatering events. Specific collections of ammocoetes have been made in large river habitats in British Columbia which are thought to be representative of downstream migrating ammocoetes (Beamish and Youson 1987; Beamish and Levings 1991). More recently, evaluations of larval Pacific lamprey occupancy and distribution in mainstem river habitats have suggested widespread occurrence in certain areas of the Columbia River and Willamette River mainstem (Jolley et al. 2012; Jolley et al. 2013, Jolley et al. 2014)

A portion of the mainstem of the lower Willamette River that is known to be occupied by larval Pacific and western brook lamprey (Jolley et al. 2012) was declared a Superfund Site in 2000 by the U.S. Environmental Protection Agency. The Superfund study area extends from river kilometer 3.2 to river kilometer 18.9 and has a broader focus area extending from the

Columbia River to Willamette Falls (Figure 1). To mitigate for past environmental damage being identified through the Natural Resource Damage Assessment (NRDA) process, this area is subject to various restoration activities as well as assessments of the effectiveness of any restoration. Presently, aquatic restoration projects are focused on restoring juvenile Chinook salmon *Oncorhynchus tshawytscha* habitat. It is unclear whether any of the restoration activities will provide additional benefits to other co-occurring species including larval and juvenile Pacific lamprey that may likewise occur in these areas. However, these activities provide an opportunity to understand the potential effects of habitat restoration on larval and juvenile lampreys. As such, there is interest in monitoring the effectiveness of the restoration, in part, relative to larval Pacific lamprey.

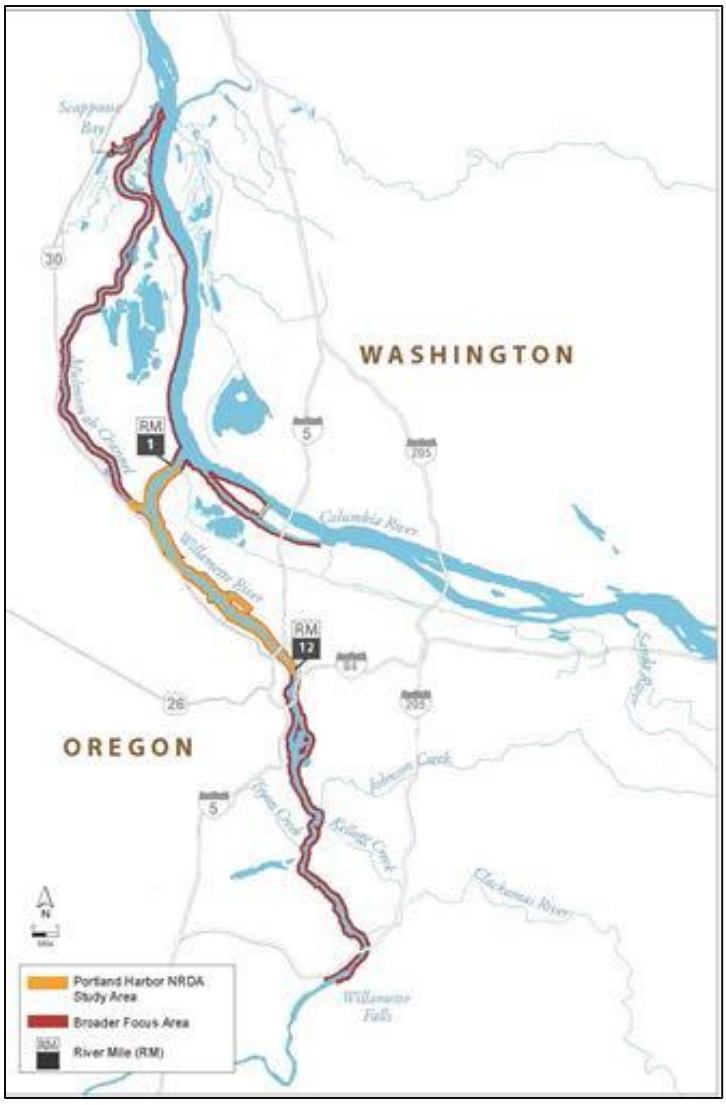

Figure 1. Portland Harbor Superfund study area (orange outline) and the broader focus area (red outline) on the lower Willamette River.

A lamprey monitoring plan (LMP) for restoration projects in the Portland Harbor Superfund area was developed based on a set of monitoring goals and objectives that were identified by the Trustee Council and lamprey biologists over two workshops held in the fall of 2011. The LMP priorities included (i.) monitoring the impact of restoration actions on larval and juvenile lamprey populations and health in Portland Harbor, and (ii.) gathering information about larval and juvenile lamprey life history, biology, and habitat requirements that could be used by the Trustee Council to inform future design and evaluation of lamprey restoration projects. Since lamprey biology and life history are different from other aquatic biota, the overlap between the LMP and the general restoration monitoring and stewardship plan is not extensive. The LMP differs from the general restoration monitoring and stewardship plan, in part, because the lamprey monitoring is proposed to continue for a period of 20 years. In most cases, the metrics proposed for collection as part of the lamprey monitoring effort need to be co-located with lamprey sampling. To maximize efficiencies, the Trustee Council will, to the extent possible, use data collected as part of the LMP for general restoration monitoring and stewardship. Biologists recommended monitoring lamprey for 20 years, with the goal of capturing data for 1 to 2 complete

generations. Pre-implementation monitoring will be conducted to the extent practical at each restoration site. Lampreys are expected to colonize habitats rapidly. Therefore, monitoring will be conducted on a yearly basis for the first five years, and every five years thereafter. In general, the proposed work is guided by the LMP. However, due to site specific conditions and constraints, the specific metrics and timing of monitoring proposed for any given site may differ slightly from those outlined in the LMP.

In 2015, we began to investigate and document patterns of larval lamprey occupancy, distribution, and habitat use in or near the Rinearson Natural Area restoration site on the lower Willamette River. Understanding larval lamprey usage of habitats in and adjacent to restoration sites is critical to gauging the effectiveness of restoration activities. At present, little specific information is available on whether lampreys colonize restored habitats, which life stages may use these habitats, or how quickly and for how long they use these habitats. A before-after control-impact (BACI) approach will be used to evaluate the effectiveness of restoration activities, as that allows us to make inferences about whether changes in lamprey occupancy observed at the restoration site are the result of the restoration actions. Thus, we propose to determine whether larval Pacific lamprey occupy restoration sites and reference sites both prior to and after restoration actions. Our specific objectives for this phase of NRDA restoration monitoring are as follows:

1. Determine whether lampreys occupy the Rinearson Natural Area restoration site and the Cemetery Creek reference site.
2. Determine the types of habitat available at each site and in which habitat types lamprey are detected.
3. Characterize lamprey species and life history stage that occupy each site.
4. Evaluate the health of lamprey detected at each site.

Study Sites

Restoration Site

Rinearson Creek flows through the Rinearson Natural Area restoration site (Clackamas County, OR) and enters the Willamette River from the east, just downstream of the mouth of the Clackamas River (river km 39; Figure 2). Currently the site has tributary or slough habitat that drains into the Willamette River, as well as associated confluence habitat in the mainstem Willamette River. Larval lamprey are known to occur in the mainstem of the Willamette River in this region (Jolley et al. 2012), and have access to and the potential to occur in proposed restoration areas in Rinearson Creek and confluence habitats in the mainstem Willamette River. Pre-restoration monitoring consisted of sampling for larval lamprey in tributary or slough reaches in Rinearson Creek as well as confluence habitats in the mainstem Willamette River.

Reference Site

Cemetery Creek (Multnomah County, OR) was selected as a reference site because it is similar in size and located in proximity to the Rinearson Natural Area restoration site. Cemetery Creek enters the Willamette River from the west, upstream of Ross Island (river km 27; Figure

2). The Cemetery Creek reference site has tributary or slough habitat that drains into the Willamette River, as well as associated confluence habitat in the mainstem Willamette River. Larval lamprey are known to occur in the mainstem of the Willamette River in this region (Jolley et al. 2012), and have access to and the potential to occur in Cemetery Creek and confluence habitats in the mainstem Willamette River. Pre-restoration monitoring at the Cemetery Creek reference site consisted of sampling for larval lamprey in tributary or slough reaches in Cemetery Creek as well as confluence habitats in the mainstem Willamette River.

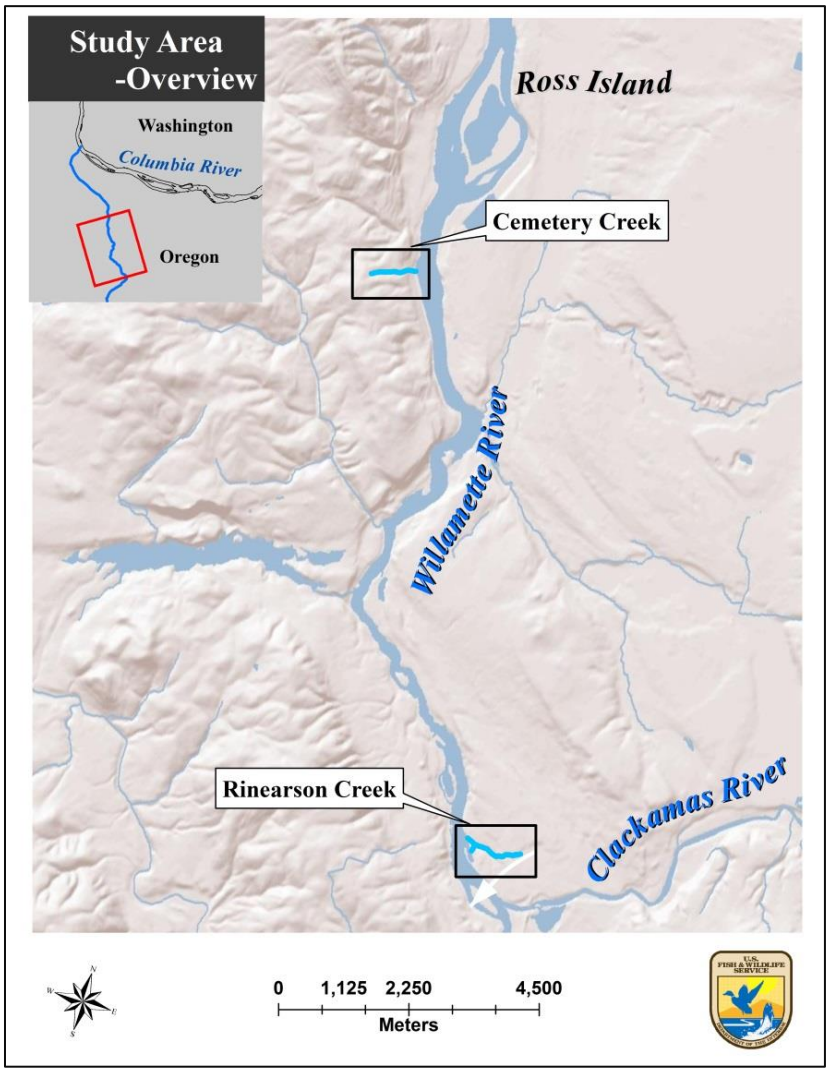

Figure 2. Locations of the Rinearson Natural Area restoration site and Cemetery Creek reference site along the lower Willamette River. Rinearson Creek (river km 39) enters the Willamette River just downstream of the Clackamas River confluence. Cemetery Creek (river km 27) enters the Willamette River just upstream of Ross Island near downtown Portland.

Methods

Sample Framework

We evaluated occupancy of larval lamprey in the restoration and reference sites by adapting an approach that has been applied previously to studies of larval lamprey occupancy in the Columbia River basin in both mainstem and tributary habitats (Silver et al. 2010; Jolley et al. 2012; Jolley et al. 2013; Jolley et al. 2014; USFWS unpublished data). The approach has several requirements: 1) a unit- and gear-specific detection probability (assumed or estimated); 2) the probability of presence (given no detection) at a predetermined acceptably low level; and 3) random identification of spatially balanced sample units that allow estimation of presence and refinement of detection probabilities. A unit-specific probability of detection, d_{unit}, was calculated as the proportion of sample quadrats or reaches in which larvae were captured. The posterior probability of area occupancy, given a larval lamprey was not detected, was estimated as:

$$(1)\ \mathrm{P}(F|C_o) = \frac{\mathrm{P}(C_o|F)\cdot\mathrm{P}(F)}{\mathrm{P}(C_o|F)\cdot\mathrm{P}(F) + \mathrm{P}(C_o|{\sim}F)\cdot\mathrm{P}({\sim}F)},$$

where P(F) is the prior probability of larval lamprey presence. Although in this case we knew the lower Willamette River was occupied with larval lamprey, a P(F) of 0.5 (uninformed) was used for future study design (i.e., P[$F|C_o$]) in areas where larval lamprey presence is unknown. P(~F), or 1 – P(F), is the prior probability of species absence, and P($C_o|F$), or 1 – d, is the probability of not detecting a species when it occurs (C_0 = no detection; Peterson and Dunham 2003). Random identification of spatially balanced sample units was achieved by using a generalized random-tessellation stratified (GRTS) approach to delineate sample units in an ordered, unbiased manner (Stevens and Olsen 2004). Patterns of occupancy by area were compared using the Fisher's Exact test for differences in detection probabilities. Significance levels were set at $\alpha = 0.05$

Confluence Area Methods

Confluence area quadrats at both the restoration and reference sites were delineated using the generalized random-tessellation stratified (GRTS) approach scripted in Program R (Stevens and Olsen 2004; Jolley et al. 2012; R Core Team, 2013). The GRTS method assigns a hierarchical order to quadrats which can be used as an unbiased method of ranking the priority of quadrats for sampling. Delineation of quadrats that are unbiased, randomly selected, and spatially balanced within a sample universe allows for calculation of unit-specific detection probabilities. In turn, unit-specific estimates of detection probability can be applied to determine sample effort necessary for achieving a desired level of certainty that an area is not occupied by lamprey when they are not detected. Here we proposed to use a sampling effort (number of sample quadrats) that we estimate would allow for at least 80% certainty that larval lampreys do not occupy at least 20% of a confluence area when they are not detected (see Bayley and Peterson 2001; Peterson and Dunham 2003). The amount of effort was based, in part, on estimates of quadrat-specific detection probabilities generated from previous work (Jolley et al. 2012). Sample effort was also dependent, in part, on total area. In the case of both the Rinearson Natural area restoration site and the Cemetery Creek reference site, this sample effort corresponded to

sampling of 10 confluence quadrats at each location.

Confluence quadrats at the restoration and reference sites were selected from a layer of quadrats delineated and overlaid on the lower Willamette River from Willamette Falls to the Columbia River in association with previous lamprey research in this region (Jolley et al. 2012). At each creek confluence area, a subset of quadrats from the lower Willamette River layer was filtered according to a 100 m semicircular buffer centered on the confluence of each creek and the Willamette River (Figure 3). Because Rinearson Creek forks into two distributary channels near its confluence with the Willamette River, the confluence quadrat selection process was duplicated at each of the two distinct confluence areas (Figure 3). The selection process resulted in a total of 34 quadrats at the Rinearson Creek confluence areas, of which the 10 lowest numbered quadrats as ordered by the GRTS method were assigned the highest priority for sampling. Given the two distinct confluence areas of Rinearson Creek, the sample effort of 10 quadrats was divided among the two locations, with five quadrats being sampled at each confluence area. At the Cemetery Creek confluence area, the selection process produced a total of 17 quadrats (Figure 3), of which the 10 lowest numbered quadrats as ordered by the GRTS method were assigned the highest priority for sampling.

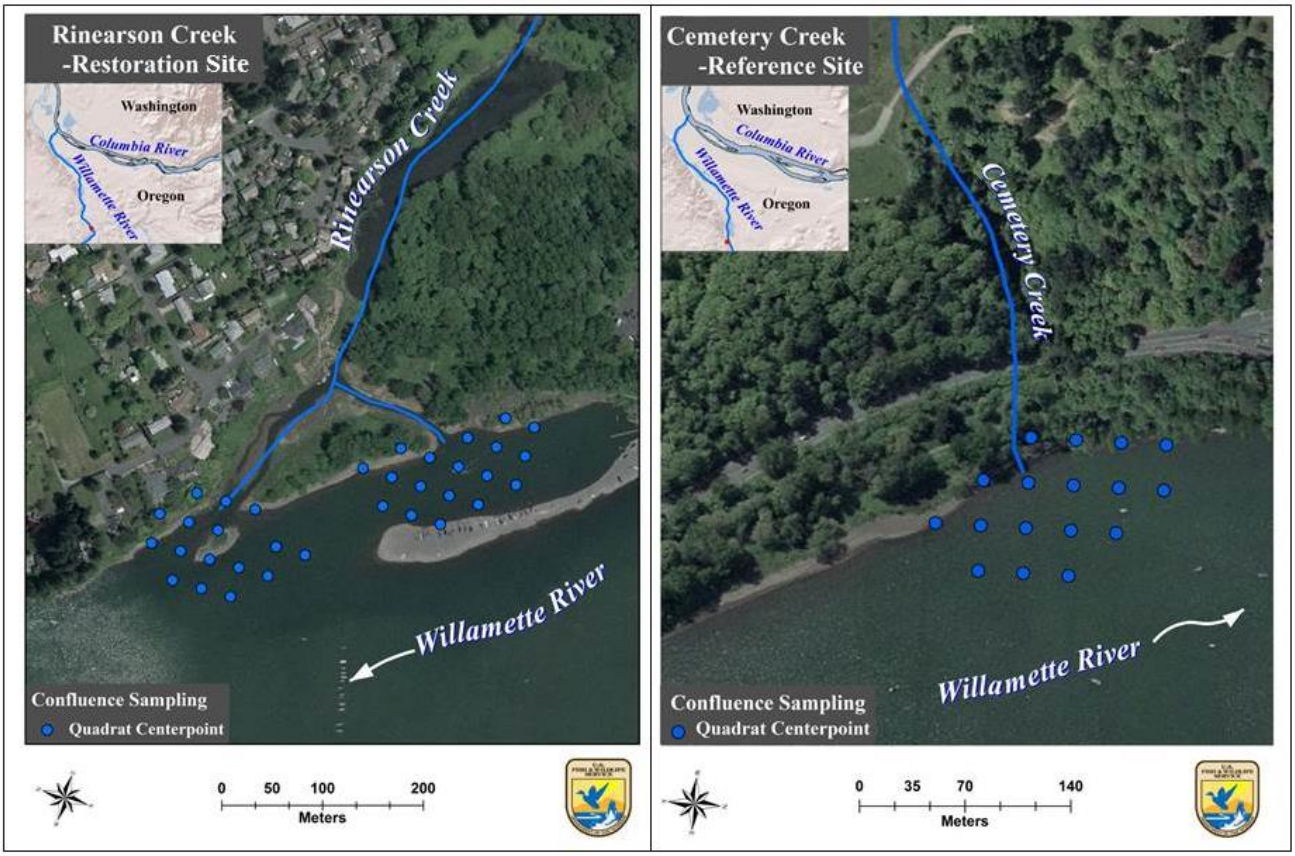

Figure 3. Sample quadrats (blue points represent quadrat center points) in confluence areas at the restoration and reference sites were selected within a 100 m semicircular radius centered on the intersection of Rinearson Creek (above left; river km 39) and Cemetery Creek (above right; river km 26) and the Willamette River. From the available quadrats, the 10 lowest numbered quadrats as ordered by the GRTS method at each tributary location were assigned the highest priority for sampling.

Each sampling event consisted of a single drop with deepwater electrofishing equipment within the 30 m by 30 m quadrat (Bergstedt and Genovese 1994; Jolley et al. 2012). Quadrats were accessed and sampled by boat, using quadrat center point Universal Transverse Mercator (UTM) coordinates for navigation. When quadrats could not be sampled due, for example, to dewatered conditions, depth less than 0.3 m, excessive velocity, or excessive depth (>21 m) they were eliminated and subsequent quadrats were increased in priority (Table 1). The deepwater electrofisher was comprised of a modified AbP-2 electrofisher (ETS Engineering, Verona, WI) which delivered electrical stimulus to river bottom substrates at electrodes mounted to a fiberglass bell (or hood; 0.61 m^2 in area). The electrofisher delivered three pulses DC per second at 10% duty cycle, with a 2:2 pulse train (i.e., two pulses on, two pulses off). Output voltage was adjusted at each quadrat to maintain a peak voltage gradient between 0.6 and 0.8 V/cm across the electrodes. The electrofisher bell was coupled by a 3" vinyl suction hose to a gasoline-fueled hydraulic pump. The hydraulic pump was started approximately 5 seconds prior to shocking to purge air from the suction hose. Suction was produced by directing flow from the pump through a hydraulic eductor, which allows larvae to be collected in a mesh basket (27 x 62 x 25 cm; 2 mm wire mesh) while preventing them from passing through the pump. A 60 second pulse delivery was followed by an additional 60 seconds of pumping to further allow displaced larvae to cycle through the hose and into the collection basket. The sampling techniques are described in detail by Bergstedt and Genovese (1994) and were similar to those used in the Great Lakes region (Fodale et al. 2003) and the Willamette River (Jolley et al. 2012).

Tributary/Slough Area Methods

Evaluation of larval lamprey occupancy of tributary habitats was conducted in Rinearson Creek at the restoration site and Cemetery Creek at the reference site. In Rinearson Creek, sampling occurred over an approximately 1200 m long segment of creek, spanning from the confluence with the Willamette River upstream to the crossing of River Road (Milwaukie, OR). In Cemetery Creek, the tributary area of interest was less than 400 m in length, spanning from the confluence with the Willamette River upstream approximately 300 m to a reach of very high gradient. Here we proposed to use a sampling effort (number of sample reaches) that would allow for at least 80% certainty that larval lampreys do not occupy at least 20% of a tributary area when they are not detected (see Bayley and Peterson 2001; Peterson and Dunham 2003). The amount of effort was based, in part, on estimates of reach-specific detection probabilities generated from previous work (Silver et al. 2010; USFWS unpublished data). Sample effort was also dependent, in part, on total area. At the restoration site, the area of interest in Rinearson Creek was longer than 400 m, thus we proposed to sample seven 50 m GRTS reaches in Rinearson Creek. At the reference site, the area of interest in Cemetery Creek was less than 400 m in length, thus we proposed to sample all viable reaches (contiguous 50 m reaches) in Cemetery Creek up to a total of 350 m (Figure 4).

Delineation of random spatially balanced 50 m sample reaches in Rinearson Creek was again accomplished using a generalized random-tessellation stratified (GRTS) approach scripted in Program R (Stevens and Olsen 2004; R Core Team 2013). The GRTS method assigns a hierarchical order to the reaches within the creek which is used as an unbiased method of ranking the priority of reaches for sampling. Delineation of sample reaches that are unbiased, randomly selected, and spatially balanced within a sample universe allows for calculation of unit-specific detection probabilities. In turn, unit-specific estimates of detection probability can be applied to determine sample effort necessary for achieving a desired level of certainty that a tributary is not

occupied by lamprey when they are not detected. In Rinearson Creek, sample reaches were delineated at a rate of one 50 m reach for every 50 m of stream. Thus, within the approximately 1200 m long study area in Rinearson Creek, 24 sample reaches were delineated, of which the lowest numbered seven reaches as ordered by the GRTS method were assigned the highest priority for sampling (Figure 4).

