UPPER COLUMBIA RIVER

FINAL
Quality Assurance Project Plan for the Macroinvertebrate Tissue Study Addendum No. 1

Prepared for

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SECTION A: PROJECT MANAGEMENT

A1 TITLE AND APPROVAL SHEET

QUALITY ASSURANCE PROJECT PLAN FOR THE MACROINVERTEBRATE TISSUE STUDY
ADDENDUM NO. 1

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
BERA	baseline ecological risk assessment
CTA	crayfish trap addendum
EPA	U.S. Environmental Protection Agency
FSP	field sampling plan
GPS	global positioning system
HHRA	human health risk assessment
ID	identification
LOE	level of effort
LPIL	lowest practical identification level
MCA	mussel collection addendum
QA	quality assurance
QAPP	quality assurance project plan
SHSP	site health and safety plan
Site	Upper Columbia River site
SOP	standard operating procedure
TAI	Teck American Incorporated
UCR	Upper Columbia River
USFWS	U.S. Fish and Wildlife Service

UNITS OF MEASURE

cm	centimeter(s)
ft	foot/feet
g ww	gram(s) wet weight
in.	inch/inches
m	meter(s)

A3 DISTRIBUTION LIST

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A4 INTRODUCTION

This addendum outlines proposed additional sampling for the Upper Columbia River (UCR, hereafter the Site[1]) macroinvertebrate tissue study, as originally described in the U.S. Environmental Protection Agency (EPA)-approved UCR quality assurance project plan (QAPP) (Exponent et al. 2016). Additional mussel and crayfish sampling from the Site is proposed for late summer or fall 2016 because the target number of samples could not be collected during the spring 2016 sampling event. The additional sampling proposed in this addendum was guided by an interim compositing plan and associated comments provided to TAI by EPA on July 22, 2016 (USEPA 2016). Additions or modifications to the QAPP, the associated field sampling plan (FSP) (QAPP Appendix A), and relevant standard operating procedures (SOPs) (QAPP Appendix A, Attachment A2) are included in this addendum. A summary of the primary additions or modifications to the original QAPP (reflected in this Addendum) is as follows:

- Main QAPP—sampling areas and numbers of samples, specific sampling locations and rationale, and sampling schedule
- FSP (QAPP Appendix A)—field sampling methods (including snorkeling and diving for mussel collection and changes to trap deployment for crayfish sampling), field equipment, and sample labeling
- Site health and safety plan (SHSP) (QAPP Appendix A, Attachment A1)—health and safety information for snorkeling and diving, included in the EPA Region 10 dive plan (Appendix A of this addendum)
- SOPs (QAPP Appendix A, Attachment A2)—amendments to SOP-2 for sample labeling, SOP-3 for mussel sampling (describes mussel collection by snorkeling and diving), and SOP-4 for crayfish sampling (changes to bait, trap setting, and trap checking procedures)
- Cultural Resources Coordination Plan (QAPP Appendix D)—amendments to the Cultural Resources Coordination Plan to discuss procedures specific to snorkeling and diving

[1] The Site as defined within the June 2, 2006 Settlement Agreement is the areal extent of hazardous substances contamination within the United States in or adjacent to the Upper Columbia River, including the Franklin D. Roosevelt Lake, from the U.S.-Canada border to the Grand Coulee Dam, and those areas in proximity to the contamination that are suitable and necessary for implementation of response actions.

All other aspects of the macroinvertebrate tissue study that are not discussed in this addendum, including project background, field sampling, sample handling procedures, and data validation, remain unchanged from the QAPP (Exponent et al. 2016).

A4.1 Addendum to Main QAPP

This section includes additions or modifications to Sections A and B of the main QAPP (Exponent et al. 2016) that describe mussel and crayfish sampling proposed for late summer or fall 2016. During the first round of sampling in spring 2016, the required level of effort (LOE) was completed (i.e., number of trap nights and beach transects), however, the target numbers of samples were not met for mussels and crayfish in all sampling areas. The additional sampling discussed in this QAPP addendum will be conducted as a second attempt to meet the sampling goals outlined in the QAPP, and will occur only in certain areas where sampling goals were not met. Decisions regarding which sampling areas to target for additional sampling were made in consultation with the EPA.

A4.1.1 Schedule (QAPP Section A7.1.2)

The initial round of sampling was conducted from April 26 to May 19, 2016. Additional sampling is proposed for September and October 2016. The summer/ fall sampling is timed to take place within the same year as the first round of sampling and during the late summer months, when crayfish are expected to be more active and easier to capture due to higher water temperatures. The reservoir water level late in the summer is expected to be higher than in the spring (i.e., during the first round of sampling), and therefore mussels will likely need to be collected via scuba diving or snorkeling instead of shore-based surveys (see Figure A7-1 in the original QAPP). The riverine water level is anticipated to be slightly lower than it was during the spring 2016 sampling event (based on average elevations at the International Boundary Station; see Figure A4-1), with slower flow conditions that will be safer for snorkelers and divers and more suitable for crayfish trap deployment than conditions during months with higher flow (i.e., June and July).

Snorkeling and diving will be conducted by the EPA dive unit. The availability of the dive unit for September and October 2016 has not yet been determined. The success of the sampling described in this QAPP addendum will depend on the confirmed ability of the dive unit to spend a sufficient amount of time in the field in September and October 2016 to meet the stated objectives.

Compositing and chemical analyses of mussel and crayfish samples collected in spring 2016 will not be performed until the second round of sampling has been conducted and a complete compositing plan has been developed for samples collected from both events. An

interim compositing plan for samples collected in spring 2016 has been developed by TAI in consultation with EPA (USEPA 2016), but for some of the proposed composites, sufficient mass is not available to conduct all analyses, or a proposed composite sample consists of only one organism (as discussed in more detail in Section A4.1.2). Therefore, delaying the chemical analyses will allow for the potential collection of additional tissue mass to supplement the tissue already collected. Organisms collected from both events will be composited and analyzed by the analytical laboratory according to the final compositing plan, which will be determined in consultation with EPA after summer/fall 2016 sampling is complete. Based on this timeline, the QAPP-specified holding time for metals (i.e., six months) could be exceeded for mussels and crayfish collected in spring 2016. Although the QAPP specified a preferred six-month holding time for metals, one year is considered acceptable for tissues frozen to -20 degrees C. Mussels and crayfish collected in spring 2016 have been stored frozen in this manner since receipt by the analytical laboratory. The metals data for samples analyzed outside of the QAPP-specified holding time will be validated as detailed in the QAPP and qualified, as appropriate, by the data validator.

Preliminary analytical chemistry results will be available approximately 60 days after the analytical laboratory has been provided with the final compositing plan for sample processing, compositing, and analysis. Laboratory quality assurance (QA) and data validation will be completed approximately 30 days after preliminary analytical results are available. Thus, validated data will be delivered to EPA within 90 days of when the final compositing plan is provided to the laboratory.

A4.1.2 Sampling Areas and Number of Samples (QAPP Section A7.3.1)

The QAPP specified a target of six composite samples[2] each for mussels and crayfish in each of six Site sampling areas and two reference areas. The total numbers of mussel and crayfish samples collected in spring 2016 compared to project goals are summarized in Table A4-1. For mussels, the sampling goal was achieved in Area 2. Areas 1, 3, 4, and 6 and the Sanpoil River reference area are targeted for further mussel sampling. Although the sampling goals were not met for mussels at Buffalo Lake, no additional sampling will be conducted at this area due to lack of suitable mussel habitat. In Area 5, 13 beaches covering a large portion of the area were initially surveyed during the TAI spring sampling event; subsequently, the sampling area was extended approximately 3 miles to the north to include five additional beaches. Despite this level of effort, no mussels or signs of their presence (i.e., shell pieces) were found. The Spokane Tribe of Indians has noted that people traditionally collected

[2] Samples may be comprised of a single organism, however, more than one organism is preferred. The use of single organism samples will be determined in conjunction with EPA after summer/fall 2016 sampling is complete.

mussels near the edge of the historic thalweg adjacent to Area 5. However, these areas will be more than 200 ft below the expected water level during the summer/fall 2016 event and will therefore be inaccessible to divers; in addition, mussels in these areas do not represent a current exposure pathway for people. Therefore, Area 5 is not a targeted sampling area for mussels. Nonetheless, because EPA has stated that the presence of mussels might indicate a complete and significant exposure pathway for ecological receptors that might consume mussels in this area, a limited reconnaissance effort will be conducted using the underwater camera to evaluate the potential presence of mussels at depths deemed accessible by the EPA dive team, not to exceed a depth of 70 ft.[3]

For crayfish, sampling goals were met in Areas 5 and 6 and in the Buffalo Lake and Sanpoil River reference areas. Additional crayfish sampling is therefore needed in Areas 1 through 4. The Sanpoil River is also targeted for additional crayfish sampling to supplement samples collected in spring 2016[4].

The numbers of mussel samples targeted for summer/fall 2016 collection in Areas 1, 3, 4, and 6 and the Sanpoil River are three, two, six, four, and three, respectively (Table A4-1). In order to direct resources efficiently, sampling is proposed for specific locations where mussels have been previously collected in each of these areas, as described in more detail in Section A4.1.5. Previous mussel surveys were conducted by the U.S. Fish and Wildlife Service (USFWS) in 2012 and 2013 and by Teck American Incorporated (TAI) in 2016. The locations surveyed by USFWS and TAI in the areas where additional samples are proposed for collection in summer/fall 2016, as well as the numbers of mussels collected at each location, are presented in Maps A4-1 to A4-5. Details on the previous sampling efforts by TAI (in spring 2016) and USFWS (in 2012 and 2013) are summarized in Table A4-2 for mussels and Table A4-3 for crayfish.

The numbers of additional crayfish samples targeted for summer/fall 2016 in Areas 1, 2, 3, and 4 are six, four, two, and five, respectively (Table A4-1). For crayfish in the Sanpoil River, no additional composite samples are targeted, however, an additional organism and additional tissue mass are targeted to supplement proposed composite samples collected in spring 2016. The locations surveyed by USFWS and TAI in the areas where additional samples are proposed for collection in summer/fall 2016, as well as the numbers of crayfish

[3] If mussels are observed by underwater camera, the LOE for diving to collect mussels will be determined in coordination with EPA oversight, and will not exceed the mussel sampling LOE identified in this QAPP addendum for other UCR sampling areas.

[4] The target number of crayfish samples were met for the Sanpoil River, however, additional sampling will take place in summer/fall to target the following: 1) one crayfish to supplement a proposed composite sample from spring 2016 that is comprised of one organism, and 2) tissue mass to supplement three proposed composite samples from spring 2016 that do not have enough mass to analyze for all target analytes.

collected at each location, are presented in Maps A4-6 to A4-10. Crayfish were collected in spring 2016 by deploying traps within each area at locations where suitable crayfish habitat (e.g., woody debris and loose cobbles) had been observed during field reconnaissance. Crayfish sampling in summer/fall 2016 will be conducted in a similar manner, with some modifications to the way in which traps are deployed (see Section A4.4.3). In these areas, the field crew will conduct reconnaissance and deploy traps in locations with suitable habitat and favorable flow conditions to prevent the current from dislodging the traps.