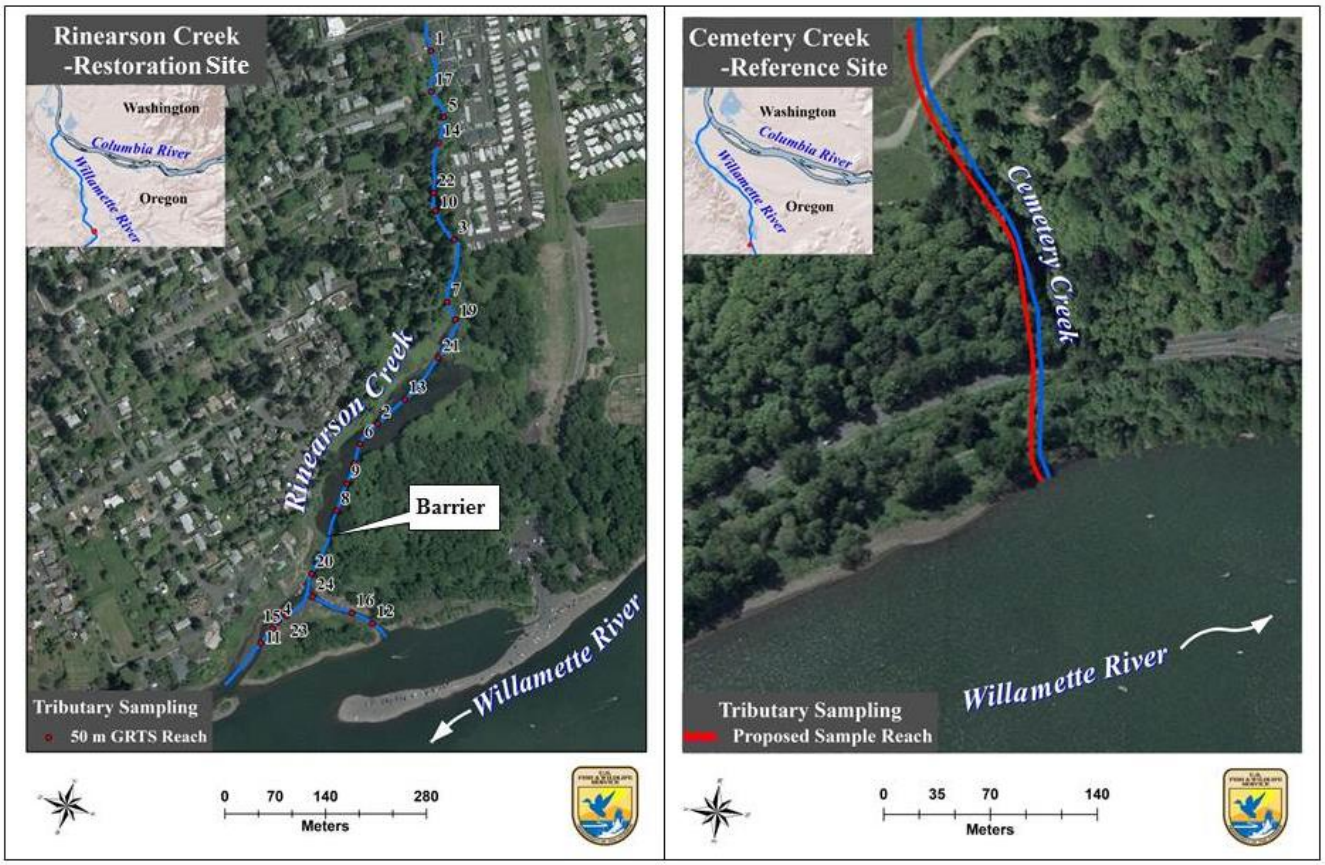

Figure 4. Tributary sample reaches (red points represent downstream reach boundary) in Rinearson Creek (above left) as delineated by the GRTS method. The lowest numbered seven reaches were assigned the highest priority for sampling. The tributary sample reach in Cemetery Creek (above right; red line) was less than 350 m and so the entire reach was proposed for sampling.

For tributary or slough (wadeable) areas, each sampling event consisted of electrofishing reaches for larval lamprey (Silver et al. 2010). Sample reaches were accessed on foot using GPS units loaded with sample reach UTMs for navigation. When a reach could not be sampled due, for example, to dewatered conditions, excessive depth (> 2 m), or lack of access due to private property, they were eliminated and subsequent reaches were increased in priority. Once a sample reach was accessed, a 50 m segment was measured and flagged. Water temperature and conductivity were recorded in each reach. The reach was electrofished using an AbP-2 backpack electrofisher. Power output settings for the AbP-2 were adapted from Weisser and Klar (1990). Initially, the electrofisher delivered three DC pulses per second at 25% duty cycle, 125 V, with a 3:1 burst pulse train (i.e., three pulses on, one pulse off). This current is designed to stimulate burrowed ammocoetes to enter the water column. Once a larva was observed in the water column, 30 pulses/second were applied to temporarily immobilize the larva for capture in a net.

We spent relatively more time within each reach electrofishing areas of preferred larval lamprey rearing habitat where depositional silt and sand substrates were dominant (henceforth Type I habitat, Slade et al. 2003). Relatively less time was spent electrofishing areas with hard bedrock and boulder substrates. All larval lamprey observed were captured and placed in buckets containing stream water.

Biological Data Collection

Collected lamprey were anesthetized in a solution of buffered tricaine methanesulfonate (MS-222), measured for total length (TL in mm; total weight was not measured), classified according to developmental stage (i.e., ammocoete, macrophthalmia, or adult), and when possible (i.e., larvae > 60 mm TL; Goodman et al. 2009) identified to genus (i.e., *Entosphenus* [Pacific lamprey] or *Lampetra* [western brook or river lamprey]) according to visual evaluations of caudal fin pigmentation patterns. Caudal fin tissue samples were also collected for potential future assignment of genus genetically (Spice et al. 2011; Docker et al. *in review*). Tissue samples are archived at the Columbia River Fisheries Program Office (CRFPO) pending funding availability for genetic identification. Upon resuming active swimming behavior, larvae were released near the area of capture. Physical anomalies (lesions, suspected bird strikes, tumors, etc.) were recorded for all larvae. If abnormalities were observed on a larva, the individual would be euthanized and preserved for potential evaluation at a later date. In addition, observations of juveniles, adults, or suspected Pacific lamprey nests were also recorded.

Habitat Data Collection

Confluence Areas

Concurrent to each sampling event a sediment sample was taken (when possible) from each quadrat with a Ponar bottom sampler (16.5 cm x 16.5 cm). Each sample was mixed thoroughly and approximately two, 250-500 ml subsamples were transferred to containers provided by a contracted laboratory. Samples were labeled with the site number, replicate number and date, placed on ice, returned to the USFWS office, and subsequently handled per the instructions provided from the contracted laboratory. Water temperature (°C), conductivity (μS/cm) and water depth were also measured at each quadrat. All confluence habitat variables are presented as mean (± s.e.) unless otherwise noted.

Tributary/Slough Areas

Sediment samples were collected from each 50 m sample reach. Samples were mixed thoroughly and approximately two, 250-500 ml subsamples were transferred to containers provided by a contracted laboratory. Each sample was labeled with the reach number, replicate number and date, placed on ice, returned to the USFWS office, and subsequently handled per the instructions provided from the contracted laboratory.

Within each sample reach, water temperature (°C) and conductivity (μS/cm) were measured, and visibility was qualitatively ranked as good, fair, or poor. The proportion (%) of Type 1 burrowing substrate within each reach was estimated. In general, larval lamprey habitats are classified as Type I, II, or III, and it is widely accepted that larvae appear to most prefer Type

I and least prefer Type III (see Slade et al. 2003). All tributary habitat variables are presented as mean (± s.e.) unless otherwise noted.

Results

Confluence Areas

We sampled 10 of 13 confluence quadrats visited at the Rinearson Natural Area restoration site and 10 of 10 confluence quadrats visited at the Cemetery Creek reference site (Table 1). The feasibility of being able to sample a quadrat in each location was 77% and 100%, respectively. Quadrats that were not sampled were omitted because they were not feasible (dewatered conditions). At Rinearson Natural Area, larval lampreys (n = 6) were detected in 3 of 10 confluence quadrats (d = 0.3; Figure 5). At Cemetery Creek, larval lampreys (n = 8) were detected in 5 of 10 confluence quadrats (d = 0.5; Figure 5). The total number of larvae occupying any individual quadrat ranged from 0 to 2; no other life stages were detected at either location. Detection probabilities (d) did not differ between Rinearson Natural Area and Cemetery Creek sample sites (Fisher's Exact Test; P = 0.65).

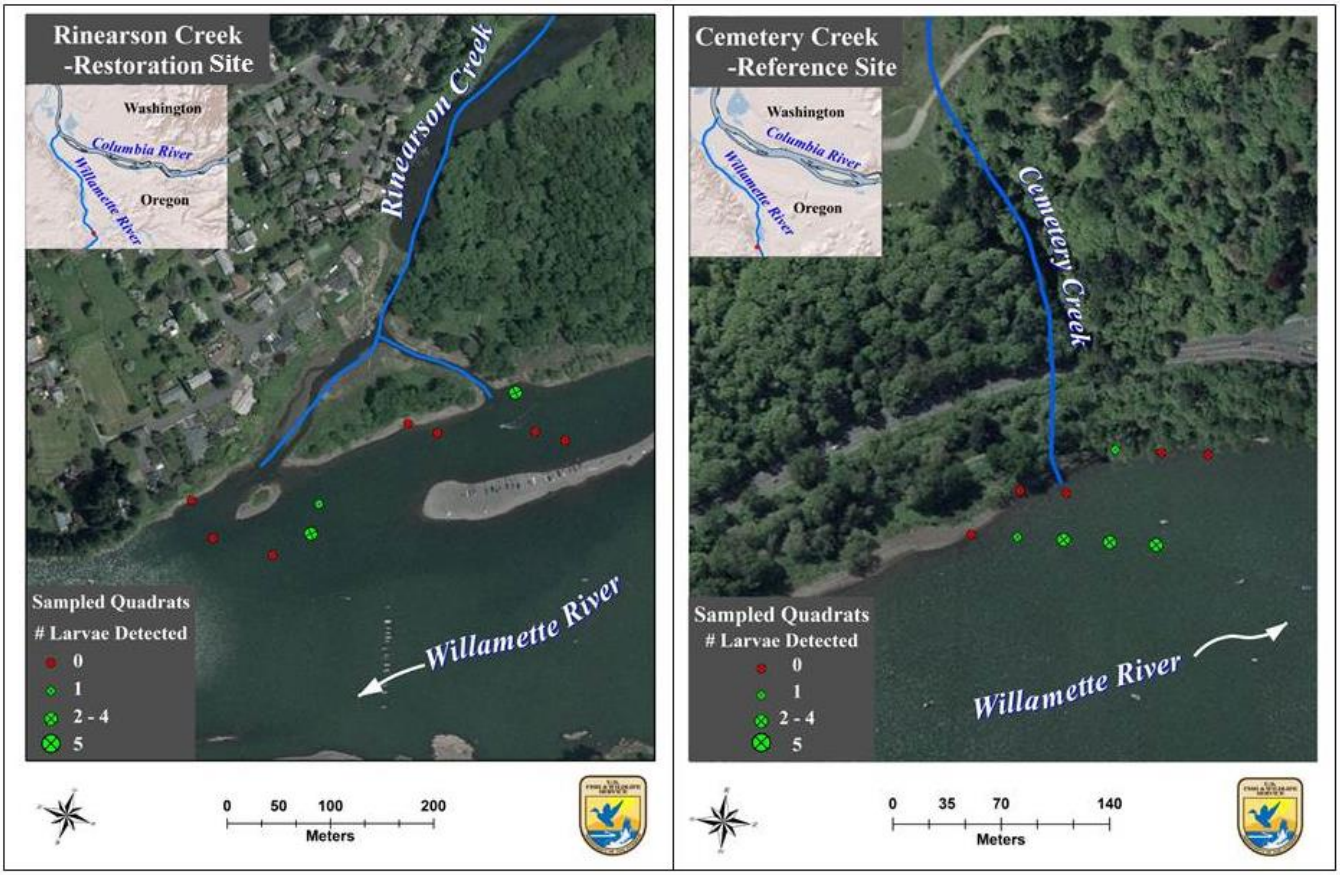

Figure 5. Larval lampreys were detected in 3 of 10 confluence quadrats sampled in the mainstem Willamette River at the Rinearson Natural Area restoration site (above left), and 5 of 10 confluence quadrats sampled at the Cemetery Creek reference site (above right). Green points represent quadrats where larvae were detected, while red points represent quadrats where larvae were not detected.

Of the six larvae collected at Rinearson Natural Area confluence quadrats, three were identified morphologically as Pacific lamprey, while three were too small to accurately identify visually (TL range 43 mm to 101 mm; Table 1; Figure 6). Of the eight larvae collected at Cemetery Creek confluence quadrats, two were identified morphologically as Pacific lamprey, while six larvae were too small to accurately identify visually (TL range 28 mm to 79 mm; Table 1; Figure 6). Larvae less than 40 mm TL are likely age-0 or age 1 while larger larvae are likely older, although definitive estimates of age based on size are difficult (Meeuwig and Bayer 2005). All collected larvae were in good condition and no visible external abnormalities were observed.

Table 1. Total number of quadrats delineated, visited, sampled, and occupied and larval species present in 2015. Unidentified lamprey are noted as "UNID".

		Quadrats								
Site	Date	Total	Visited	Sampled	Occupied	*d*	Pacific lamprey	*Lampetra* spp.	UNID	Total
Rinearson Confluence	14-May	34	13	10	3	0.3	3	0	3	6
Cemetery Confluence	27-May	17	10	10	5	0.5	2	0	6	8

At Rinearson Natural Area confluence quadrats, sample depths ranged from 0.6 m to 7.3 m, and larvae were detected in depths from 1.7 m to 7.3 m. At Cemetery Creek confluence quadrats, sample depths ranged from 0.2 m to 6.0 m, and larvae were detected in depths from 0.7 m to 6.0 m. At Rinearson Natural Area, water temperature was 16.6°C (± 0.7) and conductivity was 90.7 μS/cm (± 1.4). At Cemetery Creek, water temperature was 17.3°C (± 0.2) and conductivity was 95.7 μS /cm (± 0.1). Sediment samples collected at each confluence quadrat were transferred to ALS Environmental Laboratory (Kelso, WA) in May 2015 for quantification of parameters including grain size, grain type, and organic content. Results of sediment analyses are in Appendix 1 below.

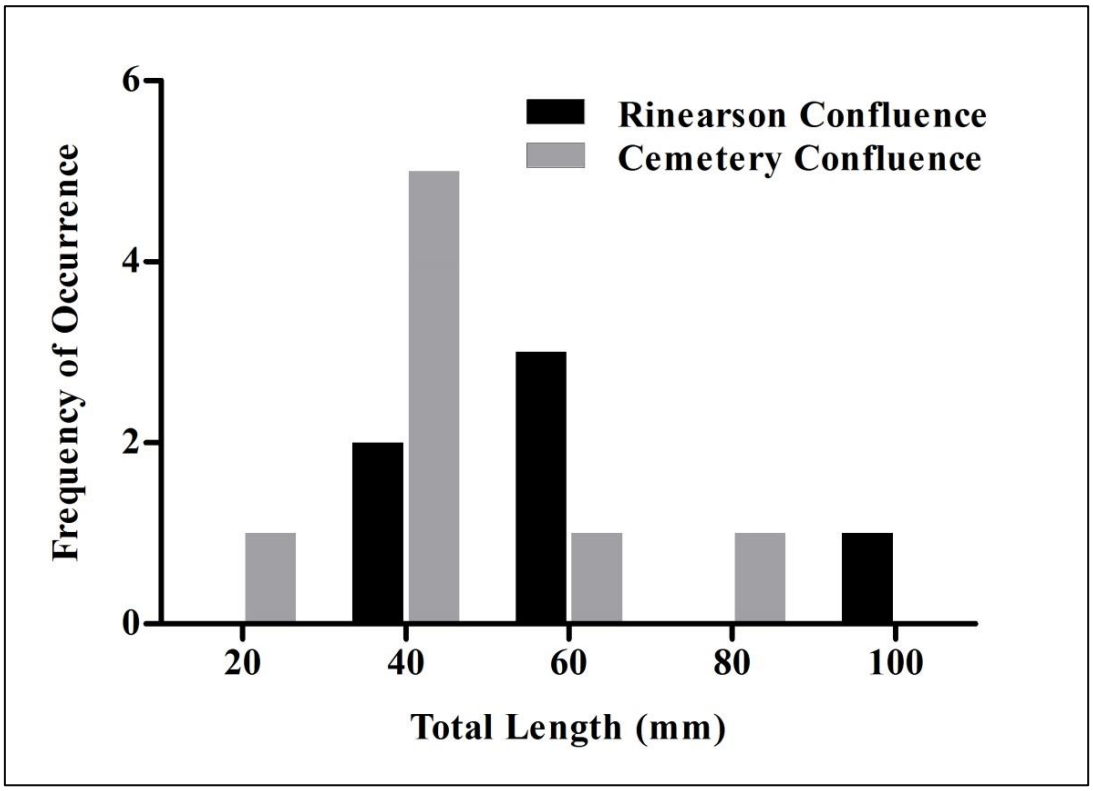

Figure 6. Length-frequency (total length in 20 mm bins centered on values shown on x-axis) of larval lamprey collected at Rinearson Natural Area and Cemetery Creek confluence quadrats. Lamprey smaller than 60 mm were unidentified species and lamprey 60 mm or larger were morphologically identified as Pacific lamprey.

Tributary/Slough Areas

In tributary habitats within Rinearson Creek, seven 50 m GRTS reaches were sampled from the confluence with the Willamette River upstream to the River Road crossing. We detected larval Pacific lampreys (n = 3; 106 mm, 117 mm, and 123 mm TL) in one of seven reaches sampled (d = 0.14; Figure 7). Water temperature was 14.6°C (± 0.4), conductivity was 177.4 μS/cm (± 5.8), and % type 1 substrate was 77% (± 13) in sampled reaches. In the one reach occupied by larvae, 100% of the substrate in the reach was classified as type 1. In the 6 reaches not occupied by larvae 73% (± 15) of the substrate on average was classified as type 1. Larvae detected in the Rinearson Creek tributary reach were in the lowermost reach sampled in the creek, and occurred approximately 30 m from the confluence with the Willamette River (Figure 7) in an area that lacked flowing water and appeared to be influenced by backwater from the Willamette River (Figure 8). Five of the seven reaches were located above a water control structure (Figure 7; Figure 9) that is likely a barrier to all upstream (and downstream) fish migration in the creek. Resident (i.e., non-migratory) western brook lampreys could potentially have occurred in the creek prior to the construction of the barrier and persisted upstream of the impounded area, however no western brook lamprey were detected in the five reaches sampled above the barrier.

In Cemetery Creek, contiguous 50 m tributary reaches beginning at the Willamette River and continuing upstream approximately 300 m were proposed for sampling. We sampled approximately two contiguous 50 m reaches (Figure 7), upstream of which the creek flows through a small, degraded wooden culvert under the railroad embankment. The culvert appeared to be a barrier due to its size and condition. Given the occurrence of the barrier culvert and safety concerns about crossing the railroad embankment, sampling of the creek was terminated at this point. No larval lampreys were detected in the two reaches sampled. Water temperature was 12.9°C, conductivity was 155.1 μS /cm, and % type 1 substrate was 50% in the two reaches sampled.

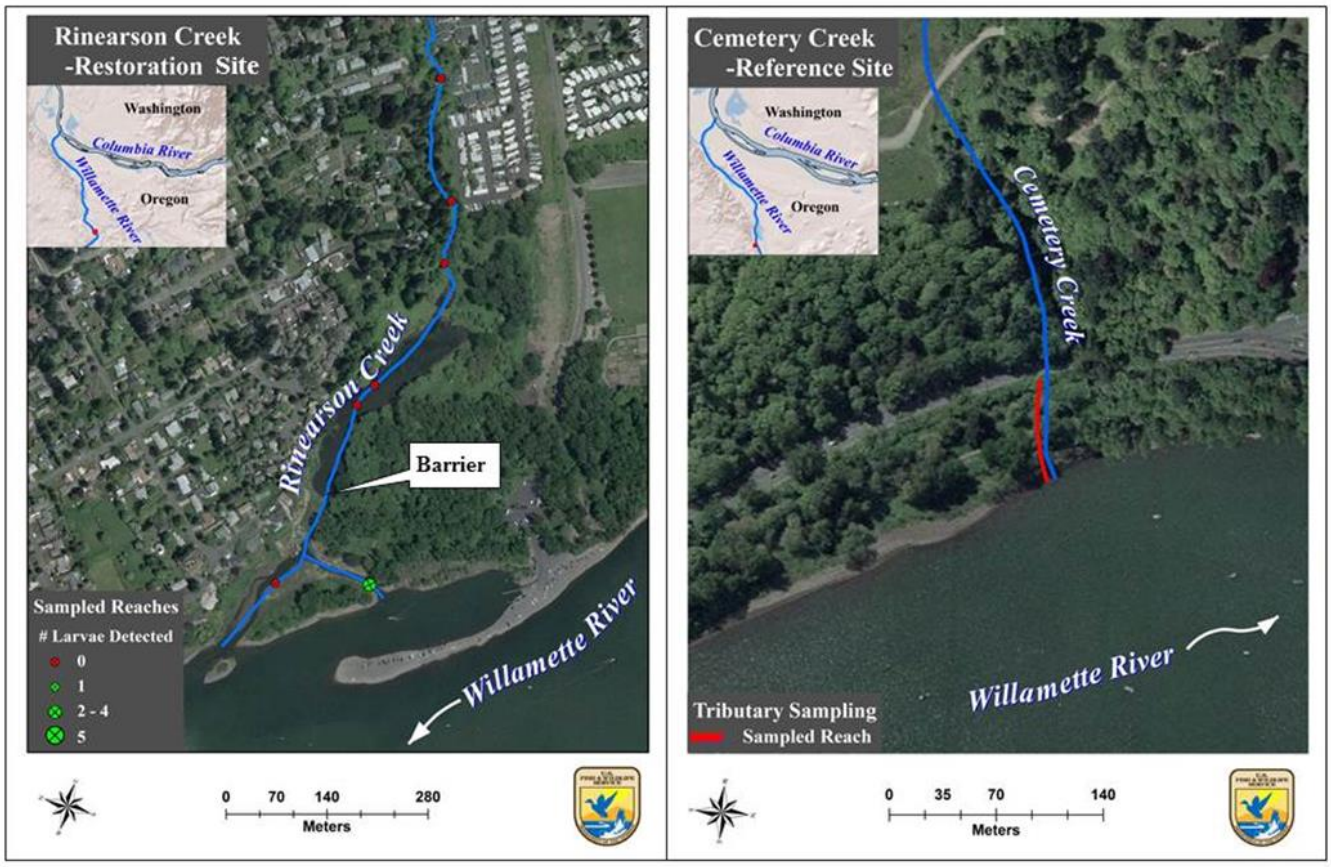

Figure 7. Within the seven tributary reaches sampled in Rinearson Creek (above left) larval lampreys were detected in one reach (green point). In the approximately 100 m of stream sampled within Cemetery Creek (above right; red line), no larval lampreys were detected.

Figure 8. Electrofishing the lowermost GRTS sample reach in Rinearson Creek, approximately 30 m upstream of the confluence with the Willamette River. Three larval Pacific lampreys were collected in this reach. The morphology of the channel suggests backwater intrusion from the Willamette River into this segment of Rinearson Creek is common.

Conclusions

Both the Rinearson Natural Area restoration site and the Cemetery Creek reference site were found to be occupied by Pacific lamprey. All observed Pacific lamprey were of the larval life stage, no detections of juveniles or evidence of adults (i.e., spawning nests) occurred. All larvae collected appeared healthy based on visual observation of external features, no abnormalities or indications of disease or poor health were observed. Collected larvae occurred across a wide range of size classes (i.e., total length), and presumably comprised multiple age/year classes based on the observed differences in length.