In addition to the mussel and crayfish samples targeted for summer/fall 2016, extra organisms or tissue mass are targeted for collection at certain areas as indicated in Table A4-4. The additional target organisms will be used to supplement samples collected in spring 2016 that are comprised of one organism, based on the interim compositing plan developed in consultation with EPA (USEPA 2016). The additional mass will be used to supplement samples collected in spring 2016 that do not contain enough mass to analyze for all target analytes.

The specific locations proposed within the sampling areas for summer/fall 2016 are discussed in Section A4.1.5. Sampling will conclude when the target numbers of organisms have been collected (assuming the target mass has also been collected) (see Table A4-4), or when the maximum LOE has been reached. The maximum LOE for mussels and crayfish is discussed in the FSP and SOPs (Sections A4.2 and A4.4). The original QAPP specified that five organisms would be collected for each sample. While this remains the target number of organisms, it is recognized that if this number is not obtained within the specified maximum LOE, it will still be possible to create composite samples as long as sufficient tissue mass is collected. In addition, during the spring 2016 sampling event, it was found that five mussels were sometimes insufficient to provide the required sample mass when the mussels were small. Therefore, mussel composites may require more than five organisms.

A4.1.3 Temporal Considerations (QAPP Section A7.4.3)

The most important temporal considerations for mussel and crayfish sampling in summer/fall 2016 are the water level and the water temperatures of the Upper Columbia River and Lake Roosevelt. Sampling in the upper reaches (Areas 1 through 3) is affected by the Upper Columbia River water level, which is typically lowest in spring and early fall. Lower river flow provides safer conditions for divers and less risk of crayfish trap loss. The lower reaches (Areas 4 through 6) are influenced by the water level in Lake Roosevelt, which is generally higher in late summer and early fall than in spring. During the spring sampling event, the water level ranged from approximately 1,248 to 1,252 ft above mean sea level (amsl). Based on the average from previous years, the water level in early

September is expected to be approximately 1,280 feet amsl or higher (see QAPP Figure A7-1). Because of the higher water level in early September, it is anticipated that most beaches and mussels will be inundated; therefore, mussels will be collected primarily by snorkelers or divers instead of by land. The water temperatures in the Upper Columbia River and Lake Roosevelt are higher in late summer and early fall than in the spring. These higher temperatures are expected to provide more favorable conditions for crayfish.

A4.1.4 Statistics and Types of Interferences (QAPP Section A7.5)

The overall sampling goal of the macroinvertebrate tissue study is to collect enough tissue to create a total of six mussel and six crayfish composite samples for each Site and reference area (Exponent et al. 2016). The numbers of composite samples attained from the spring 2016 sampling event are listed in Table A4-1 and are based on the interim compositing plan developed in consultation with EPA (USEPA 2016). As discussed in Section A4.1.2, additional mussel sampling will take place in Areas 1, 3, 4, and 6 and in the Sanpoil River reference area. Additional crayfish sampling will occur in Areas 1 through 4 and in the Sanpoil River reference area. Depending on the sampling area, two to six samples per area are targeted for mussels or crayfish, and in certain areas, additional organisms or sample mass are also targeted to supplement samples collected in spring 2016[5] (Table A4-1).

Target sample masses needed for chemical analyses for each sampling area are listed in Table A4-4. The target analyte list and the analytical concentration goals for the summer/fall sampling event are the same as detailed in the QAPP (see QAPP Table A7-4).

A4.1.5 Target Sample Locations and Rationale (QAPP Section B1.1)

Rationale for the selection of the sampling areas is the same as specified in the QAPP. Only the Site and reference areas with fewer than six composite samples collected during spring 2016 will be resampled in summer/fall 2016 (with the exception of Buffalo Lake, which will not be resampled for mussels).[6] This section focuses on specific locations proposed within the areas that will be resampled, and the rationale for targeting those locations.

The following specific sampling locations are proposed for mussel sampling within Areas 1, 3, 4, and 6 and the Sanpoil River:

[5] Except for crayfish in the Sanpoil River, where no additional samples are needed and only an additional organism and additional tissue mass are targeted.

[6] In Area 5, a limited reconnaissance will be conducted using the underwater camera, as described in the addendum to the mussel tissue sample collection SOP (Section A4.4.2). If mussels are observed, the LOE for diving to collect mussels will be determined in coordination with EPA oversight, and will not exceed the mussel sampling LOE identified in this QAPP addendum for other UCR sampling areas.