At the Rinearson Natural Area, confluence habitats in the Willamette River adjacent to the mouth of Rinearson Creek, as well as one of seven tributary reaches in Rinearson Creek were occupied by larval Pacific lamprey. At the Cemetery Creek reference site, only confluence habitats in the Willamette River adjacent to the mouth of Cemetery Creek were occupied by larval Pacific lamprey; no larvae were detected in two tributary reaches within Cemetery Creek. The larvae detected in confluence habitats were likely to have originated in spawning areas of

tributaries that enter the Willamette River upstream of the study areas (for example, the Clackamas River basin) and gradually dispersed downstream to their location of capture. Evidence suggesting dispersal of larval lamprey out of tributaries and into mainstem habitats has been observed previously in the mainstem Columbia River and Willamette River basins (Jolley et al. 2012; Jolley et al. 2013; Jolley et al. 2014) and may occur over extensive distances (Scribner and Jones 2002; Derosier et al. 2007). The presence of larvae in Rinearson Creek confluence habitats suggests newly created confluence habitats following restoration would also likely be suitable and available for colonization by larvae moving downstream in the mainstem Willamette River. Future sampling of confluence habitats following restoration would be warranted to monitor and evaluate the effects of restoration on larval lamprey occupancy in these habitats.

Figure 9. Water diversion structure and impounded area on Rinearson Creek within the Rinearson Natural Area restoration site. The structure is a passage barrier to upstream migrating fish. Five of seven 50 m GRTS sample reaches in Rinearson Creek were located upstream of the barrier.

In its current condition, natural production (adult spawning and larval rearing) of lamprey in Rinearson Creek appears unlikely given the impassable water diversion structure about 200 m from the Willamette River that limits fish usage to the lowermost segment of the creek. Suitable Pacific lamprey spawning and rearing habitats were scarce in the segment of creek between the barrier and Willamette River confluence. Larval Pacific lampreys were detected in one tributary reach below the barrier, however the reach was located about 30 m from the Willamette River, in a slough-like area that appeared to be significantly influenced by Willamette River backwater (Figure 9; presumably due to both tidal variation and changes in Willamette River discharge). These larvae were also likely to have originated in another tributary of the Willamette River and

dispersed downstream into the location of capture in Rinearson Creek during periods of high discharge or high tide. Upstream of the barrier, potentially suitable adult spawning habitats as well as type 1 larval burrowing habitats occurred in the five reaches sampled, but no larvae were detected in any reach. Thus, removal of the water diversion structure as part of the restoration of Rinearson Natural Area would likely allow migratory fish such as adult Pacific lamprey (and adult western brook and river lamprey) to access and potentially recolonized suitable areas in Rinearson Creek. Future sampling of tributary reaches in Rinearson Creek following the removal of the passage barrier would be warranted to monitor and evaluate potential lamprey recolonization of the creek.

No *Lampetra* spp. larvae were observed among larvae large enough to be identified morphologically (i.e., those > 60 mm TL); whereas Jolley et al. (2012) reported 50-59% of larvae collected in the lower Willamette River were *Lampetra* spp. Here, some proportion of the larvae too small to identify morphologically could potentially be *Lampetra* spp. larvae. However, assigning genus identification to these larvae would require genetic methods to be used. Currently, funding for genetic identification of larvae is not available. Tissue samples collected from all larvae are archived at the CRFPO in the event funding becomes available at a future date.

Data contained in this report will serve as the baseline for pre- and post-restoration monitoring of the Rinearson Natural Area restoration site paired with the Cemetery Creek reference site. Similarities of confluence habitats at both locations should allow for comparisons of larval occupancy pre- and post-restoration and conclusions regarding the effects of restoration on larval lampreys to be proposed. Post-restoration sampling is anticipated to occur at Rinearson Natural Area in calendar year 2016 pending completion of restoration actions. In addition, post-restoration sampling at the Alder Point restoration site (Jolley et al. 2015) and its associated reference site (Ross Island) is also anticipated to occur in 2016 pending completion of restoration actions at Alder Point. The results of these investigations, along with any additional pre-restoration monitoring that occurs in calendar year 2016, will be summarized and reported in an annual report in spring of 2017.

Acknowledgements

Funding for this project was provided by Rinearson Natural Area, LLC. We are grateful to all those who have been involved in developing this project. Unfortunately, it is impractical to acknowledge the large number of people and organizations by name. However, we would like to specifically thank J. Harris and J. Rivera for field assistance; R. Haverkate, C. Wang and H. Schaller for administrative support, J. Harris for analytical guidance; J. Kassakian for project oversight and integration as well as; H. Holmes and J. Buck for assistance with sediment sampling.

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Appendix 1.

Sediment descriptions from Rinearson Natural Area restoration and Cemetery Creek reference sites.

ALS Environmental
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July 02, 2015 **Anal tical Re ort for Service Re uest o** K1505440

Jennifer Kassakian
Industrial Economics, Inc.
2067 Massachusetts Ave.
Cambridge, MA 02140

RE Rinearson

Dear Jennifer,

Enclosed are the results of the sample(s) submitted to our laboratory May 19, 2015
For your reference, these analyses have been assigned our service request number **1 0 0.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3364. You may also contact me via email at howard.holmes@alsglobal.com.

Respectfully submitted,

A S rou USA, Cor . dba A S Environmental

Howard Holmes
Project Manager

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Table of Contents

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

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State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
ISO 17025	http://www.pjlabs.com/	L14-50
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Chain of Custody

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K1505440

Received 5/19/2014

Client contact	Jennifer Kassakian
Client name	Industrial Economics, Inc
Lims project name	Portland Harbor 2015
Client project name	Rinearson

Tests Requested
PSEP Particle Size
9060 TOC
Total Solids

	Rinearson	8 oz Jar	PS	TOC	TS	Archive	Date	Time	Comments
1	001 #1	1	X	X	X	No	5/14/2015	1400	
2	006 #1	1	X	X	X	No	5/14/2015	1430	Very limited sample
3	010 #1	1	X	X	X	No	5/14/2015	1445	Very limited sample
4	010 #2	1	X	X	X	No	5/14/2015	1445	
5	014 #1	1	X	X	X	No	5/14/2015	1450	Very limited sample
6	014 #2	1	X	X	X	No	5/14/2015	1450	
7	020 #1	1	X	X	X	No	5/14/2015	1440	Very limited sample
8	020 #2	1	X	X	X	No	5/14/2015	1440	
9	6017 #1	1	X	X	X	No	5/14/2015	1338	
10	9089 #1	1	X	X	X	No	5/14/2015	1350	Very limited sample
11	9089 #2	1	X	X	X	No	5/14/2015	1350	Very limited sample
12	13889 #1	1	X	X	X	No	5/14/2015	1415	
13	13889 #2	1	X	X	X	No	5/14/2015	1415	Very limited sample
14	Reach #2	1	X	X	X	No	5/14/2015		Very limited sample
15	Reach #3	1	X	X	X	No	5/14/2015		Very limited sample
16	Reach #4	1	X	X	X	No	5/14/2015		Very limited sample
17	Reach #5	1	Hold	Hold	Hold	No	5/14/2015		Sample is large rocks
18	Reach #6	1	X	X	X	No	5/14/2015		Very limited sample
19	Reach #7	1	X	X	X	No	5/14/2015		
20	Reach #12	1	X	X	X	No	5/14/2015		Very limited sample

PC #2

Cooler Receipt and Preservation Form

Client / Project: Industrial Econ. Service Request K15 05440

Received: 5/19/15 Opened: 5/19/15 By: [signature] Unloaded: 5/19/15 By: [signature]

1. Samples were received via? *Mail* *Fed Ex* *UPS* *DHL* *PDX* (*Courier*) *Hand Delivered*
2. Samples were received in: (circle) (*Cooler*) *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA (Y) N If yes, how many and where? one, front
   If present, were custody seals intact? (Y) N If present, were they signed and dated? (Y) N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID (NA)	Tracking Number (NA)	Filed
1.9	2.0	5.0	5.1	+0.1	328			

4. Packing material: *Inserts* *Baggies* (*Bubble Wrap*) *Gel Packs* (*Wet Ice*) *Dry Ice* *Sleeves* _____
5. Were custody papers properly filled out (ink, signed, etc.)? (NA) Y N
6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA (Y) N
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA (Y) N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* (NA) Y N
9. Were appropriate bottles/containers and volumes received for the tests indicated? (NA) Y N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* (NA) Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* (NA) Y N
12. Was C12/Res negative? (NA) Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: No COC

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General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	05/14/15
Sample Matrix:	Sediment	**Date Received:**	05/19/15
Analysis Method:	160.3 Modified	**Units:**	Percent
Prep Method:	None	**Basis:**	As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
001 #1	K1505440-001	**58.6**	-	-	1	06/02/15 14:10	
006 #1	K1505440-002	**70.3**	-	-	1	06/02/15 14:10	
010 #1	K1505440-003	**64.1**	-	-	1	06/02/15 14:10	
010 #2	K1505440-004	**65.1**	-	-	1	06/02/15 14:10	
014 #1	K1505440-005	**46.3**	-	-	1	06/02/15 14:10	
014 #2	K1505440-006	**49.2**	-	-	1	06/02/15 14:10	
020 #1	K1505440-007	**67.8**	-	-	1	06/02/15 14:10	
020 #2	K1505440-008	**67.5**	-	-	1	06/02/15 14:10	
6017 #1	K1505440-009	**63.2**	-	-	1	06/02/15 14:10	
9089 #1	K1505440-010	**66.0**	-	-	1	06/02/15 14:10	
9089 #2	K1505440-011	**66.3**	-	-	1	06/02/15 14:10	
13889 #1	K1505440-012	**68.1**	-	-	1	06/02/15 14:10	
13889 #2	K1505440-013	**66.9**	-	-	1	06/02/15 14:10	
Reach #2	K1505440-014	**41.5**	-	-	1	06/02/15 14:10	
Reach #3	K1505440-015	**66.8**	-	-	1	06/02/15 14:10	
Reach #4	K1505440-016	**46.4**	-	-	1	06/02/15 14:10	
Reach #6	K1505440-018	**36.9**	-	-	1	06/02/15 14:10	
Reach #7	K1505440-019	**66.8**	-	-	1	06/02/15 14:10	
Reach #12	K1505440-020	**36.2**	-	-	1	06/02/15 14:10	

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QA/QC Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project	Rinearson	**Date Collected:**	05/14/15
Sample Matrix:	Sediment	**Date Received:**	05/19/15
Analysis Method:	160.3 Modified	**Units:**	Percent
Prep Method:	None	**Basis:**	As Received

Replicate Sample Summary

Solids, Total

Sample Name:	Lab Code:	MRL	MDL	Sample Result	Duplicate Result	Average	RPD	RPD Limit	Date Analyzed
001 #1	K1505440-001DUP	-	-	58.6	61.7	60.2	5	20	06/02/15
9089 #2	K1505440-011DUP	-	-	66.3	66.4	66.4	<1	20	06/02/15

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	05/14/15
Sample Matrix:	Sediment	**Date Received:**	05/19/15
Analysis Method:	9060	**Units:**	Percent
Prep Method:	Method	**Basis:**	Dry, per Method

Carbon, Total Organic (TOC)

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
001 #1	K1505440-001	**0.71**	0.10	0.02	1	06/10/15 13:29	6/10/15	
006 #1	K1505440-002	**0.21**	0.10	0.02	1	06/10/15 13:29	6/10/15	
010 #1	K1505440-003	**0.45**	0.10	0.02	1	06/10/15 13:29	6/10/15	
010 #2	K1505440-004	**0.45**	0.10	0.02	1	06/10/15 13:29	6/10/15	
014 #1	K1505440-005	**1.71**	0.10	0.02	1	06/10/15 13:29	6/10/15	
014 #2	K1505440-006	**1.74**	0.10	0.02	1	06/10/15 13:29	6/10/15	
020 #1	K1505440-007	**0.12**	0.10	0.02	1	06/10/15 13:29	6/10/15	
020 #2	K1505440-008	**0.09 J**	0.10	0.02	1	06/10/15 13:29	6/10/15	
6017 #1	K1505440-009	**0.37**	0.10	0.02	1	06/10/15 13:29	6/10/15	
9089 #1	K1505440-010	**0.07 J**	0.10	0.02	1	06/10/15 13:29	6/10/15	
9089 #2	K1505440-011	**0.10**	0.10	0.02	1	06/10/15 13:29	6/10/15	
13889 #1	K1505440-012	**0.09 J**	0.10	0.02	1	06/10/15 13:29	6/10/15	
13889 #2	K1505440-013	**0.10 J**	0.10	0.02	1	06/10/15 13:29	6/10/15	
Reach #2	K1505440-014	**3.79**	0.10	0.02	1	06/10/15 13:29	6/10/15	
Reach #3	K1505440-015	**4.35**	0.10	0.02	1	06/10/15 13:29	6/10/15	
Reach #4	K1505440-016	**2.06**	0.10	0.02	1	06/10/15 13:29	6/10/15	
Reach #6	K1505440-018	**5.54**	0.10	0.02	1	06/10/15 13:29	6/10/15	
Reach #7	K1505440-019	**1.75**	0.10	0.02	1	06/10/15 13:29	6/10/15	
Reach #12	K1505440-020	**5.56**	0.10	0.02	1	06/10/15 13:29	6/10/15	
Method Blank	K1505440-MB	**0.03 J**	0.10	0.02	1	06/10/15 13:29	6/10/15	

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QA/QC Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project	Rinearson	**Date Collected:**	05/14/15
Sample Matrix:	Sediment	**Date Received:**	05/19/15
		Date Analyzed:	06/10/15

Replicate Sample Summary
General Chemistry Parameters

Sample Name:	001 #1	**Units:**	Percent
Lab Code:	K1505440-001	**Basis:**	Dry, per Method

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample K1505440-001DUP Result	Average	RPD	RPD Limit
Carbon, Total Organic (TOC)	9060	0.10	0.02	0.71	0.70	0.705	1	20

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Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	05/14/15
Sample Matrix:	Sediment	**Date Received:**	05/19/15
		Date Analyzed:	06/10/15
		Date Extracted:	06/10/15

Duplicate Matrix Spike Summary
Carbon, Total Organic (TOC)

Sample Name:	001 #1	**Units:**	Percent
Lab Code:	K1505440-001	**Basis:**	Dry, per Method
Analysis Method:	9060		
Prep Method:	Method		

		Matrix Spike			Duplicate Matrix Spike					
		K1505440-001MS			K1505440-001DMS					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**% Rec**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**	**RPD**	**RPD Limit**
Carbon, Total Organic (TOC)	0.71	3.27	2.42	106	3.24	2.41	105	70-122	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Analyzed:**	06/10/15
Sample Matrix:	Sediment	**Date Extracted:**	06/10/15

Lab Control Sample Summary
Carbon, Total Organic (TOC)

Analysis Method:	9060	**Units:**	Percent
Prep Method:	Method	**Basis:**	Dry, per Method
		Analysis Lot:	448741

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1505440-LCS	0.570	0.54	105	72-122

Client: Industrial Economics, Inc. **Service Request:** K1505440
Project: Rinearson

Continuing Calibration Verification (CCV) Summary

Carbon, Total Organic (TOC)

Analysis Method: 9060 **Units:** Percent

	Analysis Lot	Lab Code	Date Analyzed	True Value	Measured Value	Percent Recovery	Acceptance Limits
CCV1	448741	KQ1506325-01	06/10/15 13:29	12.0	12.9	108	85-115
CCV2	448741	KQ1506325-02	06/10/15 13:29	12.0	13.2	110	85-115
CCV3	448741	KQ1506325-03	06/10/15 13:29	12.0	13.1	109	85-115
CCV4	448741	KQ1506325-04	06/10/15 13:29	12.0	13.2	110	85-115

Client: Industrial Economics, Inc. **Service Request:**K1505440
Project: Rinearson

Continuing Calibration Blank (CCB) Summary
Carbon, Total Organic (TOC)

Analysis Method: 9060 **Units:**Percent

	Analysis Lot	Lab Code	Date Analyzed	MRL	MDL	Result	Q
CCB1	448741	KQ1506325-05	06/10/15 13:29	0.10	0.02	0.02	J
CCB2	448741	KQ1506325-06	06/10/15 13:29	0.10	0.02	0.02	J
CCB3	448741	KQ1506325-07	06/10/15 13:29	0.10	0.02	0.02	J
CCB4	448741	KQ1506325-08	06/10/15 13:29	0.10	0.02	0.02	J

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 001 #1
Lab Code: K1505440-001

Sand Fraction:	Dry Weight (Grams)	53.7887
Sand Fraction:	Weight Recovered (Grams)	53.6341
Sand Fraction:	Percent Recovery	99.71

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.1704	0.27
Very Coarse Sand	-1 to 0 Ø	0.0817	0.13
Coarse Sand	0 to 1 Ø	0.5248	0.82
Medium Sand	1 to 2 Ø	13.7481	21.57
Fine Sand	2 to 3 Ø	27.4201	43.03
Very Fine Sand	3 to 4 Ø	9.3845	14.73
62.5 µm	4 to 5 Ø	4.2300	6.64
31.3 µm	5 to 6 Ø	1.3700	2.15
15.6 µm	6 to 7 Ø	0.6300	0.99
7.8 µm	7 to 8 Ø	0.5400	0.85
3.9 µm	8 to 9 Ø	0.3650	0.57
1.95 µm	9 to 10 Ø	0.0450	0.07
0.98 µm	> 10 Ø	0.3285	0.52
		58.8381	92.33

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 006 #1
Lab Code: K1505440-002

Sand Fraction:	Dry Weight (Grams)	30.1220
Sand Fraction:	Weight Recovered (Grams)	29.9640
Sand Fraction:	Percent Recovery	99.48

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	2.9153	4.16
Very Coarse Sand	-1 to 0 Ø	0.2560	0.37
Coarse Sand	0 to 1 Ø	1.3825	1.97
Medium Sand	1 to 2 Ø	6.8350	9.76
Fine Sand	2 to 3 Ø	12.5084	17.85
Very Fine Sand	3 to 4 Ø	4.7316	6.75
62.5 µm	4 to 5 Ø	2.0400	2.91
31.3 µm	5 to 6 Ø	0.9850	1.41
15.6 µm	6 to 7 Ø	0.5350	0.76
7.8 µm	7 to 8 Ø	0.3800	0.54
3.9 µm	8 to 9 Ø	0.2850	0.41
1.95 µm	9 to 10 Ø	0.0800	0.11
0.98 µm	> 10 Ø	0.2385	0.34
		33.1723	47.34

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 010 #1
Lab Code: K1505440-003

Sand Fraction:	Dry Weight (Grams)	60.2825
Sand Fraction:	Weight Recovered (Grams)	60.1876
Sand Fraction:	Percent Recovery	99.84

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.6647	1.11
Very Coarse Sand	-1 to 0 Ø	1.5444	2.57
Coarse Sand	0 to 1 Ø	7.1946	11.97
Medium Sand	1 to 2 Ø	32.1529	53.50
Fine Sand	2 to 3 Ø	15.4696	25.74
Very Fine Sand	3 to 4 Ø	2.2038	3.67
62.5 µm	4 to 5 Ø	1.7850	2.97
31.3 µm	5 to 6 Ø	1.3050	2.17
15.6 µm	6 to 7 Ø	0.5450	0.91
7.8 µm	7 to 8 Ø	0.3400	0.57
3.9 µm	8 to 9 Ø	0.1350	0.22
1.95 µm	9 to 10 Ø	-0.0500	-0.08
0.98 µm	> 10 Ø	0.0985	0.16
		63.3885	105.47

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 010 #2
Lab Code: K1505440-004

Sand Fraction:	Dry Weight (Grams)	62.0562
Sand Fraction:	Weight Recovered (Grams)	61.9708
Sand Fraction:	Percent Recovery	99.86

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.7016	1.18
Very Coarse Sand	-1 to 0 Ø	1.5793	2.66
Coarse Sand	0 to 1 Ø	8.3570	14.07
Medium Sand	1 to 2 Ø	34.8502	58.67
Fine Sand	2 to 3 Ø	13.9213	23.44
Very Fine Sand	3 to 4 Ø	1.9076	3.21
62.5 µm	4 to 5 Ø	1.0650	1.79
31.3 µm	5 to 6 Ø	1.0600	1.78
15.6 µm	6 to 7 Ø	0.7650	1.29
7.8 µm	7 to 8 Ø	0.4950	0.83
3.9 µm	8 to 9 Ø	0.2600	0.44
1.95 µm	9 to 10 Ø	0.0000	0.00
0.98 µm	> 10 Ø	0.1435	0.24
		65.1055	109.61

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 014 #1
Lab Code: K1505440-005

Sand Fraction:	Dry Weight (Grams)	16.6015
Sand Fraction:	Weight Recovered (Grams)	16.5200
Sand Fraction:	Percent Recovery	99.51

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0000	0.00
Very Coarse Sand	-1 to 0 Ø	0.0192	0.05
Coarse Sand	0 to 1 Ø	0.0794	0.22
Medium Sand	1 to 2 Ø	1.3865	3.79
Fine Sand	2 to 3 Ø	5.1145	13.97
Very Fine Sand	3 to 4 Ø	6.7332	18.40
62.5 µm	4 to 5 Ø	6.8400	18.69
31.3 µm	5 to 6 Ø	1.8600	5.08
15.6 µm	6 to 7 Ø	0.9900	2.70
7.8 µm	7 to 8 Ø	0.5900	1.61
3.9 µm	8 to 9 Ø	0.2750	0.75
1.95 µm	9 to 10 Ø	0.0650	0.18
0.98 µm	> 10 Ø	0.0985	0.27
		24.0513	65.71

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 014 #2
Lab Code: K1505440-006

Sand Fraction: Dry Weight (Grams)	25.5312
Sand Fraction: Weight Recovered (Grams)	24.2980
Sand Fraction: Percent Recovery	95.17

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.2712	0.66
Very Coarse Sand	-1 to 0 Ø	0.0440	0.11
Coarse Sand	0 to 1 Ø	0.6193	1.50
Medium Sand	1 to 2 Ø	0.8787	2.13
Fine Sand	2 to 3 Ø	8.7967	21.37
Very Fine Sand	3 to 4 Ø	9.5579	23.22
62.5 µm	4 to 5 Ø	12.4700	30.30
31.3 µm	5 to 6 Ø	2.2650	5.50
15.6 µm	6 to 7 Ø	1.2700	3.09
7.8 µm	7 to 8 Ø	0.7550	1.83
3.9 µm	8 to 9 Ø	0.3650	0.89
1.95 µm	9 to 10 Ø	-0.4400	-1.07
0.98 µm	> 10 Ø	0.7485	1.82
		37.6013	91.36

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 020 #1
Lab Code: K1505440-007

Sand Fraction: Dry Weight (Grams)	54.2825
Sand Fraction: Weight Recovered (Grams)	54.0564
Sand Fraction: Percent Recovery	99.58

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.5533	1.26
Very Coarse Sand	-1 to 0 Ø	1.0627	2.42
Coarse Sand	0 to 1 Ø	11.8784	27.09
Medium Sand	1 to 2 Ø	35.3066	80.52
Fine Sand	2 to 3 Ø	4.6213	10.54
Very Fine Sand	3 to 4 Ø	0.4133	0.94
62.5 µm	4 to 5 Ø	0.4250	0.97
31.3 µm	5 to 6 Ø	0.6000	1.37
15.6 µm	6 to 7 Ø	0.4500	1.03
7.8 µm	7 to 8 Ø	0.2300	0.52
3.9 µm	8 to 9 Ø	0.1200	0.27
1.95 µm	9 to 10 Ø	-0.0150	0.00
0.98 µm	> 10 Ø	0.0835	0.19
		55.7291	127.13