- **Area 1 (three samples).** Northport Launch, Deadman's Eddy, and upstream of Deadman's Eddy are the proposed locations for Area 1 (Maps A4-1, A4-11, A4-12 and A4-13). At Northport Launch, mussels were collected by USFWS in 2013 (n = 130) and by TAI in spring 2016 (n = 12). At Deadman's Eddy and upstream of Deadman's Eddy, mussels were collected by USFWS in spring 2012 (n = 14) and spring and fall 2013 (n = 176); however, no mussels were found at these locations in spring 2016. Based on the field conditions encountered by USFWS in late summer and early fall, it is possible that mussels will be collected by land from this location (i.e., at wadeable depths). Deadman's Eddy is likely unsafe for divers due to strong currents; however, an upstream location where mussels were collected by USFWS in 2013 (Deadman's Eddy upstream of gravel bar) is targeted for diving/snorkeling.
- **Area 3 (two samples plus two additional mussels).** Hayes Island is the proposed location within Area 3 (Maps A4-2 and A4-14). Mussels were collected from Hayes Island by USFWS in spring 2012 (n = 1,380) and spring 2013 (n = 461), and by TAI in 2016 (4 at A3-MB01 and 5 at A3-MB06). In addition, mussels have been found in the vicinity of Hayes Island by USFWS during previous snorkeling and diving events. A few other mussels were collected in spring 2016 (1 at A3-MB04, 1 at A3-MB12, and 2 at A3-MD13), and mussels were collected by USFWS in spring 2012 close to the boundary of the sampling area (212 at Colville River). However, sampling for the summer/fall 2016 event will focus on Hayes Island because this area appears to have a substantial mussel bed which should provide enough tissue mass for the two samples targeted for collection.
- **Area 4 (six samples)**. Inchelium and Bissell Island are the proposed locations for Area 4 (Maps A4-3, A4-15, and A4-16). In spring 2016, no mussels were found at Inchelium, and Bissell Island was not surveyed; however, USFWS collected mussels by land at both locations in spring 2012 (n = 45 at Inchelium and n = 52 at Bissell Island) and spring 2013 (n = 5 at Inchelium and n = 21 at Bissell Island). Although a small number of mussels were collected at a few other locations in spring 2016 (2 at A4-MB13, 1 at A4-MB07, and 1 at A4-MB10), sampling will be focused at Inchelium and Bissell Island where the highest numbers of mussels have previously been found.

- **Area 6 (four samples plus 15.2 g ww additional total tissue mass[7]).** Covington Cove is the proposed sampling location for Area 6 (Maps A4-4 and A4-17). Mussels were collected in the vicinity of Covington Cove by USFWS in 2012 (n = 40) and by TAI in spring 2016 (n = 69). In spring 2016, TAI also collected mussels in Area 6 at MB05 (n = 7) and MB-04 (n = 1), however, sampling in summer/fall 2016 will be focused at Covington Cove, where the highest numbers of mussels were previously found.
- **Sanpoil River reference area (three samples plus 79.8 g ww additional total tissue mass[8]).** In the Sanpoil River, proposed locations are near the Silver Creek road crossing, at TAI 2016 sampling locations SR-MB01 and SR-MB09, and at several locations (to be selected in the field) between SR-MB01 and SR-MB05 that could not be safely accessed in spring 2016 due to high flow (Maps A4-5, A4-18, and A4-19). USFWS collected 100 mussels at the Silver Creek road crossing in late summer 2013, and TAI collected 4 mussels in the vicinity of the Silver Creek road crossing (2 at SR-MB04 and 2 at SR-MB03) in spring 2016. TAI collected 8 mussels at SR-MB-01 and 14 mussels at SR-MB-09 in spring 2016. Although mussels were collected at SR-MB08 (n = 6) and SR-MB11 (n = 2) in spring 2016, this area will not be resampled because of concerns expressed by EPA that it may be within the influence of the Site.

For crayfish, additional sampling will take place in Areas 1 through 4. The same general sampling procedures will be followed in summer/fall 2016 as in spring 2016, with some method modifications intended to increase sampling success (e.g., details regarding trap placement and trap checking frequency have been updated; see Section A4.2 and SOP-4). Similar to the spring 2016 sampling event, traps will be deployed at locations with suitable crayfish habitat, as determined during field reconnaissance. In addition, trap locations may include those where crayfish were caught in 2012 (by USFWS) or in spring 2016, if habitat looks suitable during field reconnaissance:

- **Area 1 (six samples).** No crayfish captured by USFWS in 2012 or by TAI in spring 2016 (Map A4-6)
- **Area 2 (four samples).** Crayfish locations may include A2-CT10, A2-CT14, A2-CT13, A2-CT06, A2-CT01, and North Gorge (Map A4-7)
- **Area 3 (two samples plus four additional crayfish).** Crayfish locations may include A3-CT14, A3-CT02, A3-CT13, A3-CT01, and Kettle Falls (Map A4-8)

[7] Assuming the shell is 50 percent of the total weight, this will provide approximately 7.6 g ww of tissue mass that is needed for additional chemical analyses on proposed composites from spring 2016.

[8] Assuming the shell is 50 percent of the total weight, this will provide approximately 39.9 g ww of tissue mass that is needed for additional chemical analyses on proposed composites from spring 2016.

- **Area 4 (five samples).** Crayfish locations may include A4-CT17, A4-CT04, A4-CT15, A4-CT01, Daisy, Cloverleaf, and Gifford (Map A4-9).
- **Sanpoil River reference area (one crayfish plus 93 g ww of additional total tissue mass) [9]:** Crayfish locations may include SR-CT11, SR-CT09, and SR-CT12 in the northern portion of the sampling area; SR-CT06, SR-CT07, and SR-CT08 in the middle portion of the sampling area; and SR-CT04 and SR-CT16 just north of where the Sanpoil River begins to widen (Map A4-10). Although crayfish were collected at SR-CT01 and SR-CT02 in spring 2016, this area will not be resampled because of concerns expressed by EPA that it may be within the influence of the Site.

A4.2 Field Sampling Plan (QAPP Appendix A)

Additions or modifications to sections of the FSP are presented below to describe the methods for collecting mussel and crayfish in summer/fall 2016.

A4.2.1 Sampling Areas (FSP Section 2.1)

The target number of mussel and crayfish samples for each sampling area is detailed in Section A4.1.4 and Table A4-1.

Specific mussel sampling locations within sampling areas (i.e., wadeable beaches or scuba diving and snorkeling locations) were chosen based on locations where mussels were previously observed, which are listed in Section A4.1.2. For crayfish, traps will be deployed at specific locations within sampling areas that have suitable crayfish habitat, as determined during field reconnaissance. Such areas will include those with loose cobbles and boulders and tree or plant debris, as well as areas near structures such as docks. Structures that could influence chemical concentrations (e.g., refueling stations) will be avoided. In addition, locations where crayfish were previously collected by TAI in 2016 or USFWS in 2012 may be resampled if habitat is determined to be suitable based on field reconnaissance.

A4.2.2 Field Survey and Sampling Methods (FSP Section 2.2)

Crayfish and mussel sampling will be conducted primarily by boat in the UCR sampling areas, although shoreline sampling may also be conducted in Area 1. In the Sanpoil River, it is expected that mussels will be collected from the shoreline, although snorkeling will be considered if beach surveying is unsuccessful.

[9] One crayfish is necessary to supplement one of the proposed samples that contains only one organism. In addition, crayfish tissue is necessary to supplement three samples collected in spring 2016. Therefore, a minimum of three crayfish weighing at least 28 g ww, 30 g ww, and 35 g ww are targeted, plus one additional organism.

EPA will provide a vessel for use by the dive team and room to accommodate a cultural resources monitor, and TAI will provide a vessel for the remainder of the sampling team. At a minimum, the following personnel are anticipated to be part of the sampling effort:

- Dive team and dive safety oversight (n = 3 or 4)
- Sampling team and field supervisor (n = 1 or 2),
- Boat captain (n = 1) and crew (n = 1) for each vessel,
- EPA oversight (n = 1), and
- Cultural resources monitor during mussel sampling only (n = 1)

In addition to personnel, the vessels used for sampling will also need to accommodate safety supplies, sample processing supplies, coolers, multiple sampling equipment storage boxes, a sample processing area, and other ancillary equipment, as well as the following gear specific to each sampling effort:

- **Crayfish sampling effort.** Crayfish sampling equipment (e.g., traps, lines, weights, and buoys) and mussel sampling equipment for collection from beaches or wadeable waters (e.g., buckets, grabbers, and transect line)
- **Mussel sampling effort.** Equipment for underwater camera reconnaissance, snorkeling, and scuba diving.

Vessels must include navigational lights, GPS, anchors, and basic sonar equipment (e.g., fathometer). Vessel operators must be familiar with the area and have the ability to make headway and maneuver in the potentially turbulent, high-velocity waters of the Site. The field team leader, together with the vessel crew, will oversee shoreline access from the vessel to ensure the safety of the field team and that boat activity has minimal impacts on potential sampling locations.

A4.2.3 Task Schedule (FSP Section 2.2.1)

Subject to EPA approval, field sampling is expected to be conducted in September and October 2016 and to take approximately 4 to 5 weeks. Prior to the commencement of field sampling activities, a detailed schedule will be prepared by the field sampling crew to facilitate planning and scheduling of EPA technical and cultural oversight. As soon as the availability of the EPA dive team is known, TAI will coordinate with EPA to determine the order of sampling for the different areas and tissue types.

A4.2.4 Field Equipment and Supplies (FSP Section 2.2.3)

In addition to the field equipment listed in the FSP (Appendix A of the QAPP (Exponent et al. 2016), equipment for underwater camera reconnaissance, snorkeling, and scuba diving

will be needed. A specific list of necessary equipment for snorkeling and scuba diving is included in the dive plan for mussel collection via snorkeling and scuba diving (Appendix A of this addendum).

A4.2.5 Sample Collection Methods (FSP Section 2.2.4)

Mussel Sampling

According to the EPA LOE technical memorandum (USEPA 2013), five species of mussels may be collected at the Site:

- *Anodonta* clade 2—Western floater
- *Anodonta* clade 1—California floater
- *Anodonta beringiana*—Yukon floater (historical populations)
- *Margaritifera falcata*—Western pearlshell (historical populations)
- *Gonidea angulata*—Western ridged mussel.

In addition, an invasive clam, *Corbicula fluminea*, has previously been collected from the Site and will be retained for possible analysis if found during sampling. Inclusion of any *Corbicula* will be determined as part of the compositing plan to be developed after sampling is completed.

Mussels will be collected from beaches or by diving/snorkeling at specific locations within sampling areas where mussels have been collected during previous sampling events (see Section A4.1.5). The sampling crew will handpick mussels from the shoreline, from wadeable waters, or while diving/snorkeling. Precise locations of mussel collection (i.e., the start and end points of the sampling transect) will be recorded via a hand-held global positioning system (GPS) unit.

A target mussel mass per composite sample was identified based on the required analytical mass (i.e., 4.5 g ww] for baseline ecological risk assessment [BERA]-only samples and 30 g ww for BERA and human health risk assessment [HHRA] samples; see Table A4-4).[10] No mussels less than 2 cm in length will be collected. The mass of soft tissue that will be analyzed is estimated to be approximately 50 percent of the total body weight based on available literature (Bura et al. 2011); this value was confirmed during the TAI spring 2016 sampling event, when two mussels of different sizes were weighed in the field with and without the shells. Based on this estimate (i.e., that 50 percent of the total weight is the shell), the field crew will target the collection of at least 9 g ww for BERA-only samples and at least

[10] The target analytical mass for BERA-only and BERA and HHRA samples takes into account sample loss due to sample processing (e.g., during homogenization and freeze drying).

60 g ww for BERA and HHRA samples. Because the exact mass of tissue will not be known in the field (i.e., mussel shells will not be removed in the field), the field crew may collect additional mussels if they are concerned that the individuals collected will not provide sufficient tissue mass.