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 020 #2
Lab Code: K1505440-008

Sand Fraction:	Dry Weight (Grams)	63.2076
Sand Fraction:	Weight Recovered (Grams)	62.7871
Sand Fraction:	Percent Recovery	99.33

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.5600	0.85
Very Coarse Sand	-1 to 0 Ø	1.2134	1.84
Coarse Sand	0 to 1 Ø	14.6679	22.28
Medium Sand	1 to 2 Ø	40.8171	62.01
Fine Sand	2 to 3 Ø	4.9946	7.59
Very Fine Sand	3 to 4 Ø	0.4222	0.64
62.5 µm	4 to 5 Ø	0.2300	0.35
31.3 µm	5 to 6 Ø	0.3600	0.55
15.6 µm	6 to 7 Ø	0.3150	0.48
7.8 µm	7 to 8 Ø	0.2050	0.31
3.9 µm	8 to 9 Ø	0.1350	0.21
1.95 µm	9 to 10 Ø	-0.0350	0.00
0.98 µm	> 10 Ø	0.0535	0.08
		63.9387	97.19

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 6017 #1
Lab Code: K1505440-009

Sand Fraction:	Dry Weight (Grams)	58.1804
Sand Fraction:	Weight Recovered (Grams)	58.1558
Sand Fraction:	Percent Recovery	99.96

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0000	0.00
Very Coarse Sand	-1 to 0 Ø	0.0372	0.06
Coarse Sand	0 to 1 Ø	0.3465	0.56
Medium Sand	1 to 2 Ø	18.3666	29.46
Fine Sand	2 to 3 Ø	33.9501	54.45
Very Fine Sand	3 to 4 Ø	4.8020	7.70
62.5 µm	4 to 5 Ø	1.4800	2.37
31.3 µm	5 to 6 Ø	0.9200	1.48
15.6 µm	6 to 7 Ø	0.5200	0.83
7.8 µm	7 to 8 Ø	0.5850	0.94
3.9 µm	8 to 9 Ø	0.2850	0.46
1.95 µm	9 to 10 Ø	0.0100	0.02
0.98 µm	> 10 Ø	0.1335	0.21
		61.4359	98.53

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 9089 #1
Lab Code: K1505440-010

Sand Fraction:	Dry Weight (Grams)	57.1520
Sand Fraction:	Weight Recovered (Grams)	57.1762
Sand Fraction:	Percent Recovery	100.04

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	1.2970	2.04
Very Coarse Sand	-1 to 0 Ø	0.5561	0.88
Coarse Sand	0 to 1 Ø	9.5349	15.03
Medium Sand	1 to 2 Ø	41.7038	65.72
Fine Sand	2 to 3 Ø	3.5128	5.54
Very Fine Sand	3 to 4 Ø	0.3471	0.55
62.5 µm	4 to 5 Ø	0.1950	0.31
31.3 µm	5 to 6 Ø	0.1400	0.22
15.6 µm	6 to 7 Ø	0.0700	0.11
7.8 µm	7 to 8 Ø	0.1150	0.18
3.9 µm	8 to 9 Ø	0.0400	0.06
1.95 µm	9 to 10 Ø	-0.0100	0.00
0.98 µm	> 10 Ø	0.0735	0.12
		57.5752	90.75

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 9089 #2
Lab Code: K1505440-011

Sand Fraction: Dry Weight (Grams)	43.5598
Sand Fraction: Weight Recovered (Grams)	43.4732
Sand Fraction: Percent Recovery	99.80

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0000	0.00
Very Coarse Sand	-1 to 0 Ø	0.3176	0.51
Coarse Sand	0 to 1 Ø	6.4726	10.38
Medium Sand	1 to 2 Ø	33.1946	53.22
Fine Sand	2 to 3 Ø	2.9372	4.71
Very Fine Sand	3 to 4 Ø	0.3430	0.55
62.5 µm	4 to 5 Ø	0.1600	0.26
31.3 µm	5 to 6 Ø	0.1250	0.20
15.6 µm	6 to 7 Ø	0.0950	0.15
7.8 µm	7 to 8 Ø	0.0800	0.13
3.9 µm	8 to 9 Ø	0.0600	0.10
1.95 µm	9 to 10 Ø	-0.0200	0.00
0.98 µm	> 10 Ø	0.0685	0.11
		43.8335	70.31

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 13889 #1
Lab Code: K1505440-012

Sand Fraction:	Dry Weight (Grams)	68.4842
Sand Fraction:	Weight Recovered (Grams)	68.6030
Sand Fraction:	Percent Recovery	100.17

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	4.5007	6.06
Very Coarse Sand	-1 to 0 Ø	2.6280	3.54
Coarse Sand	0 to 1 Ø	7.1237	9.60
Medium Sand	1 to 2 Ø	33.3086	44.88
Fine Sand	2 to 3 Ø	16.2943	21.96
Very Fine Sand	3 to 4 Ø	4.2612	5.74
62.5 µm	4 to 5 Ø	0.6050	0.82
31.3 µm	5 to 6 Ø	0.2150	0.29
15.6 µm	6 to 7 Ø	0.1950	0.26
7.8 µm	7 to 8 Ø	0.1200	0.16
3.9 µm	8 to 9 Ø	0.1150	0.15
1.95 µm	9 to 10 Ø	0.0300	0.04
0.98 µm	> 10 Ø	0.0935	0.13
		69.4900	93.64

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 13889 #2
Lab Code: K1505440-013

Sand Fraction: Dry Weight (Grams)	58.8941
Sand Fraction: Weight Recovered (Grams)	58.7920
Sand Fraction: Percent Recovery	99.83

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	3.4129	4.76
Very Coarse Sand	-1 to 0 Ø	2.6062	3.64
Coarse Sand	0 to 1 Ø	6.3478	8.86
Medium Sand	1 to 2 Ø	29.7444	41.52
Fine Sand	2 to 3 Ø	12.2898	17.16
Very Fine Sand	3 to 4 Ø	3.9128	5.46
62.5 µm	4 to 5 Ø	0.5850	0.82
31.3 µm	5 to 6 Ø	0.3050	0.43
15.6 µm	6 to 7 Ø	0.2050	0.29
7.8 µm	7 to 8 Ø	0.1650	0.23
3.9 µm	8 to 9 Ø	0.0300	0.04
1.95 µm	9 to 10 Ø	0.0150	0.02
0.98 µm	> 10 Ø	0.1485	0.21
		59.7674	83.43

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: Reach #2
Lab Code: K1505440-014

Sand Fraction:	Dry Weight (Grams)	12.4482
Sand Fraction:	Weight Recovered (Grams)	12.3232
Sand Fraction:	Percent Recovery	99.00

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.5612	2.67
Very Coarse Sand	-1 to 0 Ø	0.1013	0.48
Coarse Sand	0 to 1 Ø	0.0725	0.34
Medium Sand	1 to 2 Ø	1.3471	6.40
Fine Sand	2 to 3 Ø	4.5431	21.60
Very Fine Sand	3 to 4 Ø	4.3061	20.47
62.5 µm	4 to 5 Ø	3.4750	16.52
31.3 µm	5 to 6 Ø	2.8850	13.71
15.6 µm	6 to 7 Ø	1.9300	9.17
7.8 µm	7 to 8 Ø	1.2150	5.78
3.9 µm	8 to 9 Ø	0.7650	3.64
1.95 µm	9 to 10 Ø	0.4700	2.23
0.98 µm	> 10 Ø	0.6935	3.30
		22.3648	106.31

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: Reach #3
Lab Code: K1505440-015

Sand Fraction:	Dry Weight (Grams)	30.9334
Sand Fraction:	Weight Recovered (Grams)	30.8423
Sand Fraction:	Percent Recovery	99.71

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.5605	1.67
Very Coarse Sand	-1 to 0 Ø	1.2555	3.75
Coarse Sand	0 to 1 Ø	6.5187	19.46
Medium Sand	1 to 2 Ø	14.5706	43.49
Fine Sand	2 to 3 Ø	5.9119	17.65
Very Fine Sand	3 to 4 Ø	1.3263	3.96
62.5 µm	4 to 5 Ø	0.7050	2.10
31.3 µm	5 to 6 Ø	0.7900	2.36
15.6 µm	6 to 7 Ø	0.5500	1.64
7.8 µm	7 to 8 Ø	0.4550	1.36
3.9 µm	8 to 9 Ø	0.3000	0.90
1.95 µm	9 to 10 Ø	0.1800	0.54
0.98 µm	> 10 Ø	0.3135	0.94
		33.4370	99.80

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: Reach #4
Lab Code: K1505440-016

Sand Fraction:	Dry Weight (Grams)	24.6511
Sand Fraction:	Weight Recovered (Grams)	24.7060
Sand Fraction:	Percent Recovery	100.22

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0000	0.00
Very Coarse Sand	-1 to 0 Ø	0.0276	0.06
Coarse Sand	0 to 1 Ø	0.0537	0.13
Medium Sand	1 to 2 Ø	0.3851	0.90
Fine Sand	2 to 3 Ø	5.2625	12.28
Very Fine Sand	3 to 4 Ø	13.7429	32.07
62.5 µm	4 to 5 Ø	13.2900	31.02
31.3 µm	5 to 6 Ø	3.9400	9.20
15.6 µm	6 to 7 Ø	1.9550	4.56
7.8 µm	7 to 8 Ø	1.0300	2.40
3.9 µm	8 to 9 Ø	0.5150	1.20
1.95 µm	9 to 10 Ø	0.2450	0.57
0.98 µm	> 10 Ø	0.3885	0.91
		40.8353	95.31

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: Reach #6
Lab Code: K1505440-018

Sand Fraction: Dry Weight (Grams)	8.5742
Sand Fraction: Weight Recovered (Grams)	8.4284
Sand Fraction: Percent Recovery	98.30

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.2890	2.45
Very Coarse Sand	-1 to 0 Ø	0.0849	0.72
Coarse Sand	0 to 1 Ø	0.0714	0.61
Medium Sand	1 to 2 Ø	0.5001	4.24
Fine Sand	2 to 3 Ø	2.3380	19.81
Very Fine Sand	3 to 4 Ø	3.6557	30.98
62.5 µm	4 to 5 Ø	2.1100	17.88
31.3 µm	5 to 6 Ø	1.1550	9.79
15.6 µm	6 to 7 Ø	0.5750	4.87
7.8 µm	7 to 8 Ø	0.4450	3.77
3.9 µm	8 to 9 Ø	0.2600	2.20
1.95 µm	9 to 10 Ø	-0.0300	0.00
0.98 µm	> 10 Ø	0.0935	0.79
		11.5476	98.12

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: Reach #7
Lab Code: K1505440-019

Sand Fraction: Dry Weight (Grams)	66.1387
Sand Fraction: Weight Recovered (Grams)	66.1612
Sand Fraction: Percent Recovery	100.03

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.1810	0.26
Very Coarse Sand	-1 to 0 Ø	2.5833	3.66
Coarse Sand	0 to 1 Ø	15.6505	22.15
Medium Sand	1 to 2 Ø	27.1199	38.37
Fine Sand	2 to 3 Ø	14.7313	20.84
Very Fine Sand	3 to 4 Ø	4.2330	5.99
62.5 µm	4 to 5 Ø	2.0000	2.83
31.3 µm	5 to 6 Ø	1.6400	2.32
15.6 µm	6 to 7 Ø	1.0850	1.54
7.8 µm	7 to 8 Ø	0.7650	1.08
3.9 µm	8 to 9 Ø	0.5650	0.80
1.95 µm	9 to 10 Ø	0.3900	0.55
0.98 µm	> 10 Ø	0.2885	0.41
		71.2325	100.79

ALS Group USA, Corp.
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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: Reach #12
Lab Code: K1505440-020

Sand Fraction: Dry Weight (Grams)	6.6334
Sand Fraction: Weight Recovered (Grams)	6.5295
Sand Fraction: Percent Recovery	98.43

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.5642	3.70
Very Coarse Sand	-1 to 0 Ø	0.1237	0.81
Coarse Sand	0 to 1 Ø	0.0801	0.53
Medium Sand	1 to 2 Ø	0.5244	3.44
Fine Sand	2 to 3 Ø	1.3032	8.56
Very Fine Sand	3 to 4 Ø	2.4936	16.37
62.5 µm	4 to 5 Ø	3.3450	21.97
31.3 µm	5 to 6 Ø	2.4150	15.86
15.6 µm	6 to 7 Ø	1.3000	8.54
7.8 µm	7 to 8 Ø	0.6550	4.30
3.9 µm	8 to 9 Ø	0.3350	2.20
1.95 µm	9 to 10 Ø	0.0300	0.20
0.98 µm	> 10 Ø	0.1835	1.20
		13.3527	87.68

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505440
Project:	Rinearson	**Date Collected:**	5/14/2015
Sample Matrix:	Sediment	**Date Received:**	5/19/2015
		Date Analyzed:	6/8/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: Reach #6
Lab Code: K1505440-018 DUP

Sand Fraction:	Dry Weight (Grams)	8.5681
Sand Fraction:	Weight Recovered (Grams)	8.5264
Sand Fraction:	Percent Recovery	99.51

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0301	0.28
Very Coarse Sand	-1 to 0 Ø	0.1323	1.22
Coarse Sand	0 to 1 Ø	0.1189	1.10
Medium Sand	1 to 2 Ø	0.5322	4.92
Fine Sand	2 to 3 Ø	2.7440	25.35
Very Fine Sand	3 to 4 Ø	3.8531	35.60
62.5 µm	4 to 5 Ø	1.7100	15.80
31.3 µm	5 to 6 Ø	0.8650	7.99
15.6 µm	6 to 7 Ø	0.4900	4.53
7.8 µm	7 to 8 Ø	0.3650	3.37
3.9 µm	8 to 9 Ø	0.2050	1.89
1.95 µm	9 to 10 Ø	0.0050	0.05
0.98 µm	> 10 Ø	0.1035	0.96
		11.1541	103.06

Raw Data

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
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www.alsglobal.com

Benchsheet

Service Request #:	**K1505440, KQ1505822**	**Run #:**	**447364**
Test:	**TS**	**Balance ID:**	**K-Balance-16**
Method:	**160.3 Modified**		

Pan ID:	Lab Code:	Tare (g)	Wet Wt. (g)	Tare + Dry Wt. (g)	Dry Weight (g)	% Total Solids	RPD
	K1505440-001	1.32	20.33	13.24	11.9	58.6	
	K1505440-001DUP	1.28	22.41	15.10	13.8	61.7	5
	K1505440-002	1.30	17.90	13.88	12.6	70.3	
	K1505440-003	1.29	15.95	11.52	10.2	64.1	
	K1505440-004	1.30	17.35	12.60	11.3	65.1	
	K1505440-005	1.30	10.11	5.98	4.68	46.3	
	K1505440-006	1.29	13.46	7.91	6.62	49.2	
	K1505440-007	1.31	13.61	10.54	9.23	67.8	
	K1505440-008	1.30	15.10	11.49	10.2	67.5	
	K1505440-009	1.28	17.27	12.19	10.9	63.2	
	K1505440-010	1.30	17.22	12.66	11.4	66.0	
	K1505440-011	1.29	11.05	8.62	7.33	66.3	
	K1505440-011DUP	1.29	10.89	8.52	7.23	66.4	<1
	K1505440-012	1.31	10.01	8.13	6.82	68.1	
	K1505440-013	1.30	12.08	9.38	8.08	66.9	
	K1505440-014	1.29	20.57	9.83	8.54	41.5	
	K1505440-015	1.31	13.99	10.65	9.34	66.8	
	K1505440-016	1.30	10.52	6.18	4.88	46.4	
	K1505440-018	1.28	8.57	4.44	3.16	36.9	
	K1505440-019	1.30	14.59	11.05	9.75	66.8	
	K1505440-020	1.30	11.28	5.38	4.08	36.2	

	Oven ID	Temp In	Temp Out	Date In	Time In	Date Out	Time Out	Thermometer ID
Oven1	K-OVEN-07	105	105	6/2/2015	14:10	6/3/2015	08:26	

	Cal EQID	Cal Start Value	Cal End Value	Start Date	Start Time	End Date	End Time
Calibration1	K-Balance-16	1.00 100.00	1.00 100.00	6/2/2015	13:40	6/2/2015	14:10
Calibration2	K-Balance-16	1.00 100.00	1.01 100.01	6/3/2015	08:42	6/3/2015	08:47

KT 6/3/15

Comments: BK

Analytical Results Summary

Instrument Name: K-Balance-16 **Analyst:** DMADDEN **Analysis Lot:** 447364 **Method/Testcode:** 160.3 Modified/TS

Lab Code	Target Analytes	QC	Parent Sample	Matrix	Raw Result	Sample Amt.	Final Result	Dil	MDL	PQL	% Rec	% RSD	Date Analyzed	QC?	Tier
K1505440-001	Solids, Total	N/A		Sediment	58.60 Percent	20.33 g	58.6 Percent	1					6/2/15 14:10	N	IV
K1505440-002	Solids, Total	N/A		Sediment	70.30 Percent	17.90 g	70.3 Percent	1					6/2/15 14:10	N	IV
K1505440-003	Solids, Total	N/A		Sediment	64.10 Percent	15.95 g	64.1 Percent	1					6/2/15 14:10	N	IV
K1505440-004	Solids, Total	N/A		Sediment	65.10 Percent	17.35 g	65.1 Percent	1					6/2/15 14:10	N	IV
K1505440-005	Solids, Total	N/A		Sediment	46.30 Percent	10.11 g	46.3 Percent	1					6/2/15 14:10	N	IV
K1505440-006	Solids, Total	N/A		Sediment	49.20 Percent	13.46 g	49.2 Percent	1					6/2/15 14:10	N	IV
K1505440-007	Solids, Total	N/A		Sediment	67.80 Percent	13.61 g	67.8 Percent	1					6/2/15 14:10	N	IV
K1505440-008	Solids, Total	N/A		Sediment	67.50 Percent	15.10 g	67.5 Percent	1					6/2/15 14:10	N	IV
K1505440-009	Solids, Total	N/A		Sediment	63.20 Percent	17.27 g	63.2 Percent	1					6/2/15 14:10	N	IV
K1505440-010	Solids, Total	N/A		Sediment	66.00 Percent	17.22 g	66.0 Percent	1					6/2/15 14:10	N	IV
K1505440-011	Solids, Total	N/A		Sediment	66.30 Percent	11.05 g	66.3 Percent	1					6/2/15 14:10	N	IV
K1505440-012	Solids, Total	N/A		Sediment	68.10 Percent	10.01 g	68.1 Percent	1					6/2/15 14:10	N	IV
K1505440-013	Solids, Total	N/A		Sediment	66.90 Percent	12.08 g	66.9 Percent	1					6/2/15 14:10	N	IV
K1505440-014	Solids, Total	N/A		Sediment	41.50 Percent	20.57 g	41.5 Percent	1					6/2/15 14:10	N	IV
K1505440-015	Solids, Total	N/A		Sediment	66.80 Percent	13.99 g	66.8 Percent	1					6/2/15 14:10	N	IV
K1505440-016	Solids, Total	N/A		Sediment	46.40 Percent	10.52 g	46.4 Percent	1					6/2/15 14:10	N	IV
K1505440-018	Solids, Total	N/A		Sediment	36.90 Percent	8.57 g	36.9 Percent	1					6/2/15 14:10	N	IV
K1505440-019	Solids, Total	N/A		Sediment	66.80 Percent	14.59 g	66.8 Percent	1					6/2/15 14:10	N	IV
K1505440-020	Solids, Total	N/A		Sediment	36.20 Percent	11.28 g	36.2 Percent	1					6/2/15 14:10	N	IV
KQ1505822-01	Solids, Total	DUP	K1505440-001	Sediment	61.70 Percent	22.41 g	61.7 Percent	1				5	6/2/15 14:10	N	IV
KQ1505822-02	Solids, Total	DUP	K1505440-011	Sediment	66.40 Percent	10.89 g	66.4 Percent	1				<1	6/2/15 14:10	N	IV

DJM 6/3/15

# indicates Final Result is not yet adjusted for Solids because it has not yet been determined.

Work Request # Original ( ) K1505440

Tier: IV

Date Analyzed: 6/10/15

Analyst: AB

Analysis: Toc Soil / 9060

Run # 448741

DATA QUALITY REPORT
INORGANICS

Explain any "no" responses to questions below, and any corrective actions in the comments section below.