After a sufficient number of mussels have been collected to achieve the targeted composites, additional individuals that are located within the maximum LOE (as described below) will be collected to supplement samples collected in spring 2016 and to create field split and/or EPA split samples[11].

A total of two to six composite samples is targeted for collection in each sampling area (Table A4-1). Additional organisms and sample mass targeted to supplement samples collected by TAI in spring 2016 are listed in Table A4-4. If sufficient mass for all target samples within an area (i.e., composites samples, organisms and mass to supplement spring 2016 samples, and field split and/or EPA split samples) is collected at one sampling location, other target sampling locations within the same area will not be checked for mussels.

Prior to conducting snorkeling or diving activities in the targeted UCR areas—or in conjunction with snorkeling or diving activities, depending upon the EPA dive unit schedule—an underwater camera reconnaissance will be conducted to locate areas containing mussels. If no mussels are visible by camera after all identified locations described in Section A4.1.5 have been completely searched based on consultation with EPA oversight, or after a maximum LOE of two field days,[12] no transect will be surveyed by the scuba diving or snorkeling team. However, if there is reason to believe that mussels might be more easily seen by the scuba diving or snorkeling crew than by camera (e.g., in case of poor visibility or difficulties encountered during surveying by camera), at least one transect will be surveyed by scuba divers or snorkelers. If no mussels are collected during the first transect survey conducted where no mussels were observed by camera, additional transects will not be surveyed. At each sampling area where diving/snorkeling will be conducted, the maximum LOE will be two field days, but the actual LOE may be less if sufficient sample mass is collected before the two field days have been completed. One additional field day may be added to a particular sampling area if mussel tissue goals have not been met and if sampling takes less than two field days at another area, as determined based on discussions with EPA oversight in the field.

[11] Field splits and EPA splits are targeted for analysis on a subset of 5 percent and 15 percent of the total number of samples, respectively. Each sample analyzed as a split will need twice the targeted sample mass listed in Table A4-4.

[12] One field day of camera work is defined as four hours of active camera searching.

Beaches in Area 1 may be surveyed for mussels prior to snorkeling or diving, depending upon the availability of the EPA dive unit and the development of the proposed schedule. In addition, beaches in Area 1 may be surveyed if diving is conducted first and mussel sampling is unsuccessful. Beach surveying will not be needed in Area 1 if diving is conducted first and the targeted tissue goals are met. If beach surveying is needed in Area 1, the field crew will search a maximum of 12 beaches. Ideally, each beach will contain approximately 150 m (500 ft) of shoreline, although it is possible that a sufficient number of beaches that are this length and that can be safely sampled may not be available. Each identified beach will be surveyed from approximately 10 m (approximately 33 ft) above the waterline to the maximum wadeable water depth. Specific procedures for how beach areas will be searched are discussed in SOP-3 (QAPP Appendix A, Attachment A2).

At each of the three identified locations along the Sanpoil River (Silver Creek Crossing, SR-MB01, and SR-BM09,) and at additional locations that may be identified in the field (as described in Section A4.1.5), the field crew will also search a maximum of 150 m of shoreline in the same manner as described above for Area 1. If additional beaches can be found and safely sampled in the Sanpoil River, a maximum of 12 beaches will be surveyed. As discussed in Section A4.2.3, if beach surveying along the shoreline of the Sanpoil River does not result in sufficient mussel mass to meet the area sampling goal, and if conditions indicate that snorkeling might be a more successful approach, then the EPA dive team will return to conduct sampling by snorkeling. Any decision to end sampling before this LOE is met will be made in consultation with EPA.

Field teams will collect any of the mussel species present at the sampling areas (along with any *Corbicula*) and identify to the lowest practical identification level (LPIL, genus or species). Mussel identification methods will be based on *Freshwater Mussels of the Pacific Northwest (*Nedeau et al. 2009), with the recognition that shell morphology may not be reliable to determine species, but may be reliable for clades (particularly for *Anodonta* sp.). As requested by EPA, TAI will report the location and consult with EPA if western pearlshell mussels are found in the reservoir or riverine segments of the Site. It should be noted that although western pearlshell mussels are preferred by people for consumption, this species has only recently been found in the Kettle River, and has not been found in the main stem of the UCR.

Individual mussel (and clam) characteristics to be recorded in the field form include taxonomic identification; shell length, width, and breadth (as shown on Figure A1 from Appendix A of the QAPP); total weight; and presence of holes in shells, or other evidence of parasitism. An example of a field form used to enter data is shown in QAPP Appendix A, Attachment A3. Mussels collected from a given beach will be photographed (either

individually or as a group), and the photograph identification (ID) will be documented in the field so that the photograph can be subsequently labeled with station location, date, and time of sample (QAPP SOP-9). All mussels and clams will be individually wrapped in heavy-duty food-grade aluminum foil (dull side toward the organisms) and placed in individual resealable plastic bags. Each bagged mussel and the associated label will be placed in a second resealable plastic bag and then placed in a cooler with ice, as described in QAPP SOP-3. Soft tissue from mussels will be removed from the shell at the analytical laboratory prior to analysis (see SOP-3); any liquid inside the shell will be included with the sample during homogenization. Each mussel sample will be evaluated for the following acceptance criteria:

- Proper identification
- Appropriate sample handling and decontamination process (QAPP SOP-5).

If dead mussels are observed at a given location, their presence will be noted, but they will not be collected.

Crayfish Sampling

Two species of crayfish have been trapped in the Site—northern crayfish (*Orconectes virilis*) and signal crayfish (*Pacifastacus leniusculus*). Crayfish identification will be determined based on the use of applicable field guides and field crew knowledge of these species; photographs will be taken of all crayfish collected at the site, as discussed below and in QAPP SOP-4. As requested by EPA, TAI will report the location and consult with EPA if signal crayfish are encountered in the Site; non-target species (i.e., species other than crayfish) captured in crayfish traps will be released at point of capture and noted on the non-target species form (see QAPP Appendix A, Attachment A3).

Crayfish will be sampled via the deployment of baited traps with escape guards (e.g., minnow traps) that will be placed in areas with potential crayfish habitat. Crayfish habitat includes areas with loose cobbles and boulders, areas with tree or plant debris, and areas near structures such as docks (see QAPP SOP-4).[13] Bait (i.e., salmon) will be placed in a claw-proof bag (e.g., nylon or cheesecloth) or bait canister to ensure that crayfish do not consume the bait, which could affect sampling results; broken bait bags and canisters will be noted on the field forms. Within each sampling area, the specific locations where traps will be set will be determined by the field crew based on best professional judgment. The field crew will target areas that provide good habitat and, when possible, good spatial coverage of the sampling area. Locations where the USFWS survey found crayfish (Maps

[13] Traps will not be placed in the vicinity of structures such as refueling stations, which could influence chemical concentrations.

A4-6 through A4-9) will also be used to inform the selection of specific sampling locations within the sampling areas (see Appendix B of the QAPP for details).

A total of two to six composite samples is targeted for collection in Areas 1 through 4. In addition, extra organisms or sample mass are targeted for certain sampling areas to supplement samples collected by TAI in spring 2016 (Table A4-4). In the Sanpoil River, one crayfish and an additional 93 g ww of crayfish tissue are targeted (i.e., additional composite samples are not targeted). The required analytical mass needed for each composite sample is 4.5 g ww for BERA-only samples and 60 g ww for BERA and HHRA samples (see Table A4-4).[14] It is estimated that one composite sample will comprise five individual crayfish. Crayfish size requirements are detailed in SOP-4 (QAPP Appendix A, Attachment A2). Based on the spring 2016 sampling event, the average crayfish captured was 3.3 in. in total length and weighed 28.4 g ww. Based on this information, a composite of five crayfish will weigh approximately 142 g ww, more than sufficient to meet the analytical requirements.

If additional individuals are trapped, these will be retained, and may be composited with the other individuals to supplement samples collected in spring 2016 and to create sufficient mass for a field split sample and/or EPA split sample. All non-native crayfish (i.e., northern and virile crayfish) will be retained regardless of size. For native (i.e., signal) crayfish, only individuals greater than 3.25 in. in total length will be retained, in accordance with Washington fishing regulations, for the human health exposure areas (i.e., Area 2). All crayfish, regardless of size, will be retained in other sampling areas.

The compositing scheme will be determined in consultation with EPA following the completion of sampling; therefore, individual crayfish will be processed separately for shipment to the laboratory. In each sampling area, a total of 30 traps will be deployed (i.e., at least 1 trap per targeted crayfish) for a maximum of 3 overnight periods per trap. Any decision to end sampling before this LOE is met will be made in consultation with EPA. Precise locations will be recorded using GPS, and ropes will be inconspicuously marked to minimize vandalism. Traps will be checked twice daily (mornings and evenings) during sampling for a maximum of three nights in a given sampling area. Crayfish from each trap will be removed to a bucket for processing. It is anticipated that crayfish found in traps would still be living. Any dead crayfish recovered in traps may also be retained in consultation with EPA oversight; this information would be noted on the field form. Field teams will identify captured crayfish by species and record it on the specimen collection

[14] The target analytical mass for BERA-only and BERA and HHRA samples takes into account sample loss due to sample processing (e.g., during homogenization and freeze drying).

form. Once the targeted mass of crayfish is collected or the maximum period designated for trap deployment has been reached (whichever comes first), all traps and ropes will be removed from the sampling area.

Each crayfish will be photographed, and the photograph ID will be documented on the field form so that the photograph can be subsequently labeled with station location, date, and time of sample collection (SOP-9 in QAPP Appendix A, Attachment A2). Length (both total and carapace, as indicated in QAPP Figure A2), total weight, and the presence of lesions, missing limbs, and general condition of collected individual crayfish will be noted on the field form. In addition, the field crew will note on the field forms if any of the following are applicable: 1) crayfish are molting, 2) crayfish are carrying eggs, 3) crayfish were dead upon trap retrieval, or 4) bait bags or canisters are broken. This information will be considered in the development of the compositing plan that will be prepared in consultation with EPA following the completion of the sampling effort. All crayfish will be individually wrapped in heavy-duty food-grade aluminum foil (dull side toward the organism), and placed in a resealable plastic bag with the associated label. The label and foil-wrapped and bagged crayfish will be placed in a second clean, resealable plastic outer bag, and then stored in a cooler with ice while in the field, as described in QAPP SOP-4.

Each crayfish sample will be evaluated for the following acceptance criteria:

- Proper deployment and functioning of trap
- Adequate retrieval and appropriate sample handling.

Crayfish tissue dissection and compositing will be performed by the analytical laboratory. For BERA samples, crayfish will be analyzed as whole-body samples (i.e., no dissection will be needed). For samples that will be used for both the BERA and HHRA, crayfish will be analyzed as two parts: the carapace and stomach will be removed and analyzed as one sample, and to better represent the tissue generally consumed by people, the remaining parts will be analyzed as the other sample (see the ALS Environmental SOPs in Appendix C of the QAPP for details on tissue dissection procedures). Whole-body chemical concentrations can be calculated for use in the BERA using the weights of the two samples (i.e., the carapace and stomach, and the other remaining tissue) and their chemical concentrations. Target samples and tissue types are summarized in QAPP Appendix A, Table A3.