1.	Is the method name and number correct and appropriate?	(yes)/no/NA
2.	Holding times met for all analyses and for all samples?	(yes)/no/NA
3.	Are calculations correct?	(yes)/no/NA
4.	Is the reporting basis correct? (Dry Weight)	(yes)/no/NA
5.	All quality control criteria met?	(yes)/no
6.	Is the calibration curve correlation coefficient ≥ 0.995?	(yes)/no/NA
7.	MBs, CCVs, CCBs, LCSs, Dups, and Spikes, analyzed at proper frequency?	(yes)/no/NA
8.	Are ICVs, CCVs, and CCBs all within acceptance limits?	(yes)/no/NA
9.	Are results for methods blanks all ND?	(yes)/no/NA
10.	Are all QC samples within acceptance criteria? (LCS % rec, MS/DMS % rec, DUP or MS/DMS RPDs, etc.)	(yes)/no/NA
11.	Are all exceptions explained?	yes/no/(NA)
12.	Have all applicable service requests been reviewed?	(yes)/no/NA
13.	Are all samples labeled correctly?	(yes)/no/NA
14.	Have all instructions on the service request been followed? (e.g. Special MRLs, QC on a specific sample, Form V)	(yes)/no/NA
15.	Are detection limits and units reported correctly?	(yes)/no/NA
16.	Is the unused space on the benchsheet crossed out?	(yes)/no/NA
17.	Was analysis turned in by the due date? (n-2) (If not record SR#)	yes/(no)/NA Due 6/12/15

COMMENTS:

Final Approved by: [signature] Date: 06/12/15

DQREPORT

Analytical Results Summary

Instrument Name: K-TOC-04 **Analyst:** DBRADBURY **Analysis Lot:** 448741 **Method/Testcode:** 9060/TOC

Lab Code	Target Analytes	QC	Parent Sample	Matrix	Raw Result	Sample Amt.	Final Result	Dil	MDL	PQL	% Rec	% RSD	Date Analyzed	QC?	Tier
K1505440-001	Carbon, Total Organic (TOC)	N/A		Sediment	0.71 Percent		0.71 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-002	Carbon, Total Organic (TOC)	N/A		Sediment	0.21 Percent		0.21 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-003	Carbon, Total Organic (TOC)	N/A		Sediment	0.45 Percent		0.45 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-004	Carbon, Total Organic (TOC)	N/A		Sediment	0.45 Percent		0.45 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-005	Carbon, Total Organic (TOC)	N/A		Sediment	1.71 Percent		1.71 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-006	Carbon, Total Organic (TOC)	N/A		Sediment	1.74 Percent		1.74 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-007	Carbon, Total Organic (TOC)	N/A		Sediment	0.12 Percent		0.12 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-008	Carbon, Total Organic (TOC)	N/A		Sediment	0.09 Percent		0.09 Percent J	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-009	Carbon, Total Organic (TOC)	N/A		Sediment	0.37 Percent		0.37 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-010	Carbon, Total Organic (TOC)	N/A		Sediment	0.07 Percent		0.07 Percent J	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-011	Carbon, Total Organic (TOC)	N/A		Sediment	0.10 Percent		0.10 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-012	Carbon, Total Organic (TOC)	N/A		Sediment	0.09 Percent		0.09 Percent J	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-013	Carbon, Total Organic (TOC)	N/A		Sediment	0.10 Percent		0.10 Percent J	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-014	Carbon, Total Organic (TOC)	N/A		Sediment	3.79 Percent		3.79 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-015	Carbon, Total Organic (TOC)	N/A		Sediment	4.35 Percent		4.35 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-016	Carbon, Total Organic (TOC)	N/A		Sediment	2.06 Percent		2.06 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-018	Carbon, Total Organic (TOC)	N/A		Sediment	5.54 Percent		5.54 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-019	Carbon, Total Organic (TOC)	N/A		Sediment	1.75 Percent		1.75 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
K1505440-020	Carbon, Total Organic (TOC)	N/A		Sediment	5.56 Percent		5.56 Percent	1	0.02	0.10			6/10/15 13:29:00	N	IV
KQ1506324-01	Carbon, Total Organic (TOC)	DUP	K1505440-001	Sediment	0.70 Percent		0.70 Percent	1	0.02	0.10		1	6/10/15 13:29:00	N	IV
KQ1506324-02	Carbon, Total Organic (TOC)	MS	K1505440-001	Sediment	3.27 Percent		3.27 Percent	1	0.02	0.10	106		6/10/15 13:29:00	N	IV
KQ1506324-03	Carbon, Total Organic (TOC)	DMS	K1505440-001	Sediment	3.24 Percent		3.24 Percent	1	0.02	0.10	105	<1	6/10/15 13:29:00	N	IV
KQ1506324-04	Carbon, Total Organic (TOC)	LCS		Sediment	0.57 Percent		0.570 Percent	1	0.02	0.10	105		6/10/15 13:29:00	N	IV

# indicates Final Result is not yet adjusted for Solids because it has not yet been determined.

06/12/15

Analytical Results Summary

Instrument Name: K-TOC-04 **Analyst:** DBRADBURY **Analysis Lot:** 448741 **Method/Testcode:** 9060/TOC

Lab Code	Target Analytes	QC	Parent Sample	Matrix	Raw Result	Sample Amt.	Final Result	Dil	MDL	PQL	% Rec	% RSD	Date Analyzed	QC?	Tier
KQ1506324-05	Carbon, Total Organic (TOC)	MB		Sediment	0.03 Percent		0.03 Percent J	1	0.02	0.10			6/10/15 13:29:00	N	IV
KQ1506325-01	Carbon, Total Organic (TOC)	CCV		Sediment	12.93 Percent		12.9 Percent	1			108		6/10/15 13:29:00	N	IV
KQ1506325-02	Carbon, Total Organic (TOC)	CCV		Sediment	13.17 Percent		13.2 Percent	1			110		6/10/15 13:29:00	N	IV
KQ1506325-03	Carbon, Total Organic (TOC)	CCV		Sediment	13.06 Percent		13.1 Percent	1			109		6/10/15 13:29:00	N	IV
KQ1506325-04	Carbon, Total Organic (TOC)	CCV		Sediment	13.23 Percent		13.2 Percent	1			110		6/10/15 13:29:00	N	IV
KQ1506325-05	Carbon, Total Organic (TOC)	CCB		Sediment	0.02 Percent		0.02 Percent J	1	0.02	0.10			6/10/15 13:29:00	N	IV
KQ1506325-06	Carbon, Total Organic (TOC)	CCB		Sediment	0.02 Percent		0.02 Percent J	1	0.02	0.10			6/10/15 13:29:00	N	IV
KQ1506325-07	Carbon, Total Organic (TOC)	CCB		Sediment	0.02 Percent		0.02 Percent J	1	0.02	0.10			6/10/15 13:29:00	N	IV
KQ1506325-08	Carbon, Total Organic (TOC)	CCB		Sediment	0.02 Percent		0.02 Percent J	1	0.02	0.10			6/10/15 13:29:00	N	IV

AB 6/11/15

# indicates Final Result is not yet adjusted for Solids because it has not yet been determined.

aj-analyzer multi EA 4000; multiWin 5.2; Serial number: N4-138/M
% TOTAL ORGANIC CARBON

AnalysisGroup

AnalysisGroup: % TOC

Remark: % Total Organic Carbon by EPA 9060 M

Run # 448741

Created on: 3/16/2013 11:53:50 AM
Last modification: 6/10/2015 8:18:57 PM
State: solid

Analysis name	Result (average)	Sample quantity	Time of analysis
CCV	TC: 12.93%	25.200mg % REC = 103	6/10/2015 1:29:40 PM
CCB	TC: 0.024%	250.000mg	6/10/2015 1:44:49 PM
LCS	TC: 0.57%	252.000mg % REC = 105	6/10/2015 1:53:31 PM
MB	TC: 0.026%	250.000mg	6/10/2015 2:06:29 PM
K1505440-001	TC: 0.71%	251.300mg	6/10/2015 2:15:32 PM
K1505440-001d	TC: 0.70%	252.100mg	6/10/2015 2:27:35 PM
K1505440-001ms	TC: 3.27%	125.700mg	6/10/2015 2:39:53 PM
K1505440-001msd	TC: 3.24%	125.600mg	6/10/2015 2:55:00 PM
K1505440-002	TC: 0.21%	252.500mg	6/10/2015 3:11:13 PM
K1505440-003	TC: 0.45%	251.100mg	6/10/2015 3:21:13 PM
K1505440-004	TC: 0.45%	250.600mg	6/10/2015 3:32:30 PM
K1505440-005	TC: 1.71%	252.300mg	6/10/2015 3:44:16 PM
CCV	TC: 13.17%	25.100mg % REC = 110	6/10/2015 3:58:17 PM
CCB	TC: 0.021%	250.000mg	6/10/2015 4:15:11 PM
K1505440-006	TC: 1.74%	250.900mg	6/10/2015 4:23:45 PM
K1505440-007	TC: 0.12%	252.700mg	6/10/2015 4:38:08 PM
K1505440-008	TC: 0.092%	251.700mg	6/10/2015 4:48:11 PM
K1505440-009	TC: 0.37%	251.200mg	6/10/2015 4:58:07 PM
K1505440-010	TC: 0.067%	251.500mg	6/10/2015 5:09:25 PM
K1505440-011	TC: 0.10%	251.300mg	6/10/2015 5:19:23 PM
K1505440-012	TC: 0.092%	253.000mg	6/10/2015 5:29:49 PM
K1505440-013	TC: 0.099%	252.400mg	6/10/2015 5:39:59 PM
K1505440-014	TC: 3.79%	200.800mg	6/10/2015 5:50:18 PM
K1505440-015	TC: 4.35%	200.700mg	6/10/2015 6:06:12 PM
CCV	TC: 13.06%	25.200mg % REC = 109	6/10/2015 6:22:30 PM
CCB	TC: 0.021%	250.000mg	6/10/2015 6:39:12 PM
K1505440-016	TC: 2.06%	201.800mg	6/10/2015 6:49:00 PM
K1505440-018	TC: 5.54%	100.900mg	6/10/2015 7:05:05 PM
K1505440-019	TC: 1.75%	251.300mg	6/10/2015 7:21:10 PM
K1505440-020	TC: 5.56%	100.800mg	6/10/2015 7:37:17 PM
CCV	TC: 13.23%	25.100mg % REC = 110	6/10/2015 7:53:30 PM
CCB	TC: 0.021%	250.000mg	6/10/2015 8:09:52 PM

06/12/15

Page 1 of 1

Service Request: K1505440 **Method:** EPA 9060

Date Weighed: 6/10/15 **Analysis:** Total Organic Carbon in Soil

Analyst: AB **Prep Run / Run #** 237921 / 448741

Sample Position	Sample ID	Weight (mg)
1	Clean	NA
2	CCV	25.2
3	CCB	250.0
4	LCS	252.0
5	MB	250.0
6	K1505440-001	251.3
7	K1505440-001d	252.1
8	K1505440-001ms	125.7
9	K1505440-001msd	125.6
10	K1505440-002	252.5
11	K1505440-003	251.1
12	K1505440-004	250.6
13	K1505440-005	252.3
14	CCV	25.1
15	CCB	250.0
16	K1505440-006	250.9
17	K1505440-007	252.7
18	K1505440-008	251.7
19	K1505440-009	251.2
20	K1505440-010	251.5
21	K1505440-011	251.3
22	K1505440-012	253.0
23	K1505440-013	252.4
24	K1505440-014	200.8

Sample Position	Sample ID	Weight (mg)
25	K1505440-015	200.7
26	CCV	25.2
27	CCB	250.0
28	K1505440-016	201.8
29	K1505440-018	100.9
30	K1505440-019	251.3
31	K1505440-020	100.8
32	CCV	25.1
33	CCB	250.0
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		

MS CaCO3 (mg)	K1505440-001ms	25.3
MSD CaCO3 (mg)	K1505440-001msd	25.2

06/12/15

Balance ID: K-BALANCE-38 **Oven ID:** K-OVEN-01

HCL ID: TOC/2-81-G **Thermometer ID:** K31316

CCV: CaCO3, Alfa Aesar, ID: 13-TOC-01-1C, Lot # J05X011, TV = 12.0% % REC = 108, 110, 109, 110

LCS: Nutrients in Soil, ERA, ID: TOCS/1-17-F, Lot # D087-542, TV = 0.543% % REC = 105

MS: (mg CCV)(% TV CCV) / (mg sample) = (25.3)(12) / 125.7 = 2.42 % REC = 106

MSD: (mg CCV)(% TV CCV) / (mg sample) = (25.2)(12) / 125.6 = 2.41 % REC = 105

Original
Work Request # ( ) 5440

Tier:

Date Analyzed: 6/8/15

Analyst: GS CC

Analysis: ICP GS

45/255

DATA QUALITY REPORT
INORGANICS

Explain any "no" responses to questions below, and any corrective actions in the comments section below.

1.	Is the method name and number correct and appropriate?	yes/no/NA
2.	Holding times met for all analyses and for all samples?	yes/no/NA
3.	Are calculations correct?	yes/no/NA
4.	Is the reporting basis correct? (Dry Weight)	yes/no/NA
5.	All quality control criteria met?	yes/no
6.	Is the calibration curve correlation coefficient ≥ 0.995?	yes/no/NA
7.	MBs, CCVs, CCBs, LCSs, Dups, and Spikes, analyzed at proper frequency?	yes/no/NA
8.	Are ICVs, CCVs, and CCBs all within acceptance limits?	yes/no/NA
9.	Are results for methods blanks all ND?	yes/no/NA
10.	Are all QC samples within acceptance criteria? (LCS % rec, MS/DMS % rec, DUP or MS/DMS RPDs, etc.)	yes/no/NA
11.	Are all exceptions explained?	yes/no/NA
12.	Have all applicable service requests been reviewed?	yes/no/NA
13.	Are all samples labeled correctly?	yes/no/NA
14.	Have all instructions on the service request been followed? (e.g. Special MRLs, QC on a specific sample, Form V)	yes/no/NA
15.	Are detection limits and units reported correctly?	yes/no/NA
16.	Is the unused space on the benchsheet crossed out?	yes/no/NA
17.	Was analysis turned in by the due date? (n-2) (If not record SR#)	yes/no/NA

COMMENTS:
Percent of total wt. recovered was outside ALS acceptance limits for 5440-2, 5, 7, 11, 13, 20.
5440-2, 11, 13 - no more sample available.
5440-5, 7, 20 - limited sample remaining.
The samples were sandy with a lot of rocks on top which made it hard to homogenize as the water will settle fast.

Final Approved by: [signature] Date: 6/30/15

DQREPORT

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request K1505440
Sample #: K1505440-001

Client:	Industrial Economics, Inc.
Project:	Rinearson
Sample Matrix:	Sediment

Sample Name	001 #1
Date Collected	5/14/2015
Date Received	5/19/2015
Date Analyzed	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.1704	0.2908
V.C. Sand, 1.00 mm (g)	18	0.0817	0.1394
C. Sand, 0.500 mm (g)	35	0.5248	0.8956
M. Sand, 0.250 mm (g)	60	13.7481	23.4609
F. Sand, 0.125 mm (g)	120	27.4201	46.7920
V.F. Sand, 0.0625 mm (g)	230	9.3845	16.0145
S/C <0.0625 mm (g)	Pan	2.3045	3.9326

Total (g) Recov'd	53.6341
Total (%) Recov'd	99.7

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	154.6065
Grams Beaker (Tare)	100.8178
GramsGravel/Sand	53.7887

I. Sample Preparation

Grams As Received Sample	108.7420
Percent (%) Solids	58.6
Grams Oven Dried Sample	63.7228

III. Determination of Silt/Clay Fraction

Temperature °C.: 21 Time Start: 9:42 AM Time Finish: 5:22 PM
Date Start: 6/15/2015 Date Finish: 6/16/2015

Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	46.4451	30.0246	30.6779	31.4396	27.9465	30.5474	41.5795
Grams of Tare	46.2927	29.9568	30.6375	31.4118	27.9295	30.5377	41.5707
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1502	0.0656	0.0382	0.0256	0.0148	0.0075	0.0066
Total Grams Sample X 50	4.2300	1.3700	0.6300	0.5400	0.3650	0.0450	0.3285

Analyst: CC Date Completed: 6/17/2015

K1505440wet.cc2

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-002

Client:	Industrial Economics, Inc.	Sample Name:	006 #1
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	2.9153	4.1469
V.C. Sand, 1.00 mm (g)	18	0.2560	0.3642
C. Sand, 0.500 mm (g)	35	1.3825	1.9666
M. Sand, 0.250 mm (g)	60	6.8350	9.7226
F. Sand, 0.125 mm (g)	120	12.5084	17.7929
V.F. Sand, 0.0625 mm (g)	230	4.7316	6.7306
S/C <0.0625 mm (g)	Pan	1.3352	1.8993

Total (g) Recov'd	29.9640
Total (%) Recov'd	99.5

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	135.9562
Grams Beaker (Tare)	105.8342
GramsGravel/Sand	30.1220

I. Sample Preparation

Grams As Received Sample	99.6665
Percent (%) Solids	70.3
Grams Oven Dried Sample	70.0655

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	31.0114	44.1358	30.4928	30.9586	39.8419	40.0791	31.6238
Grams of Tare	30.9183	44.0835	30.4602	30.9367	39.8276	40.0705	31.6168
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0909	0.0501	0.0304	0.0197	0.0121	0.0064	0.0048
Total Grams Sample X 50	2.0400	0.9850	0.5350	0.3800	0.2850	0.0800	0.2385

Analyst: CC Date: 6/17/2015
Reviewed by: Date:

K1505440wet.cc2

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-003

Client:	Industrial Economics, Inc.
Project:	Rinearson
Sample Matrix:	Sediment

Sample Name:	010 #1
Date Collected:	5/14/2015
Date Received:	5/19/2015
Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.6647	1.2709
V.C. Sand, 1.00 mm (g)	18	1.5444	2.9530
C. Sand, 0.500 mm (g)	35	7.1946	13.7564
M. Sand, 0.250 mm (g)	60	32.1529	61.4778
F. Sand, 0.125 mm (g)	120	15.4696	29.5786
V.F. Sand, 0.0625 mm (g)	230	2.2038	4.2138
S/C <0.0625 mm (g)	Pan	0.9576	1.8310

Total (g) Recov'd	60.1876
Total (%) Recov'd	99.8

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	162.2846
Grams Beaker (Tare)	102.0021
GramsGravel/Sand	60.2825

I. Sample Preparation

Grams As Received Sample	114.9143
Percent (%) Solids	52.3
Grams Oven Dried Sample	60.1002

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	31.0005	40.7944	41.0234	41.7728	35.3796	39.9354	41.7988
Grams of Tare	30.9151	40.7447	40.9998	41.7601	35.3737	39.9322	41.7946
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0832	0.0475	0.0214	0.0105	0.0037	0.0010	0.0020
Total Grams Sample X 50	1.7850	1.3050	0.5450	0.3400	0.1350	-0.0500	0.0985

Analyst: CC Date: 6/17/2015
Reviewed by: Date:

K1505440wet.cc2

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-004

Client:	Industrial Economics, Inc.	Sample Name:	010 #2
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.7016	1.3415
V.C. Sand, 1.00 mm (g)	18	1.5793	3.0197
C. Sand, 0.500 mm (g)	35	8.3570	15.9790
M. Sand, 0.250 mm (g)	60	34.8502	66.6352
F. Sand, 0.125 mm (g)	120	13.9213	26.6182
V.F. Sand, 0.0625 mm (g)	230	1.9076	3.6474
S/C <0.0625 mm (g)	Pan	0.6538	1.2501

Total (g) Recov'd	61.9708
Total (%) Recov'd	99.9

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	176.3225
Grams Beaker (Tare)	114.2663
GramsGravel/Sand	62.0562

I. Sample Preparation

Grams As Received Sample	113.5724
Percent (%) Solids	52.3
Grams Oven Dried Sample	59.3984

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	33.9181	42.0841	34.2766	28.0517	26.2430	30.8323	42.2008
Grams of Tare	33.8401	42.0274	34.2411	28.0315	26.2327	30.8272	42.1957
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0758	0.0545	0.0333	0.0180	0.0081	0.0029	0.0029
Total Grams Sample X 50	1.0650	1.0600	0.7650	0.4950	0.2600	0.0000	0.1435

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

K1505440wet.cc3

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-005

Client:	Industrial Economics, Inc.	Sample Name:	014 #1
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0000	0.0000
V.C. Sand, 1.00 mm (g)	18	0.0192	0.0467
C. Sand, 0.500 mm (g)	35	0.0794	0.1932
M. Sand, 0.250 mm (g)	60	1.3865	3.3735
F. Sand, 0.125 mm (g)	120	5.1145	12.4440
V.F. Sand, 0.0625 mm (g)	230	6.7332	16.3825
S/C <0.0625 mm (g)	Pan	3.1872	7.7547

Total (g) Recov'd	16.5200
Total (%) Recov'd	99.5

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	139.4975
Grams Beaker (Tare)	122.8960
GramsGravel/Sand	16.6015

I. Sample Preparation

Grams As Received Sample	89.0559
Percent (%) Solids	41.1
Grams Oven Dried Sample	36.6020

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	40.0794	30.8472	40.5797	40.7513	31.7823	31.5873	35.0779
Grams of Tare	39.8628	30.7674	40.5371	40.7285	31.7713	31.5818	35.0737
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.2144	0.0776	0.0404	0.0206	0.0088	0.0033	0.0020
Total Grams Sample X 50	6.8400	1.8600	0.9900	0.5900	0.2750	0.0650	0.0985

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-006

Client:	Industrial Economics, Inc.	Sample Name:	014 #2
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.2712	0.5960
V.C. Sand, 1.00 mm (g)	18	0.0440	0.0967
C. Sand, 0.500 mm (g)	35	0.6193	1.3611
M. Sand, 0.250 mm (g)	60	0.8787	1.9312
F. Sand, 0.125 mm (g)	120	8.7967	19.3334
V.F. Sand, 0.0625 mm (g)	230	9.5579	21.0064
S/C <0.0625 mm (g)	Pan	4.1302	9.0774

Total (g) Recov'd	24.2980
Total (%) Recov'd	95.2

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	140.0641
Grams Beaker (Tare)	114.5329
GramsGravel/Sand	25.5312

I. Sample Preparation

Grams As Received Sample	90.4588
Percent (%) Solids	45.5
Grams Oven Dried Sample	41.1588

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	33.5989	41.5655	41.1226	30.3119	34.0772	29.8018	40.7134
Grams of Tare	33.2480	41.4640	41.0664	30.2811	34.0615	29.7934	40.6962
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.3487	0.0993	0.0540	0.0286	0.0135	0.0062	0.0150
Total Grams Sample X 50	12.4700	2.2650	1.2700	0.7550	0.3650	-0.4400	0.7485

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

K1505440wet.cc3

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-007

Client:	Industrial Economics, Inc.	Sample Name:	020 #1
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.5533	1.2661
V.C. Sand, 1.00 mm (g)	18	1.0627	2.4318
C. Sand, 0.500 mm (g)	35	11.8784	27.1817
M. Sand, 0.250 mm (g)	60	35.3066	80.7931
F. Sand, 0.125 mm (g)	120	4.6213	10.5751
V.F. Sand, 0.0625 mm (g)	230	0.4133	0.9458
S/C <0.0625 mm (g)	Pan	0.2208	0.5053

Total (g) Recov'd	54.0564
Total (%) Recov'd	99.6

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	162.5638
Grams Beaker (Tare)	108.2813
GramsGravel/Sand	54.2825

I. Sample Preparation

Grams As Received Sample	100.3405
Percent (%) Solids	43.7
Grams Oven Dried Sample	43.8488

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	33.9284	27.2169	33.3861	33.6181	40.4811	34.4538	29.8051
Grams of Tare	33.8883	27.1853	33.3665	33.6075	40.4751	34.4502	29.8012
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0379	0.0294	0.0174	0.0084	0.0038	0.0014	0.0017
Total Grams Sample X 50	0.4250	0.6000	0.4500	0.2300	0.1200	-0.0150	0.0835

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-008

Client:	Industrial Economics, Inc.	Sample Name:	020 #2
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.5600	0.8296
V.C. Sand, 1.00 mm (g)	18	1.2134	1.7976
C. Sand, 0.500 mm (g)	35	14.6679	21.7302
M. Sand, 0.250 mm (g)	60	40.8171	60.4698
F. Sand, 0.125 mm (g)	120	4.9946	7.3994
V.F. Sand, 0.0625 mm (g)	230	0.4222	0.6255
S/C <0.0625 mm (g)	Pan	0.1119	0.1658

Total (g) Recov'd	62.7871
Total (%) Recov'd	99.3

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	158.5204
Grams Beaker (Tare)	95.3128
GramsGravel/Sand	63.2076

I. Sample Preparation

Grams As Received Sample	97.5156
Percent (%) Solids	67.5
Grams Oven Dried Sample	65.8230

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	30.1328	43.6132	34.8651	30.2271	40.4928	34.1976	41.0028
Grams of Tare	30.1053	43.5903	34.8494	30.2177	40.4875	34.1950	40.9995
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0253	0.0207	0.0135	0.0072	0.0031	0.0004	0.0011
Total Grams Sample X 50	0.2300	0.3600	0.3150	0.2050	0.1350	-0.0350	0.0535

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-009

Client:	Industrial Economics, Inc.	Sample Name:	6017 #1
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0000	0.0000
V.C. Sand, 1.00 mm (g)	18	0.0372	0.0589
C. Sand, 0.500 mm (g)	35	0.3465	0.5483
M. Sand, 0.250 mm (g)	60	18.3666	29.0611
F. Sand, 0.125 mm (g)	120	33.9501	53.7185
V.F. Sand, 0.0625 mm (g)	230	4.8020	7.5981
S/C <0.0625 mm (g)	Pan	0.6534	1.0339

Total (g) Recov'd	58.1558
Total (%) Recov'd	100.0

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	160.2879
Grams Beaker (Tare)	102.1075
GramsGravel/Sand	58.1804

I. Sample Preparation

Grams As Received Sample	98.6623
Percent (%) Solids	63.2
Grams Oven Dried Sample	62.3546

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	41.0363	31.5943	42.0291	33.1712	41.7721	33.8361	40.5761
Grams of Tare	40.9554	31.5430	41.9962	33.1487	41.7613	33.8310	40.5712
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0787	0.0491	0.0307	0.0203	0.0086	0.0029	0.0027
Total Grams Sample X 50	1.4800	0.9200	0.5200	0.5850	0.2850	0.0100	0.1335

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

K1505440wet.cc4

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-010

Client:	Industrial Economics, Inc.	Sample Name:	9089 #1
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	1.2970	1.9652
V.C. Sand, 1.00 mm (g)	18	0.5561	0.8426
C. Sand, 0.500 mm (g)	35	9.5349	14.4468
M. Sand, 0.250 mm (g)	60	41.7038	63.1876
F. Sand, 0.125 mm (g)	120	3.5128	5.3224
V.F. Sand, 0.0625 mm (g)	230	0.3471	0.5259
S/C <0.0625 mm (g)	Pan	0.2245	0.3402

Total (g) Recov'd	57.1762
Total (%) Recov'd	100.0

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	168.7253
Grams Beaker (Tare)	111.5733
GramsGravel/Sand	57.1520

I. Sample Preparation

Grams As Received Sample	96.1415
Percent (%) Solids	66.0
Grams Oven Dried Sample	63.4534

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	30.4283	31.3356	42.2384	29.5660	31.6464	41.5296	29.7516
Grams of Tare	30.4136	31.3248	42.2304	29.5594	31.6421	41.5261	29.7479
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0125	0.0086	0.0058	0.0044	0.0021	0.0013	0.0015
Total Grams Sample X 50	0.1950	0.1400	0.0700	0.1150	0.0400	-0.0100	0.0735

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

K1505440wet.cc5

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-011

Client:	Industrial Economics, Inc.	Sample Name:	9089 #2
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0000	0.0000
V.C. Sand, 1.00 mm (g)	18	0.3176	0.4790
C. Sand, 0.500 mm (g)	35	6.4726	9.7626
M. Sand, 0.250 mm (g)	60	33.1946	50.0673
F. Sand, 0.125 mm (g)	120	2.9372	4.4302
V.F. Sand, 0.0625 mm (g)	230	0.3430	0.5173
S/C <0.0625 mm (g)	Pan	0.2082	0.3140

Total (g) Recov'd	43.4732
Total (%) Recov'd	99.8

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	148.8081
Grams Beaker (Tare)	105.2483
GramsGravel/Sand	43.5598

I. Sample Preparation

Grams As Received Sample	94.0711
Percent (%) Solids	66.3
Grams Oven Dried Sample	62.3691

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	30.2929	31.7825	30.9118	39.4162	39.8225	31.5401	28.7275
Grams of Tare	30.2793	31.7721	30.9039	39.4102	39.8181	31.5369	28.7239
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0114	0.0082	0.0057	0.0038	0.0022	0.0010	0.0014
Total Grams Sample X 50	0.1600	0.1250	0.0950	0.0800	0.0600	-0.0200	0.0685

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-012

Client:	Industrial Economics, Inc.	Sample Name:	13889 #1
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	4.5007	6.6090
V.C. Sand, 1.00 mm (g)	18	2.6280	3.8590
C. Sand, 0.500 mm (g)	35	7.1237	10.4606
M. Sand, 0.250 mm (g)	60	33.3086	48.9113
F. Sand, 0.125 mm (g)	120	16.2943	23.9270
V.F. Sand, 0.0625 mm (g)	230	4.2612	6.2573
S/C <0.0625 mm (g)	Pan	0.4865	0.7144

Total (g) Recov'd	68.6030
Total (%) Recov'd	100.2

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	164.1645
Grams Beaker (Tare)	95.6803
GramsGravel/Sand	68.4842

I. Sample Preparation

Grams As Received Sample	108.9732
Percent (%) Solids	68.1
Grams Oven Dried Sample	74.2107

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	27.7960	31.2049	34.7511	29.8251	29.9917	28.7884	31.6062
Grams of Tare	27.7663	31.1873	34.7378	29.8157	29.9847	28.7837	31.6021
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0275	0.0154	0.0111	0.0072	0.0048	0.0025	0.0019
Total Grams Sample X 50	0.6050	0.2150	0.1950	0.1200	0.1150	0.0300	0.0935

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

K1505440wet.cc5

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-013

Client:	Industrial Economics, Inc.	Sample Name:	13889 #2
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	3.4129	5.1015
V.C. Sand, 1.00 mm (g)	18	2.6062	3.8957
C. Sand, 0.500 mm (g)	35	6.3478	9.4885
M. Sand, 0.250 mm (g)	60	29.7444	44.4610
F. Sand, 0.125 mm (g)	120	12.2898	18.3704
V.F. Sand, 0.0625 mm (g)	230	3.9128	5.8487
S/C <0.0625 mm (g)	Pan	0.4781	0.7146

Total (g) Recov'd	58.7920
Total (%) Recov'd	99.8

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	160.8371
Grams Beaker (Tare)	101.9430
GramsGravel/Sand	58.8941

I. Sample Preparation

Grams As Received Sample	107.0791
Percent (%) Solids	66.9
Grams Oven Dried Sample	71.6359

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	40.5425	39.9141	34.0622	41.6252	39.7107	30.1001	30.8913
Grams of Tare	40.5112	39.8945	34.0487	41.6158	39.7046	30.0946	30.8861
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0291	0.0174	0.0113	0.0072	0.0039	0.0033	0.0030
Total Grams Sample X 50	0.5850	0.3050	0.2050	0.1650	0.0300	0.0150	0.1485

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-014

Client:	Industrial Economics, Inc.	Sample Name:	Reach #2
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.5612	1.3523
V.C. Sand, 1.00 mm (g)	18	0.1013	0.2441
C. Sand, 0.500 mm (g)	35	0.0725	0.1747
M. Sand, 0.250 mm (g)	60	1.3471	3.2460
F. Sand, 0.125 mm (g)	120	4.5431	10.9472
V.F. Sand, 0.0625 mm (g)	230	4.3061	10.3761
S/C <0.0625 mm (g)	Pan	1.3919	3.3540

Total (g) Recov'd	12.3232
Total (%) Recov'd	99.0

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	111.9702
Grams Beaker (Tare)	99.5220
GramsGravel/Sand	12.4482

I. Sample Preparation

Grams As Received Sample	50.6917
Percent (%) Solids	41.5
Grams Oven Dried Sample	21.0371

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	28.3105	34.9220	31.0829	31.7369	42.1395	28.6635	40.4238
Grams of Tare	28.0796	34.7606	30.9792	31.6718	42.0987	28.6380	40.4077
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.2287	0.1592	0.1015	0.0629	0.0386	0.0233	0.0139
Total Grams Sample X 50	3.4750	2.8850	1.9300	1.2150	0.7650	0.4700	0.6935

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-015

Client:	Industrial Economics, Inc.	Sample Name:	Reach #3
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.5605	0.8391
V.C. Sand, 1.00 mm (g)	18	1.2555	1.8795
C. Sand, 0.500 mm (g)	35	6.5187	9.7585
M. Sand, 0.250 mm (g)	60	14.5706	21.8123
F. Sand, 0.125 mm (g)	120	5.9119	8.8501
V.F. Sand, 0.0625 mm (g)	230	1.3263	1.9855
S/C <0.0625 mm (g)	Pan	0.6988	1.0461

Total (g) Recov'd	30.8423
Total (%) Recov'd	99.7

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	129.4935
Grams Beaker (Tare)	98.5601
GramsGravel/Sand	30.9334

I. Sample Preparation

Grams As Received Sample	50.1548
Percent (%) Solids	66.8
Grams Oven Dried Sample	33.5034

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	33.7448	40.0276	31.1672	33.1911	42.4383	30.9398	29.8239
Grams of Tare	33.6767	39.9736	31.1290	33.1639	42.4202	30.9277	29.8154
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0659	0.0518	0.0360	0.0250	0.0159	0.0099	0.0063
Total Grams Sample X 50	0.7050	0.7900	0.5500	0.4550	0.3000	0.1800	0.3135

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-016

Client:	Industrial Economics, Inc.	Sample Name:	Reach #4
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0000	0.0000
V.C. Sand, 1.00 mm (g)	18	0.0276	0.0595
C. Sand, 0.500 mm (g)	35	0.0537	0.1157
M. Sand, 0.250 mm (g)	60	0.3851	0.8300
F. Sand, 0.125 mm (g)	120	5.2625	11.3416
V.F. Sand, 0.0625 mm (g)	230	13.7429	29.6183
S/C <0.0625 mm (g)	Pan	5.2342	11.2806

Total (g) Recov'd	24.7060
Total (%) Recov'd	100.2

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	129.0002
Grams Beaker (Tare)	104.3491
GramsGravel/Sand	24.6511

I. Sample Preparation

Grams As Received Sample	92.3422
Percent (%) Solids	46.4
Grams Oven Dried Sample	42.8468

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	41.4144	34.2730	29.6117	41.7966	35.3903	34.1433	40.3875
Grams of Tare	40.9849	34.1093	29.5268	41.7508	35.3651	34.1284	40.3775
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.4273	0.1615	0.0827	0.0436	0.0230	0.0127	0.0078
Total Grams Sample X 50	13.2900	3.9400	1.9550	1.0300	0.5150	0.2450	0.3885

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-018

Client:	Industrial Economics, Inc.	Sample Name:	Reach #6
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.2890	0.7832
V.C. Sand, 1.00 mm (g)	18	0.0849	0.2301
C. Sand, 0.500 mm (g)	35	0.0714	0.1935
M. Sand, 0.250 mm (g)	60	0.5001	1.3553
F. Sand, 0.125 mm (g)	120	2.3380	6.3360
V.F. Sand, 0.0625 mm (g)	230	3.6557	9.9070
S/C <0.0625 mm (g)	Pan	1.4893	4.0360

Total (g) Recov'd	8.4284
Total (%) Recov'd	98.3

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	129.3951
Grams Beaker (Tare)	120.8209
GramsGravel/Sand	8.5742

I. Sample Preparation

Grams As Received Sample	31.9782
Percent (%) Solids	36.9
Grams Oven Dried Sample	11.8000

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	40.1411	31.3913	30.9112	30.4995	34.2135	31.2889	31.5484
Grams of Tare	40.0467	31.3391	30.8821	30.4819	34.2048	31.2854	31.5443
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0922	0.0500	0.0269	0.0154	0.0065	0.0013	0.0019
Total Grams Sample X 50	2.1100	1.1550	0.5750	0.4450	0.2600	-0.0300	0.0935

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-019

Client:	Industrial Economics, Inc.	Sample Name:	Reach #7
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.1810	0.2710
V.C. Sand, 1.00 mm (g)	18	2.5833	3.8672
C. Sand, 0.500 mm (g)	35	15.6505	23.4289
M. Sand, 0.250 mm (g)	60	27.1199	40.5987
F. Sand, 0.125 mm (g)	120	14.7313	22.0528
V.F. Sand, 0.0625 mm (g)	230	4.2330	6.3368
S/C <0.0625 mm (g)	Pan	1.6622	2.4883

Total (g) Recov'd	66.1612
Total (%) Recov'd	100.0

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	166.9826
Grams Beaker (Tare)	100.8439
GramsGravel/Sand	66.1387

I. Sample Preparation

Grams As Received Sample	105.7964
Percent (%) Solids	66.8
Grams Oven Dried Sample	70.6720

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID# C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	30.7746	32.2286	29.8871	31.2611	31.2438	40.2219	31.7168
Grams of Tare	30.6377	32.1317	29.8230	31.2187	31.2167	40.2061	31.7088
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1347	0.0947	0.0619	0.0402	0.0249	0.0136	0.0058
Total Grams Sample X 50	2.0000	1.6400	1.0850	0.7650	0.5650	0.3900	0.2885

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

K1505440wet.cc7

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-020

Client:	Industrial Economics, Inc.	Sample Name:	Reach #12
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.5642	1.6497
V.C. Sand, 1.00 mm (g)	18	0.1237	0.3617
C. Sand, 0.500 mm (g)	35	0.0801	0.2342
M. Sand, 0.250 mm (g)	60	0.5244	1.5333
F. Sand, 0.125 mm (g)	120	1.3032	3.8105
V.F. Sand, 0.0625 mm (g)	230	2.4936	7.2912
S/C <0.0625 mm (g)	Pan	1.4403	4.2114

Total (g) Recov'd	6.5295
Total (%) Recov'd	98.4

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	111.1589
Grams Beaker (Tare)	104.5255
GramsGravel/Sand	6.6334

I. Sample Preparation

Grams As Received Sample	44.5280
Percent (%) Solids	34.2
Grams Oven Dried Sample	15.2286

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	29.5827	31.8173	40.7598	41.1984	30.8085	29.1616	31.8531
Grams of Tare	29.4152	31.7167	40.7075	41.1721	30.7953	29.1551	31.8472
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1653	0.0984	0.0501	0.0241	0.0110	0.0043	0.0037
Total Grams Sample X 50	3.3450	2.4150	1.3000	0.6550	0.3350	0.0300	0.1835

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505440
Sample #: K1505440-018 DUP

Client:	Industrial Economics, Inc.	Sample Name:	Reach #6
Project:	Rinearson	Date Collected:	5/14/2015
Sample Matrix:	Sediment	Date Received:	5/19/2015
		Date Analyzed:	6/8/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0301	0.0816
V.C. Sand, 1.00 mm (g)	18	0.1323	0.3585
C. Sand, 0.500 mm (g)	35	0.1189	0.3222
M. Sand, 0.250 mm (g)	60	0.5322	1.4423
F. Sand, 0.125 mm (g)	120	2.7440	7.4363
V.F. Sand, 0.0625 mm (g)	230	3.8531	10.4420
S/C <0.0625 mm (g)	Pan	1.1158	3.0238

Total (g) Recov'd	8.5264
Total (%) Recov'd	99.5

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	110.6977
Grams Beaker (Tare)	102.1296
GramsGravel/Sand	8.5681

I. Sample Preparation

Grams As Received Sample	29.3315
Percent (%) Solids	36.9
Grams Oven Dried Sample	10.8233

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID C65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	31.8587	30.6047	29.3601	31.4518	33.2828	42.0259	34.0134
Grams of Tare	31.7816	30.5618	29.3345	31.4360	33.2743	42.0215	34.0091
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0749	0.0407	0.0234	0.0136	0.0063	0.0022	0.0021
Total Grams Sample X 50	1.7100	0.8650	0.4900	0.3650	0.2050	0.0050	0.1035

Analyst: CC Date: 6/17/2015
Reviewed by: EL Date: 6/30/2015

K1505440wet.cc8

ALS Environmental
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.alsglobal.com

July 02, 2015 **Anal tical Re ort for Service Re uest o** K1505775

Jennifer Kassakian
Industrial Economics, Inc.
2067 Massachusetts Ave.
Cambridge, MA 02140

RE Cemeter Cree

Dear Jennifer,

Enclosed are the results of the sample(s) submitted to our laboratory May 29, 2015
For your reference, these analyses have been assigned our service request number **1 0 .**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3364. You may also contact me via email at howard.holmes@alsglobal.com.

Respectfully submitted,

A S rou USA, Cor . dba A S Environmental

Howard Holmes
Project Manager

ALS Environmental
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Table of Contents

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
ISO 17025	http://www.pjlabs.com/	L14-50
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Chain of Custody

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Client contact	Jennifer Kassakian	Received	5/29/2015
Client name	Industrial Economics, Inc		
Lims project name	Portland Harbor 2015		
Client project name	Cemetery Creek		

K1505775

Tests Requested
PSEP Particle Size
9060 TOC
Total Solids

	Rinearson	8 oz Jar	PS	TOC	TS	Date	Time	Comments
1	1574	1	X	X	X	5/27/2015	1035	
2	2598	1	X	X	X	5/27/2015	1015	
3	4646	1	X	X	X	5/27/2015	1050	
4	5670	1	X	X	X	5/27/2015	1120	
5	8742	1	Hold	Hold	Hold	5/27/2015	1056	EMPTY
6	9254	1	X	X	X	5/27/2015	1010	Limited Sample
7	9766	1	X	X	X	5/27/2015	1110	
8	12838	1	X	X	X	5/27/2015	1000	
9	13862	1	X	X	X	5/27/2015	1025	
10	14374	1	Hold	Hold	Hold	5/27/2015	1105	EMPTY
11	Reach #1	1	X	X	X	5/27/2015	915	

PC 112

(Cemetary Creek) Cooler Receipt and Preservation Form

Client / Project: Fish N Wildlife - Industrial Economics Service Request K15 0 5775

Received: 5.29.15 Opened: 5.29.15 By: bw Unloaded: 5.29.15 By: bw

1. Samples were received via? *Mail* *Fed Ex* *UPS* *DHL* *PDX* (*Courier*) *Hand Delivered*
2. Samples were received in: (circle) (*Cooler*) *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y (N) If yes, how many and where? _____
   If present, were custody seals intact? Y (N) If present, were they signed and dated? Y (N)

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID (NA)	Tracking Number (NA)	Filed
0.1	0.1	2.1	2.1	0	3+9			

4. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* (*Wet Ice*) *Dry Ice* *Sleeves* _____
5. Were custody papers properly filled out (ink, signed, etc.)? NA Y (N)
6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA (Y) N
7. Were all sample labels complete (i.e analysis, preservation, etc.)? (NA) Y N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* (NA) Y N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA (Y) N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* (NA) Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* (NA) Y N
12. Was C12/Res negative? (NA) Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: Did not receive Chain of Custody.

Page _____ ***of*** _____

General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	05/27/15
Sample Matrix:	Sediment	**Date Received:**	05/29/15
Analysis Method:	160.3 Modified	**Units:**	Percent
Prep Method:	None	**Basis:**	As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Q
1574	K1505775-001	**51.2**	-	-	1	06/29/15 16:35	
2598	K1505775-002	**63.9**	-	-	1	06/03/15 15:08	
4646	K1505775-003	**58.5**	-	-	1	06/03/15 15:08	
5670	K1505775-004	**47.6**	-	-	1	06/03/15 15:08	
9254	K1505775-006	**82.0**	-	-	1	06/03/15 15:08	
9766	K1505775-007	**50.5**	-	-	1	06/29/15 16:35	
12838	K1505775-008	**46.8**	-	-	1	06/03/15 15:08	
13862	K1505775-009	**56.2**	-	-	1	06/03/15 15:08	
Reach #1	K1505775-011	**78.0**	-	-	1	06/05/15 11:49	

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QA/QC Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project	Cemetery Creek	**Date Collected:**	05/27/15
Sample Matrix:	Sediment	**Date Received:**	05/29/15
Analysis Method:	160.3 Modified	**Units:**	Percent
Prep Method:	None	**Basis:**	As Received

Replicate Sample Summary

Solids, Total

Sample Name:	Lab Code:	MRL	MDL	Sample Result	Duplicate Result	Average	RPD	RPD Limit	Date Analyzed
1574	K1505775-001DUP	-	-	51.2	51.4	51.3	<1	20	06/29/15
4646	K1505775-003DUP	-	-	58.5	57.9	58.2	1	20	06/03/15

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	05/27/15
Sample Matrix:	Sediment	**Date Received:**	05/29/15
Analysis Method:	9060	**Units:**	Percent
Prep Method:	Method	**Basis:**	Dry, per Method

Carbon, Total Organic (TOC)

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
1574	K1505775-001	**1.44**	0.10	0.02	1	06/12/15 12:32	6/12/15	
2598	K1505775-002	**0.75**	0.10	0.02	1	06/12/15 12:32	6/12/15	
4646	K1505775-003	**1.01**	0.10	0.02	1	06/12/15 12:32	6/12/15	
5670	K1505775-004	**1.77**	0.10	0.02	1	06/12/15 12:32	6/12/15	
9254	K1505775-006	**0.06 J**	0.10	0.02	1	06/12/15 12:32	6/12/15	
9766	K1505775-007	**1.35**	0.10	0.02	1	06/12/15 12:32	6/12/15	
12838	K1505775-008	**1.67**	0.10	0.02	1	06/12/15 12:32	6/12/15	
13862	K1505775-009	**1.30**	0.10	0.02	1	06/12/15 12:32	6/12/15	
Reach #1	K1505775-011	**0.55**	0.10	0.02	1	06/12/15 12:32	6/12/15	
Method Blank	K1505775-MB	**0.02 J**	0.10	0.02	1	06/12/15 12:32	6/12/15	

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QA/QC Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project	Cemetery Creek	**Date Collected:**	NA
Sample Matrix:	Sediment	**Date Received:**	NA
		Date Analyzed:	06/12/15

Replicate Sample Summary
General Chemistry Parameters

Sample Name:	Batch QC	**Units:**	Percent
Lab Code:	K1505691-001	**Basis:**	Dry, per Method

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample K1505691-001DUP Result	Average	RPD	RPD Limit
Carbon, Total Organic (TOC)	9060	0.10	0.02	2.91	2.89	2.90	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	N/A
Sample Matrix:	Sediment	**Date Received:**	N/A
		Date Analyzed:	06/12/15
		Date Extracted:	06/12/15

Duplicate Matrix Spike Summary
Carbon, Total Organic (TOC)

Sample Name:	Batch QC	**Units:**	Percent
Lab Code:	K1505691-001	**Basis:**	Dry, per Method
Analysis Method:	9060		
Prep Method:	Method		

		Matrix Spike			Duplicate Matrix Spike					
		K1505691-001MS			K1505691-001DMS					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**% Rec**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**	**RPD**	**RPD Limit**
Carbon, Total Organic (TOC)	2.91	5.48	2.41	107	5.39	2.39	104	70-122	2	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Analyzed:**	06/12/15
Sample Matrix:	Sediment	**Date Extracted:**	06/12/15

Lab Control Sample Summary
Carbon, Total Organic (TOC)

Analysis Method:	9060	**Units:**	Percent
Prep Method:	Method	**Basis:**	Dry, per Method
		Analysis Lot:	449104

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1505775-LCS	0.550	0.54	101	72-122

Client: Industrial Economics, Inc. **Service Request:** K1505775
Project: Cemetery Creek

Continuing Calibration Verification (CCV) Summary

Carbon, Total Organic (TOC)

Analysis Method: 9060 **Units:** Percent

	Analysis Lot	Lab Code	Date Analyzed	True Value	Measured Value	Percent Recovery	Acceptance Limits
CCV1	449104	KQ1506458-01	06/12/15 12:32	12.0	12.1	101	85-115
CCV2	449104	KQ1506458-02	06/12/15 12:32	12.0	13.0	108	85-115
CCV3	449104	KQ1506458-03	06/12/15 12:32	12.0	13.1	109	85-115

Client: Industrial Economics, Inc. **Service Request:**K1505775
Project: Cemetery Creek

Continuing Calibration Blank (CCB) Summary
Carbon, Total Organic (TOC)

Analysis Method: 9060 **Units:**Percent

	Analysis Lot	Lab Code	Date Analyzed	MRL	MDL	Result	Q
CCB1	449104	KQ1506458-04	06/12/15 12:32	0.10	0.02	0.02	J
CCB2	449104	KQ1506458-05	06/12/15 12:32	0.10	0.02	0.02	J
CCB3	449104	KQ1506458-06	06/12/15 12:32	0.10	0.02	0.02	J

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 1574
Lab Code: K1505775-001

Sand Fraction:	Dry Weight (Grams)	9.8247
Sand Fraction:	Weight Recovered (Grams)	9.6264
Sand Fraction:	Percent Recovery	97.98

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0000	0.00
Very Coarse Sand	-1 to 0 Ø	0.0343	0.22
Coarse Sand	0 to 1 Ø	0.0140	0.09
Medium Sand	1 to 2 Ø	0.0750	0.49
Fine Sand	2 to 3 Ø	2.7863	18.14
Very Fine Sand	3 to 4 Ø	4.5285	29.48
62.5 µm	4 to 5 Ø	4.2950	27.96
31.3 µm	5 to 6 Ø	1.7250	11.23
15.6 µm	6 to 7 Ø	0.6250	4.07
7.8 µm	7 to 8 Ø	0.5100	3.32
3.9 µm	8 to 9 Ø	0.3800	2.47
1.95 µm	9 to 10 Ø	0.0300	0.20
0.98 µm	> 10 Ø	0.0085	0.06
		15.0116	97.71

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 2598
Lab Code: K1505775-002

Sand Fraction:	Dry Weight (Grams)	16.1246
Sand Fraction:	Weight Recovered (Grams)	15.7494
Sand Fraction:	Percent Recovery	97.67

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	2.9501	15.38
Very Coarse Sand	-1 to 0 Ø	1.3721	7.15
Coarse Sand	0 to 1 Ø	1.1657	6.08
Medium Sand	1 to 2 Ø	0.6944	3.62
Fine Sand	2 to 3 Ø	2.8514	14.87
Very Fine Sand	3 to 4 Ø	5.0214	26.18
62.5 µm	4 to 5 Ø	2.2550	11.76
31.3 µm	5 to 6 Ø	1.0850	5.66
15.6 µm	6 to 7 Ø	0.2350	1.23
7.8 µm	7 to 8 Ø	0.6250	3.26
3.9 µm	8 to 9 Ø	0.2750	1.43
1.95 µm	9 to 10 Ø	-0.0050	0.00
0.98 µm	> 10 Ø	0.0385	0.20
		18.5636	96.81

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 4646
Lab Code: K1505775-003

Sand Fraction:	Dry Weight (Grams)	11.8966
Sand Fraction:	Weight Recovered (Grams)	11.6626
Sand Fraction:	Percent Recovery	98.03

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0952	0.54
Very Coarse Sand	-1 to 0 Ø	0.0907	0.52
Coarse Sand	0 to 1 Ø	0.1148	0.65
Medium Sand	1 to 2 Ø	0.3207	1.83
Fine Sand	2 to 3 Ø	1.5894	9.06
Very Fine Sand	3 to 4 Ø	6.4516	36.76
62.5 µm	4 to 5 Ø	5.3450	30.45
31.3 µm	5 to 6 Ø	1.7800	10.14
15.6 µm	6 to 7 Ø	0.4100	2.34
7.8 µm	7 to 8 Ø	0.6750	3.85
3.9 µm	8 to 9 Ø	0.3000	1.71
1.95 µm	9 to 10 Ø	0.0750	0.43
0.98 µm	> 10 Ø	0.0835	0.48
		17.3309	98.74

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 5670
Lab Code: K1505775-004

Sand Fraction:	Dry Weight (Grams)	8.3020
Sand Fraction:	Weight Recovered (Grams)	8.1037
Sand Fraction:	Percent Recovery	97.61

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0465	0.33
Very Coarse Sand	-1 to 0 Ø	0.0436	0.30
Coarse Sand	0 to 1 Ø	0.0562	0.39
Medium Sand	1 to 2 Ø	0.1752	1.22
Fine Sand	2 to 3 Ø	2.6106	18.25
Very Fine Sand	3 to 4 Ø	3.1556	22.06
62.5 µm	4 to 5 Ø	3.7650	26.32
31.3 µm	5 to 6 Ø	1.9950	13.95
15.6 µm	6 to 7 Ø	0.6800	4.75
7.8 µm	7 to 8 Ø	0.9750	6.82
3.9 µm	8 to 9 Ø	0.4650	3.25
1.95 µm	9 to 10 Ø	0.1450	1.01
0.98 µm	> 10 Ø	0.1085	0.76
		14.2212	99.42

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 9254
Lab Code: K1505775-006

Sand Fraction:	Dry Weight (Grams)	65.4877
Sand Fraction:	Weight Recovered (Grams)	65.3599
Sand Fraction:	Percent Recovery	99.80

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	42.2121	64.31
Very Coarse Sand	-1 to 0 Ø	7.2062	10.98
Coarse Sand	0 to 1 Ø	9.5568	14.56
Medium Sand	1 to 2 Ø	4.1712	6.35
Fine Sand	2 to 3 Ø	1.4052	2.14
Very Fine Sand	3 to 4 Ø	0.6243	0.95
62.5 µm	4 to 5 Ø	1.7200	2.62
31.3 µm	5 to 6 Ø	0.4550	0.69
15.6 µm	6 to 7 Ø	0.1350	0.21
7.8 µm	7 to 8 Ø	0.2600	0.40
3.9 µm	8 to 9 Ø	0.0785	0.12
1.95 µm	9 to 10 Ø	-0.0135	0.00
0.98 µm	> 10 Ø	0.0085	0.01
		67.8193	103.34

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 9766
Lab Code: K1505775-007

Sand Fraction:	Dry Weight (Grams)	10.7719
Sand Fraction:	Weight Recovered (Grams)	10.4748
Sand Fraction:	Percent Recovery	97.24

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0765	0.50
Very Coarse Sand	-1 to 0 Ø	0.0058	0.04
Coarse Sand	0 to 1 Ø	0.0315	0.21
Medium Sand	1 to 2 Ø	0.2087	1.37
Fine Sand	2 to 3 Ø	3.9719	26.16
Very Fine Sand	3 to 4 Ø	4.0960	26.97
62.5 µm	4 to 5 Ø	1.4200	9.35
31.3 µm	5 to 6 Ø	1.4200	9.35
15.6 µm	6 to 7 Ø	0.5100	3.36
7.8 µm	7 to 8 Ø	0.7200	4.74
3.9 µm	8 to 9 Ø	0.3150	2.07
1.95 µm	9 to 10 Ø	0.2100	1.38
0.98 µm	> 10 Ø	0.0735	0.48
		13.0589	86.00

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 12838
Lab Code: K1505775-008

Sand Fraction:	Dry Weight (Grams)	9.1807
Sand Fraction:	Weight Recovered (Grams)	8.9704
Sand Fraction:	Percent Recovery	97.71

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0383	0.27
Very Coarse Sand	-1 to 0 Ø	0.0211	0.15
Coarse Sand	0 to 1 Ø	0.0128	0.09
Medium Sand	1 to 2 Ø	0.1471	1.05
Fine Sand	2 to 3 Ø	3.3855	24.06
Very Fine Sand	3 to 4 Ø	3.5041	24.90
62.5 µm	4 to 5 Ø	3.3550	23.84
31.3 µm	5 to 6 Ø	1.5250	10.84
15.6 µm	6 to 7 Ø	0.4600	3.27
7.8 µm	7 to 8 Ø	0.6900	4.90
3.9 µm	8 to 9 Ø	0.0750	0.53
1.95 µm	9 to 10 Ø	0.0600	0.43
0.98 µm	> 10 Ø	0.0635	0.45
		13.3374	94.77

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 13862
Lab Code: K1505775-009

Sand Fraction:	Dry Weight (Grams)	12.2513
Sand Fraction:	Weight Recovered (Grams)	11.9848
Sand Fraction:	Percent Recovery	97.82

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.3237	1.92
Very Coarse Sand	-1 to 0 Ø	0.3498	2.07
Coarse Sand	0 to 1 Ø	0.5156	3.05
Medium Sand	1 to 2 Ø	0.5441	3.22
Fine Sand	2 to 3 Ø	4.4863	26.56
Very Fine Sand	3 to 4 Ø	4.2892	25.39
62.5 µm	4 to 5 Ø	2.1100	12.49
31.3 µm	5 to 6 Ø	1.2250	7.25
15.6 µm	6 to 7 Ø	0.5400	3.20
7.8 µm	7 to 8 Ø	0.6150	3.64
3.9 µm	8 to 9 Ø	0.3650	2.16
1.95 µm	9 to 10 Ø	0.3150	1.86
0.98 µm	> 10 Ø	0.0335	0.20
		15.7122	93.00

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: Reach #1
Lab Code: K1505775-011

Sand Fraction:	Dry Weight (Grams)	29.0059
Sand Fraction:	Weight Recovered (Grams)	28.9089
Sand Fraction:	Percent Recovery	99.67

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	8.9518	28.68
Very Coarse Sand	-1 to 0 Ø	2.1052	6.74
Coarse Sand	0 to 1 Ø	6.5196	20.89
Medium Sand	1 to 2 Ø	6.2118	19.90
Fine Sand	2 to 3 Ø	3.8141	12.22
Very Fine Sand	3 to 4 Ø	0.9876	3.16
62.5 µm	4 to 5 Ø	1.0550	3.38
31.3 µm	5 to 6 Ø	0.6200	1.99
15.6 µm	6 to 7 Ø	0.0100	0.03
7.8 µm	7 to 8 Ø	0.4550	1.46
3.9 µm	8 to 9 Ø	0.1400	0.45
1.95 µm	9 to 10 Ø	0.0450	0.14
0.98 µm	> 10 Ø	0.0485	0.16
		30.9636	99.19

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Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 1574
Lab Code: K1505775-001 dup

Sand Fraction:	Dry Weight (Grams)	10.0360
Sand Fraction:	Weight Recovered (Grams)	9.9044
Sand Fraction:	Percent Recovery	98.69

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0000	0.00
Very Coarse Sand	-1 to 0 Ø	0.0097	0.06
Coarse Sand	0 to 1 Ø	0.0305	0.20
Medium Sand	1 to 2 Ø	0.0602	0.39
Fine Sand	2 to 3 Ø	2.8998	18.88
Very Fine Sand	3 to 4 Ø	4.6123	30.03
62.5 µm	4 to 5 Ø	3.6900	24.02
31.3 µm	5 to 6 Ø	1.7150	11.16
15.6 µm	6 to 7 Ø	0.4650	3.03
7.8 µm	7 to 8 Ø	0.6750	4.39
3.9 µm	8 to 9 Ø	0.2500	1.63
1.95 µm	9 to 10 Ø	0.0850	0.55
0.98 µm	> 10 Ø	0.0735	0.48
		14.5660	94.82

ALS Group USA, Corp.
dba ALS Environmental
Analytical Report

Client:	Industrial Economics, Inc.	**Service Request:**	K1505775
Project:	Cemetery Creek	**Date Collected:**	5/27/2015
Sample Matrix:	Sediment	**Date Received:**	5/29/2015
		Date Analyzed:	6/16/2015

Particle Size Determination
Puget Sound Estuary Program Protocol

Sample Name: 1574
Lab Code: K1505775-001 trp

Sand Fraction:	Dry Weight (Grams)	9.9912
Sand Fraction:	Weight Recovered (Grams)	9.8009
Sand Fraction:	Percent Recovery	98.10

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0000	0.00
Very Coarse Sand	-1 to 0 Ø	0.0077	0.05
Coarse Sand	0 to 1 Ø	0.0120	0.08
Medium Sand	1 to 2 Ø	0.0415	0.27
Fine Sand	2 to 3 Ø	2.5601	16.64
Very Fine Sand	3 to 4 Ø	4.9831	32.39
62.5 µm	4 to 5 Ø	2.9050	18.88
31.3 µm	5 to 6 Ø	1.8550	12.06
15.6 µm	6 to 7 Ø	0.3000	1.95
7.8 µm	7 to 8 Ø	0.6600	4.29
3.9 µm	8 to 9 Ø	0.2600	1.69
1.95 µm	9 to 10 Ø	0.1300	0.84
0.98 µm	> 10 Ø	0.0335	0.22
		13.7479	89.36

Raw Data

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Benchsheet

Service Request #:	K1505856, KQ1505917, K1505148, K1505775, K1505617	Run #:	447583
Test:	TS	Balance ID:	K-Balance-16
Method:	160.3 Modified		

Pan ID:	Lab Code:	Tare (g)	Wet Wt. (g)	Tare + Dry Wt. (g)	Dry Weight (g)	% Total Solids	RPD
	K1505856-031	1.32	9.64	2.22	0.900	9.34	
	K1505856-031DUP	1.31	13.08	2.62	1.31	10.0	7
	K1505856-032	1.32	9.72	2.08	0.760	7.82	
	K1505856-033	1.31	13.56	2.48	1.17	8.63	% Moisture
	K1505148-001	1.33	17.14	12.33	11.0	64.2	35.8
	K1505148-002	1.33	11.91	5.31	3.98	33.4	66.6
	K1505148-003	1.32	14.29	6.28	4.96	34.7	65.3
	K1505148-004	1.32	9.69	3.05	1.73	17.9	82.1
	K1505148-005	1.33	17.40	13.27	11.9	68.6	31.4
	K1505775-001	1.32	27.21	16.44	15.1	55.6	~~44.4~~
	K1505775-002	1.33	20.59	14.48	13.2	63.9	~~36.1~~
	K1505775-003	1.34	17.55	11.61	10.3	58.5	
	K1505775-003DUP	1.32	16.69	10.99	9.67	57.9	1
	K1505775-004	1.34	12.32	7.20	5.86	47.6	
	K1505775-006	1.30	15.96	14.39	13.1	82.0	
	K1505775-007	1.31	11.86	7.60	6.29	53.0	
	K1505775-008	1.33	8.70	5.40	4.07	46.8	
	K1505775-009	1.33	14.10	9.25	7.92	56.2	
	K1505617-002	1.34	15.49	15.39	14.1	90.7	

	Oven ID	Temp In	Temp Out	Date In	Time In	Date Out	Time Out	Thermometer ID
Oven1	K-OVEN-07	105	105	6/3/2015	15:08	6/4/2015	08:23	

	Cal EQID	Cal Start Value	Cal End Value	Start Date	Start Time	End Date	End Time
Calibration1	K-Balance-16	1.00 100.00	1.00 100.01	6/3/2015	14:26	6/3/2015	15:08
Calibration2	K-Balance-16	1.00 100.00	1.00 100.00	6/4/2015	08:43	6/4/2015	08:48

Comments: BK

Analytical Results Summary

Instrument Name: K-Balance-20 **Analyst:** DMADDEN **Analysis Lot:** 448258 **Method/Testcode:** 160.3 Modified/Moisture

Lab Code	Target Analytes	QC	Parent Sample	Matrix	Raw Result	Sample Amt.	Final Result	Dil	MDL	PQL	% Rec	% RSD	Date Analyzed	QC?	Tier
K1505148-001	Moisture	N/A		Soil	35.80 Percent		35.8 Percent	1					6/3/15 14:26:00	N	V
K1505148-002	Moisture	N/A		Soil	66.60 Percent		66.6 Percent	1					6/3/15 14:26:00	N	V
K1505148-003	Moisture	N/A		Soil	65.30 Percent		65.3 Percent	1					6/3/15 14:26:00	N	V
K1505148-004	Moisture	N/A		Soil	82.10 Percent		82.1 Percent	1					6/3/15 14:26:00	N	V
K1505148-005	Moisture	N/A		Soil	31.40 Percent		31.4 Percent	1					6/3/15 14:26:00	N	V

DJM 6/9/15

# indicates Final Result is not yet adjusted for Solids because it has not yet been determined.

Benchsheet

Service Request #:	**K1505810, KQ1506020, K1505775**	**Run #:**	**447921**
Test:	**TS**	**Balance ID:**	**K-Balance-16**
Method:	**160.3 Modified**		

Pan ID:	Lab Code:	Tare (g)	Wet Wt. (g)	Tare + Dry Wt. (g)	Dry Weight (g)	% Total Solids	RPD
	K1505810-001	1.31	12.04	12.50	11.2	92.9	
	K1505810-001DUP	1.31	11.28	11.75	10.4	92.6	<1
	K1505810-002	1.30	13.03	13.43	12.1	93.1	
	K1505775-011	1.30	20.36	17.18	15.9	78.0	

	Oven ID	Temp In	Temp Out	Date In	Time In	Date Out	Time Out	Thermometer ID
Oven1	K-OVEN-07	105	105	6/5/2015	11:49	6/8/2015	08:26	

	Cal EQID	Cal Start Value	Cal End Value	Start Date	Start Time	End Date	End Time
Calibration1	K-Balance-16	1.00 100.01	1.00 100.00	6/5/2015	11:43	6/5/2015	11:49
Calibration2	K-Balance-16	1.00, 100.01	0.98, 100.01	6/8/2015	08:50	6/8/2015	08:50

Comments: BK/DJM

Analytical Results Summary

Instrument Name: K-Balance-16 **Analyst:** DMADDEN **Analysis Lot:** 447921 **Method/Testcode:** 160.3 Modified/TS

Lab Code	Target Analytes	QC	Parent Sample	Matrix	Raw Result	Sample Amt.	Final Result	Dil	MDL	PQL	% Rec	% RSD	Date Analyzed	QC?	Tier
K1505775-011	Solids, Total	N/A		Sediment	78.00 Percent	20.36 g	78.0 Percent	1					6/5/15 11:49	N	IV
K1505810-001	Solids, Total	N/A		Misc. Solid	92.90 Percent	12.04 g	92.9 Percent	1					6/5/15 11:49	N	II
K1505810-002	Solids, Total	N/A		Misc. Solid	93.10 Percent	13.03 g	93.1 Percent	1					6/5/15 11:49	N	II
KQ1506020-01	Solids, Total	DUP	K1505810-001	Misc. Solid	92.60 Percent	11.28 g	92.6 Percent	1				<1	6/5/15 11:49	N	II

DM 6/8/15

# indicates Final Result is not yet adjusted for Solids because it has not yet been determined.

Benchsheet

Service Request #:	K1505148, K1505775, KQ1507075, K1506922	Run #:	451138
Test:	TS	Balance ID:	K-Balance-16
Method:	160.3 Modified		

Pan ID:	Lab Code:	Tare (g)	Wet Wt. (g)	Tare + Dry Wt. (g)	Dry Weight (g)	% Total Solids	RPD
	K1505148-002	1.30	8.32	4.49	3.19	38.3	
	K1505148-003	1.29	9.70	5.15	3.86	39.8	
	K1505775-001	1.30	24.55	13.87	12.6	51.2	
	K1505775-001DUP	1.29	20.28	11.72	10.4	51.4	<1
	K1505775-007	1.29	25.60	14.21	12.9	50.5	
	K1506922-001	1.29	10.61	10.40	9.11	85.9	

	Oven ID	Temp In	Temp Out	Date In	Time In	Date Out	Time Out	Thermometer ID
Oven1	K-OVEN-07	105	105	6/29/2015	16:35	6/30/2015	08:22	

	Cal EQID	Cal Start Value	Cal End Value	Start Date	Start Time	End Date	End Time
Calibration1	K-Balance-16	1.00, 100.01	0.99, 100.01	6/29/2015	16:23	6/29/2015	16:35
Calibration2	K-Balance-16	1.00, 100.01	1.00, 100.00	6/30/2015	08:45	6/30/2015	08:47

6/30/15

Comments: DJM

Analytical Results Summary

Instrument Name: K-Balance-16 **Analyst:** DMADDEN **Analysis Lot:** 451138 **Method/Testcode:** 160.3 Modified/TS

Lab Code	Target Analytes	QC	Parent Sample	Matrix	Raw Result	Sample Amt.	Final Result	Dil	MDL	PQL	% Rec	% RSD	Date Analyzed	QC?	Tier
K1505148-002	Solids, Total	N/A		Soil	38.30 Percent	8.32 g	38.3 Percent	1					6/29/15 16:35	N	V
K1505148-003	Solids, Total	N/A		Soil	39.80 Percent	9.70 g	39.8 Percent	1					6/29/15 16:35	N	V
K1505775-001	Solids, Total	N/A		Sediment	51.20 Percent	24.55 g	51.2 Percent	1					6/29/15 16:35	N	IV
K1505775-007	Solids, Total	N/A		Sediment	50.50 Percent	25.60 g	50.5 Percent	1					6/29/15 16:35	N	IV
K1506922-001	Solids, Total	N/A		Soil	85.90 Percent	10.61 g	85.9 Percent	1					6/29/15 16:35	N	IV
KQ1507075-01	Solids, Total	DUP	K1505775-001	Sediment	51.40 Percent	20.28 g	51.4 Percent	1				<1	6/29/15 16:35	N	IV

DJM 6/30/2015

# indicates Final Result is not yet adjusted for Solids because it has not yet been determined.

Work Request # (Original) K1505691, 5775

Tier: V IV

Date Analyzed: 6/12/15

Analyst: AB

Analysis: TOC Soil/9060

Run # 449104

DATA QUALITY REPORT
INORGANICS

Explain any "no" responses to questions below, and any corrective actions in the comments section below.

1.	Is the method name and number correct and appropriate?	yes/no/NA
2.	Holding times met for all analyses and for all samples?	yes/no/NA
3.	Are calculations correct?	yes/no/NA
4.	Is the reporting basis correct? (Dry Weight)	yes/no/NA
5.	All quality control criteria met?	yes/no
6.	Is the calibration curve correlation coefficient ≥ 0.995?	yes/no/NA
7.	MBs, CCVs, CCBs, LCSs, Dups, and Spikes, analyzed at proper frequency?	yes/no/NA
8.	Are ICVs, CCVs, and CCBs all within acceptance limits?	yes/no/NA
9.	Are results for methods blanks all ND?	yes/no/NA
10.	Are all QC samples within acceptance criteria? (LCS % rec, MS/DMS % rec, DUP or MS/DMS RPDs, etc.)	yes/no/NA
11.	Are all exceptions explained?	yes/no/NA
12.	Have all applicable service requests been reviewed?	yes/no/NA
13.	Are all samples labeled correctly?	yes/no/NA
14.	Have all instructions on the service request been followed? (e.g. Special MRLs, QC on a specific sample, Form V)	yes/no/NA
15.	Are detection limits and units reported correctly?	yes/no/NA
16.	Is the unused space on the benchsheet crossed out?	yes/no/NA
17.	Was analysis turned in by the due date? (n-2) (If not record SR#)	yes/no/NA K1505691 due 6/15/15

COMMENTS:

Final Approved by: [signature] Date: 6/16/15

DQREPORT

Analytical Results Summary

Instrument Name: K-TOC-04 **Analyst:** DBRADBURY **Analysis Lot:** 449104 **Method/Testcode:** 9060/TOC

Lab Code	Target Analytes	QC	Parent Sample	Matrix	Raw Result	Sample Amt.	Final Result	Dil	MDL	PQL	% Rec	% RSD	Date Analyzed	QC?	Tier
K1505691-001	Carbon, Total Organic (TOC)	N/A		Sediment	2.91 Percent		2.91 Percent	1	0.02	0.10			6/12/15 12:32:00	Y	V
K1505775-001	Carbon, Total Organic (TOC)	N/A		Sediment	1.44 Percent		1.44 Percent	1	0.02	0.10			6/12/15 12:32:00	N	IV
K1505775-002	Carbon, Total Organic (TOC)	N/A		Sediment	0.75 Percent		0.75 Percent	1	0.02	0.10			6/12/15 12:32:00	N	IV
K1505775-003	Carbon, Total Organic (TOC)	N/A		Sediment	1.01 Percent		1.01 Percent	1	0.02	0.10			6/12/15 12:32:00	N	IV
K1505775-004	Carbon, Total Organic (TOC)	N/A		Sediment	1.77 Percent		1.77 Percent	1	0.02	0.10			6/12/15 12:32:00	N	IV
K1505775-006	Carbon, Total Organic (TOC)	N/A		Sediment	0.06 Percent		0.06 Percent J	1	0.02	0.10			6/12/15 12:32:00	N	IV
K1505775-007	Carbon, Total Organic (TOC)	N/A		Sediment	1.35 Percent		1.35 Percent	1	0.02	0.10			6/12/15 12:32:00	N	IV
K1505775-008	Carbon, Total Organic (TOC)	N/A		Sediment	1.67 Percent		1.67 Percent	1	0.02	0.10			6/12/15 12:32:00	N	IV
K1505775-009	Carbon, Total Organic (TOC)	N/A		Sediment	1.30 Percent		1.30 Percent	1	0.02	0.10			6/12/15 12:32:00	N	IV
K1505775-011	Carbon, Total Organic (TOC)	N/A		Sediment	0.55 Percent		0.55 Percent	1	0.02	0.10			6/12/15 12:32:00	N	IV
KQ1506457-01	Carbon, Total Organic (TOC)	DUP	K1505691-001	Sediment	2.89 Pereent		2.89 Percent	1	0.02	0.10		<1	6/12/15 12:32:00	N	V
KQ1506457-02	Carbon, Total Organic (TOC)	MS	K1505691-001	Sediment	5.48 Percent		5.48 Percent	1	0.02	0.10	107		6/12/15 12:32:00	N	V
KQ1506457-03	Carbon, Total Organic (TOC)	DMS	K1505691-001	Sediment	5.39 Percent		5.39 Percent	1	0.02	0.10	104	2	6/12/15 12:32:00	N	V
KQ1506457-04	Carbon, Total Organic (TOC)	LCS		Sediment	0.55 Percent		0.550 Percent	1	0.02	0.10	101		6/12/15 12:32:00	N	V
KQ1506457-05	Carbon, Total Organic (TOC)	MB		Sediment	0.02 Percent		0.02 Percent J	1	0.02	0.10			6/12/15 12:32:00	N	V
KQ1506458-01	Carbon, Total Organic (TOC)	CCV		Sediment	12.14 Percent		12.1 Percent	1			101		6/12/15 12:32:00	N	V
KQ1506458-02	Carbon, Total Organic (TOC)	CCV		Sediment	12.97 Percent		13.0 Percent	1			108		6/12/15 12:32:00	N	V
KQ1506458-03	Carbon, Total Organic (TOC)	CCV		Sediment	13.13 Percent		13.1 Percent	1			109		6/12/15 12:32:00	N	V
KQ1506458-04	Carbon, Total Organic (TOC)	CCB		Sediment	0.02 Percent		0.02 Percent J	1	0.02	0.10			6/12/15 12:32:00	N	V
KQ1506458-05	Carbon, Total Organic (TOC)	CCB		Sediment	0.02 Percent		0.02 Percent J	1	0.02	0.10			6/12/15 12:32:00	N	V
KQ1506458-06	Carbon, Total Organic (TOC)	CCB		Sediment	0.02 Percent		0.02 Percent J	1	0.02	0.10			6/12/15 12:32:00	N	V

AB 6/15/15

# indicates Final Result is not yet adjusted for Solids because it has not yet been determined.

aj-analyzer multi EA 4000; multiWin 5.2; Serial number: N4-138/M
% TOTAL ORGANIC CARBON

AnalysisGroup

AnalysisGroup: % TOC

Remark: % Total Organic Carbon by EPA 9060 M Run # 449104

Created on: 3/16/2013 11:53:50 AM
Last modification: 6/12/2015 5:18:50 PM
State: solid

Analysis name	Result (average)	Sample quantity	Time of analysis
CCV	TC: 12.14%	25.200mg % REC = 101	6/12/2015 12:32:45 PM
CCB	TC: 0.021%	250.000mg	6/12/2015 12:47:55 PM
LCS	TC: 0.55%	251.200mg % REC = 101	6/12/2015 12:56:30 PM
MB	TC: 0.021%	250.000mg	6/12/2015 1:08:12 PM
K1505691-001	TC: 2.91%	251.600mg	6/12/2015 1:16:46 PM
K1505691-001d	TC: 2.89%	251.100mg	6/12/2015 1:33:49 PM
K1505691-001ms	TC: 5.48%	126.700mg	6/12/2015 1:50:58 PM
K1505691-001msd	TC: 5.39%	127.200mg	6/12/2015 2:07:57 PM
K1505775-001	TC: 1.44%	250.900mg	6/12/2015 2:25:07 PM
K1505775-002	TC: 0.75%	250.800mg	6/12/2015 2:37:37 PM
K1505775-003	TC: 1.01%	250.700mg	6/12/2015 2:49:21 PM
K1505775-004	TC: 1.77%	250.300mg	6/12/2015 3:01:51 PM
CCV	TC: 12.97%	25.300mg % REC = 108	6/12/2015 3:16:59 PM
CCB	TC: 0.021%	250.000mg	6/12/2015 3:35:09 PM
K1505775-006	TC: 0.063%	252.900mg	6/12/2015 3:43:42 PM
K1505775-007	TC: 1.35%	253.200mg	6/12/2015 3:54:10 PM
K1505775-008	TC: 1.67%	251.100mg	6/12/2015 4:11:14 PM
K1505775-009	TC: 1.30%	252.300mg	6/12/2015 4:26:53 PM
K1505775-011	TC: 0.55%	250.900mg	6/12/2015 4:40:49 PM
CCV	TC: 13.13%	25.200mg % REC = 109	6/12/2015 4:52:48 PM
CCB	TC: 0.021%	250.000mg	6/12/2015 5:10:58 PM

Service Request: K1505691, 5775 **Method:** EPA 9060

Date Weighed: 6/12/15 **Analysis:** Total Organic Carbon in Soil

Analyst: AB **Prep Run / Run #** 238128 / 449104

Sample Position	Sample ID	Weight (mg)
1	Clean	NA
2	CCV	25.2
3	CCB	250.0
4	LCS	251.2
5	MB	250.0
6	K1505691-001	251.6
7	K1505691-001d	251.1
8	K1505691-001ms	126.7
9	K1505691-001msd	127.2
10	K1505775-001	250.9
11	K1505775-002	250.8
12	K1505775-003	250.7
13	K1505775-004	250.3
14	CCV	25.3
15	CCB	250.0
16	K1505775-006	252.9
17	K1505775-007	253.2
18	K1505775-008	251.1
19	K1505775-009	252.3
20	K1505775-011	250.9
21	CCV	25.2
22	CCB	250.0
23		
24		

Sample Position	Sample ID	Weight (mg)
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		

MS CaCO3 (mg)	K1505691-001ms	25.4
MSD CaCO3 (mg)	K1505691-001msd	25.3

Balance ID: K-BALANCE-38 **Oven ID:** K-OVEN-01

HCL ID: TOC/2-81-G **Thermometer ID:** K31316

CCV: CaCO3, Alfa Aesar, ID: 13-TOC-01-1C, Lot # J05X011, TV = 12.0% % REC = 101, 108, 109

LCS: Nutrients in Soil, ERA, ID: TOCS/1-17-F, Lot # D087-542, TV = 0.543% % REC = 101

MS: (mg CCV)(% TV CCV) / (mg sample) = (25.4)(12) / 126.7 = 2.41 % REC = 107

MSD: (mg CCV)(% TV CCV) / (mg sample) = (25.3)(12) / 127.2 = 2.39 % REC = 104

Work Request # Original ( ) 5775

Tier:

Date Analyzed: 6/16/15

Analyst: CC

Analysis: GS

45103

DATA QUALITY REPORT
INORGANICS

Explain any "no" responses to questions below, and any corrective actions in the comments section below.

1.	Is the method name and number correct and appropriate?	yes/no/NA
2.	Holding times met for all analyses and for all samples?	yes/no/NA
3.	Are calculations correct?	yes/no/NA
4.	Is the reporting basis correct? (Dry Weight)	yes/no/NA
5.	All quality control criteria met?	yes/no
6.	Is the calibration curve correlation coefficient ≥ 0.995?	yes/no/NA
7.	MBs, CCVs, CCBs, LCSs, Dups, and Spikes, analyzed at proper frequency?	yes/no/NA
8.	Are ICVs, CCVs, and CCBs all within acceptance limits?	yes/no/NA
9.	Are results for methods blanks all ND?	yes/no/NA
10.	Are all QC samples within acceptance criteria? (LCS % rec, MS/DMS % rec, DUP or MS/DMS RPDs, etc.)	yes/no/NA
11.	Are all exceptions explained?	yes/no/NA
12.	Have all applicable service requests been reviewed?	yes/no/NA
13.	Are all samples labeled correctly?	yes/no/NA
14.	Have all instructions on the service request been followed? (e.g. Special MRLs, QC on a specific sample, Form V)	yes/no/NA
15.	Are detection limits and units reported correctly?	yes/no/NA
16.	Is the unused space on the benchsheet crossed out?	yes/no/NA
17.	Was analysis turned in by the due date? (n-2) (If not record SR#)	yes/no/NA

COMMENTS:

5775-7 - % of total weight recover was outside ALS acceptance limits at 86%.

Final Approved by: [signature] Date: 6/30/15

DQREPORT

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-001

Client:	Industrial Economics, Inc.	Sample Name:	1574
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0000	N/A
V.C. Sand, 1.00 mm (g)	18	0.0343	N/A
C. Sand, 0.500 mm (g)	35	0.0140	N/A
M. Sand, 0.250 mm (g)	60	0.0750	N/A
F. Sand, 0.125 mm (g)	120	2.7863	N/A
V.F. Sand, 0.0625 mm (g)	230	4.5285	N/A
S/C <0.0625 mm (g)	Pan	2.1883	N/A

Total (g) Recov'd	9.6264
Total (%) Recov'd	98.0

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	109.1713
Grams Beaker (Tare)	99.3466
GramsGravel/Sand	9.8247

I. Sample Preparation

Grams As Received Sample	30.0072
Percent (%) Solids	51.2
Grams Oven Dried Sample	15.3637

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	40.4673	29.5439	42.6199	41.4435	26.4487	29.3301	30.7591
Grams of Tare	40.3136	29.4761	42.5866	41.4227	26.4381	29.3271	30.7567
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1515	0.0656	0.0311	0.0186	0.0084	0.0008	0.0002
Total Grams Sample X 50	4.2950	1.7250	0.6250	0.5100	0.3800	0.0300	0.0085

Analyst: CC Date: 6/16/2015
Reviewed by: EL Date: 6/30/2015

K1505775wet.cc1

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-002

Client:	Industrial Economics, Inc.	Sample Name:	2598
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	2.9501	N/A
V.C. Sand, 1.00 mm (g)	18	1.3721	N/A
C. Sand, 0.500 mm (g)	35	1.1657	N/A
M. Sand, 0.250 mm (g)	60	0.6944	N/A
F. Sand, 0.125 mm (g)	120	2.8514	N/A
V.F. Sand, 0.0625 mm (g)	230	5.0214	N/A
S/C <0.0625 mm (g)	Pan	1.6943	N/A

Total (g) Recov'd	15.7494
Total (%) Recov'd	98

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	120.5465
Grams Beaker (Tare)	104.4219
GramsGravel/Sand	16.1246

I. Sample Preparation

Grams As Received Sample	30.0160
Percent (%) Solids	63.9
Grams Oven Dried Sample	19.1802

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	26.7058	40.5941	31.7561	42.1471	40.1805	33.8047	42.5342
Grams of Tare	26.6134	40.5468	31.7305	42.1262	40.1721	33.8018	42.5312
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0902	0.0451	0.0234	0.0187	0.0062	0.0007	0.0008
Total Grams Sample X 50	2.2550	1.0850	0.2350	0.6250	0.2750	-0.0050	0.0385

Analyst: CC Date: 6/16/2015
Reviewed by: EL Date: 6/30/2015

K1505775wet.cc1

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-003

Client:	Industrial Economics, Inc.	Sample Name:	4646
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0952	N/A
V.C. Sand, 1.00 mm (g)	18	0.0907	N/A
C. Sand, 0.500 mm (g)	35	0.1148	N/A
M. Sand, 0.250 mm (g)	60	0.3207	N/A
F. Sand, 0.125 mm (g)	120	1.5894	N/A
V.F. Sand, 0.0625 mm (g)	230	6.4516	N/A
S/C <0.0625 mm (g)	Pan	3.0002	N/A

Total (g) Recov'd	11.6626
Total (%) Recov'd	98.0

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	117.2284
Grams Beaker (Tare)	105.3318
GramsGravel/Sand	11.8966

I. Sample Preparation

Grams As Received Sample	30.0043
Percent (%) Solids	58.5
Grams Oven Dried Sample	17.5525

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	28.8068	40.5535	42.7722	42.0042	29.6298	30.8878	29.2008
Grams of Tare	28.6312	40.4848	42.7391	41.9793	29.6184	30.8824	29.1969
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1734	0.0665	0.0309	0.0227	0.0092	0.0032	0.0017
Total Grams Sample X 50	5.3450	1.7800	0.4100	0.6750	0.3000	0.0750	0.0835

Analyst: CC Date: 6/16/2015
Reviewed by: EL Date: 6/30/2015

K1505775wet.cc1

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-004

Client:	Industrial Economics, Inc.	Sample Name:	5670
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0465	N/A
V.C. Sand, 1.00 mm (g)	18	0.0436	N/A
C. Sand, 0.500 mm (g)	35	0.0562	N/A
M. Sand, 0.250 mm (g)	60	0.1752	N/A
F. Sand, 0.125 mm (g)	120	2.6106	N/A
V.F. Sand, 0.0625 mm (g)	230	3.1556	N/A
S/C <0.0625 mm (g)	Pan	2.0160	N/A

Total (g) Recov'd	8.1037
Total (%) Recov'd	97.6

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	104.0974
Grams Beaker (Tare)	95.7954
GramsGravel/Sand	8.3020

I. Sample Preparation

Grams As Received Sample	30.0496
Percent (%) Solids	47.6
Grams Oven Dried Sample	14.3036

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	30.2156	30.8875	28.1268	40.3470	29.0632	30.1382	42.2359
Grams of Tare	30.0507	30.7979	28.0771	40.3109	29.0466	30.1309	42.2315
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1627	0.0874	0.0475	0.0339	0.0144	0.0051	0.0022
Total Grams Sample X 50	3.7650	1.9950	0.6800	0.9750	0.4650	0.1450	0.1085

Analyst: CC Date: 6/16/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-006

Client:	Industrial Economics, Inc.	Sample Name:	9254
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	42.2121	N/A
V.C. Sand, 1.00 mm (g)	18	7.2062	N/A
C. Sand, 0.500 mm (g)	35	9.5568	N/A
M. Sand, 0.250 mm (g)	60	4.1712	N/A
F. Sand, 0.125 mm (g)	120	1.4052	N/A
V.F. Sand, 0.0625 mm (g)	230	0.6243	N/A
S/C <0.0625 mm (g)	Pan	0.1841	N/A

Total (g) Recov'd	65.3599
Total (%) Recov'd	100

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	166.2018
Grams Beaker (Tare)	100.7141
GramsGravel/Sand	65.4877

I. Sample Preparation

Grams As Received Sample	80.0480
Percent (%) Solids	82.0
Grams Oven Dried Sample	65.6394

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	33.4018	29.8029	30.7901	32.2121	42.2315	41.6015	40.2810
Grams of Tare	33.3467	29.7822	30.7785	32.2032	42.2278	41.5994	40.2786
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0529	0.0185	0.0094	0.0067	0.0015	-0.0001	0.0002
Total Grams Sample X 50	1.7200	0.4550	0.1350	0.2600	0.0785	-0.0135	0.0085

Analyst: CC Date: 6/16/2015
Reviewed by: EL Date: 6/30/2015

K1505775wet.cc2

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-007

Client:	Industrial Economics, Inc.	Sample Name:	9766
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0765	N/A
V.C. Sand, 1.00 mm (g)	18	0.0058	N/A
C. Sand, 0.500 mm (g)	35	0.0315	N/A
M. Sand, 0.250 mm (g)	60	0.2087	N/A
F. Sand, 0.125 mm (g)	120	3.9719	N/A
V.F. Sand, 0.0625 mm (g)	230	4.0960	N/A
S/C <0.0625 mm (g)	Pan	2.0844	N/A

Total (g) Recov'd	10.4748
Total (%) Recov'd	97.2

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	117.5941
Grams Beaker (Tare)	106.8222
GramsGravel/Sand	10.7719

I. Sample Preparation

Grams As Received Sample	30.0687
Percent (%) Solids	50.5
Grams Oven Dried Sample	15.1847

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	30.1921	34.2954	30.0689	40.7953	42.6938	41.9658	41.4389
Grams of Tare	30.0965	34.2282	30.0301	40.7667	42.6796	41.9579	41.4352
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0934	0.0650	0.0366	0.0264	0.0120	0.0057	0.0015
Total Grams Sample X 50	1.4200	1.4200	0.5100	0.7200	0.3150	0.2100	0.0735

Analyst: CC Date: 6/16/2015
Reviewed by: EL Date: 6/30/2015

K1505775wet.cc2

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-008

Client:	Industrial Economics, Inc.	Sample Name:	12838
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0383	N/A
V.C. Sand, 1.00 mm (g)	18	0.0211	N/A
C. Sand, 0.500 mm (g)	35	0.0128	N/A
M. Sand, 0.250 mm (g)	60	0.1471	N/A
F. Sand, 0.125 mm (g)	120	3.3855	N/A
V.F. Sand, 0.0625 mm (g)	230	3.5041	N/A
S/C <0.0625 mm (g)	Pan	1.8615	N/A

Total (g) Recov'd	8.9704
Total (%) Recov'd	97.7

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	112.1412
Grams Beaker (Tare)	102.9605
GramsGravel/Sand	9.1807

I. Sample Preparation

Grams As Received Sample	30.0719
Percent (%) Solids	46.8
Grams Oven Dried Sample	14.0736

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	31.4081	35.2798	42.4015	34.4264	30.7441	40.3238	31.5019
Grams of Tare	31.2813	35.2201	42.3723	34.4064	30.7379	40.3191	31.4984
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1246	0.0575	0.0270	0.0178	0.0040	0.0025	0.0013
Total Grams Sample X 50	3.3550	1.5250	0.4600	0.6900	0.0750	0.0600	0.0635

Analyst: cc Date: 6/16/2015
Reviewed by: el Date: 6/30/2015

K1505775wet.cc3

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-009

Client:	Industrial Economics, Inc.	Sample Name:	13862
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.3237	N/A
V.C. Sand, 1.00 mm (g)	18	0.3498	N/A
C. Sand, 0.500 mm (g)	35	0.5156	N/A
M. Sand, 0.250 mm (g)	60	0.5441	N/A
F. Sand, 0.125 mm (g)	120	4.4863	N/A
V.F. Sand, 0.0625 mm (g)	230	4.2892	N/A
S/C <0.0625 mm (g)	Pan	1.4761	N/A

Total (g) Recov'd	11.9848
Total (%) Recov'd	98

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	116.3083
Grams Beaker (Tare)	104.0570
GramsGravel/Sand	12.2513

I. Sample Preparation

Grams As Received Sample	30.0604
Percent (%) Solids	56.2
Grams Oven Dried Sample	16.8939

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	33.4360	31.8245	31.3924	31.3479	28.7048	34.6701	28.2340
Grams of Tare	33.3297	31.7604	31.3528	31.3191	28.6883	34.6609	28.2311
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1041	0.0619	0.0374	0.0266	0.0143	0.0070	0.0007
Total Grams Sample X 50	2.1100	1.2250	0.5400	0.6150	0.3650	0.3150	0.0335

Analyst: cc Date: 6/16/2015
Reviewed by: el Date: 6/30/2015

K1505775wet.cc3

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-011

Client:	Industrial Economics, Inc.	Sample Name:	Reach #1
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	8.9518	N/A
V.C. Sand, 1.00 mm (g)	18	2.1052	N/A
C. Sand, 0.500 mm (g)	35	6.5196	N/A
M. Sand, 0.250 mm (g)	60	6.2118	N/A
F. Sand, 0.125 mm (g)	120	3.8141	N/A
V.F. Sand, 0.0625 mm (g)	230	0.9876	N/A
S/C <0.0625 mm (g)	Pan	0.3188	N/A

Total (g) Recov'd	28.9089
Total (%) Recov'd	99.7

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	127.9991
Grams Beaker (Tare)	98.9932
GramsGravel/Sand	29.0059

I. Sample Preparation

Grams As Received Sample	40.0213
Percent (%) Solids	78.0
Grams Oven Dried Sample	31.2166

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	34.2842	34.6046	35.2907	29.3953	29.5791	29.3981	40.2944
Grams of Tare	34.2345	34.5760	35.2745	29.3793	29.5722	29.3940	40.2912
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.0475	0.0264	0.0140	0.0138	0.0047	0.0019	0.0010
Total Grams Sample X 50	1.0550	0.6200	0.0100	0.4550	0.1400	0.0450	0.0485

Analyst: cc Date: 6/16/2015
Reviewed by: el Date: 6/30/2015

K1505775wet.cc3

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-001 dup

Client:	Industrial Economics, Inc.	Sample Name:	1574
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0000	N/A
V.C. Sand, 1.00 mm (g)	18	0.0097	N/A
C. Sand, 0.500 mm (g)	35	0.0305	N/A
M. Sand, 0.250 mm (g)	60	0.0602	N/A
F. Sand, 0.125 mm (g)	120	2.8998	N/A
V.F. Sand, 0.0625 mm (g)	230	4.6123	N/A
S/C <0.0625 mm (g)	Pan	2.2919	N/A

Total (g) Recov'd	9.9044
Total (%) Recov'd	98.7

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	111.6584
Grams Beaker (Tare)	101.6224
GramsGravel/Sand	10.0360

I. Sample Preparation

Grams As Received Sample	30.0029
Percent (%) Solids	51.2
Grams Oven Dried Sample	15.3615

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	31.9133	31.6189	41.7035	34.0624	31.8024	31.6595	31.5215
Grams of Tare	31.7720	31.5514	41.6703	34.0385	31.7920	31.6541	31.5178
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1391	0.0653	0.0310	0.0217	0.0082	0.0032	0.0015
Total Grams Sample X 50	3.6900	1.7150	0.4650	0.6750	0.2500	0.0850	0.0735

Analyst: CC Date: 6/16/2015
Reviewed by: EL Date: 6/30/2015

COLUMBIA ANALYTICAL SERVICES, INC.

1317 South 13th Avenue
Kelso, Wa 98626

Method: PSEP Particle Size
Puget Sound Protocol

Service Request #: K1505775
Sample #: K1505775-001 trp

Client:	Industrial Economics, Inc.	Sample Name:	1574
Project:	Cemetery Creek	Date Collected:	5/27/2015
Sample Matrix:	Sediment	Date Received:	5/29/2015
		Date Analyzed:	6/16/2015

I. Sieving Operation	Sieve #	Weight (g)	As Rec'd (g)
Gravel 2.00 mm (g)	10	0.0000	N/A
V.C. Sand, 1.00 mm (g)	18	0.0077	N/A
C. Sand, 0.500 mm (g)	35	0.0120	N/A
M. Sand, 0.250 mm (g)	60	0.0415	N/A
F. Sand, 0.125 mm (g)	120	2.5601	N/A
V.F. Sand, 0.0625 mm (g)	230	4.9831	N/A
S/C <0.0625 mm (g)	Pan	2.1965	N/A

Total (g) Recov'd	9.8009
Total (%) Recov'd	98

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	130.3388
Grams Beaker (Tare)	120.3476
GramsGravel/Sand	9.9912

I. Sample Preparation

Grams As Received Sample	30.0483
Percent (%) Solids	51.2
Grams Oven Dried Sample	15.3847

III. Determination of Silt/Clay Fraction

Temperature: 21 Thermometer ID c65669

	4	5	6	7	8	9	10
Total Volume of Sample (mls)	1000	1000	1000	1000	1000	1000	1000
Amount of Dispersant	10	10	10	10	10	10	10
Volume of Aliquot (mls)	20	20	20	20	20	20	20
Grams Sample, Dispersant & Tare	30.4498	31.8663	40.8511	31.6687	27.0552	31.1458	40.7121
Grams of Tare	30.3247	31.7993	40.8212	31.6448	27.0445	31.1403	40.7092
Grams of Dispersant Correction	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Grams of Sample	0.1229	0.0648	0.0277	0.0217	0.0085	0.0033	0.0007
Total Grams Sample X 50	2.9050	1.8550	0.3000	0.6600	0.2600	0.1300	0.0335

Analyst: CC Date: 6/16/2015
Reviewed by: EL Date: 6/30/2015

U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office
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Vancouver, WA 98683

March 2016