A4.2.6 Sample Labeling (FSP Sections 2.2.9 to 2.2.11 and SOP-2)

This section describes a new naming convention for sampling locations and sample IDs to distinguish between samples collected in summer/fall 2016 and those collected in spring 2016. The updated sample labeling information is detailed below.

Location IDs (FSP Section 2.2.9)

Mussel collection locations and crayfish trap locations will be determined by the field crew during field sampling; each will be assigned a unique identifier. These location IDs will consist of the following parts:

- Two-digit sampling area code (e.g., A1 = Sampling Area 1, A2 = Sampling Area 2)
- Sample type code (MCA = mussel collection addendum, CTA = crayfish trap addendum)
- Two-digit sequential number.

Examples:

A2-CTA03 = the third crayfish trap placed in Sampling Area 2

A3-MCA01 = the first mussel collection location in Sampling Area 3.

These location IDs will be used to document sampling locations.

Sample IDs for Individual Organisms (FSP Section 2.2.10)

Each individual organism will be assigned a unique identifier. The sample ID will include the location ID (as described above), the species code, and the individual number, as shown below.

- Two-digit sampling area code (e.g., A1 = Sampling Area 1, A2 = Sampling Area 2).
- Sample type code (MCA = mussel collection addendum, CTA = crayfish trap addendum).
- Two-digit sequential number.
- Species code (MU = mussels, CL = clam, and CR = crayfish).
- Two-digit individual number—sequential number for each individual collected in a given sampling area (e.g., mussel #03 collected in Sampling Area 4). Note that this number is important to be able to link analytical chemistry results.

Examples:

A4-MCA01-MU-03 = the third mussel collected from location 1 in Sampling Area 4

A1-CTA01-CR-01 = the first crayfish collected from trap 1 in Sampling Area 1

Sample IDs for Composite Samples (FSP Section 2.2.11)

Mussel and crayfish tissue composite samples will be prepared by the analytical laboratory upon receipt of samples; a compositing plan will be determined in consultation with EPA

after the summer/fall 2016 sampling event is complete. The compositing plan will document which individual organisms will be included in each composite sample.[15] This information will also be documented by the analytical laboratory during processing. Unique sample identifiers will be assigned to these composites according to the naming convention discussed in the FSP.

A4.3 Site Health and Safety Plan (QAPP Appendix A, Attachment A1)

The SHSP for this sampling effort is the same as the SHSP included in the QAPP. Health and safety information for snorkeling and scuba diving is included in EPA's dive plan (Appendix A of this addendum).

A4.4 SOPs (QAPP Appendix A, Attachment A2)

SOPs with changes from the QAPP are described below. No updates are necessary for SOP 1 and SOPs 5 through 10.

A4.4.1 SOP-2 Sample Labeling

Updates to SOP-2 for sample labeling are described above in Section A4.2.6.

A4.4.2 SOP-3 Mussel Tissue Sample Collection

This section includes updates to SOP-3 for mussel collection. In spring 2016, mussels were collected entirely by beach surveys. In summer/fall 2016, snorkeling and scuba diving will also be used to collect mussels. Changes to SOP-3 are as follows:

- Additional equipment needed for scuba diving and snorkeling is provided in the dive plan (Appendix A of this addendum), which describes the procedures for collecting mussels by diving/snorkeling. EPA is solely responsible for scuba diving and snorkeling and any liabilities associated with these sampling methods. The following equipment (or equivalent) is needed to conduct underwater camera reconnaissance at specific sampling locations for mussels
  - A 30-cm-long sled with Deep Sea Power & Light© WidEye color camera, LED light, depth sensor, stabilizer wing, and marine scaling lasers
  - Digital recorder to overlay GPS data onto the video feed
  - Hypack© survey software package to record transects.

[15] A sample may consist of only one organism if the mass is sufficient for the target analytes and additional organisms cannot be collected (based on discussions with EPA.).

- Procedures for collecting mussels by land are the same as detailed in SOP-3 of the QAPP, with the exception that only the specific locations described in Section A4.1.5 will be surveyed. Accessible beaches at sampling locations in Area 1 will be surveyed for mussels according to the procedures in SOP-3. In addition, accessible beaches at sampling locations in the Sanpoil River will be surveyed during mussel sampling, prior to conducting any diving/snorkeling. In addition to handpicking mussels, grabbers may also be used. Live mussels seen at locations other than Area 1 during crayfish sampling will also be collected, and the location of any dead mussels that are observed will be noted.
- During the summer/fall sampling event, surveys will be conducted by diving/snorkeling at Areas 3, 4, and 6. At Area 1, mussel sampling will be conducted by diving, snorkeling, and/or beach surveying, depending upon the order in which these methods occur (which is based on the EPA dive team's availability) and the success of the different methods. Along the Sanpoil River, mussel sampling will first be attempted along the beach; if sufficient mussels are not found, diving/snorkeling may be conducted depending upon river conditions and the potential for success. If mussels are observed in shallow water at any time during the scuba diving and snorkeling survey event, they will be collected using grabbers. At each specific scuba diving or snorkeling location, underwater video camera reconnaissance will be conducted by TAI's contractor using a vessel separate from that of the EPA dive team. This reconnaissance will occur prior to sampling (either on the same day or during a previous visit to the location, depending upon the EPA dive team's availability) to identify the potential transect areas most likely to be yield sufficient mussel tissue mass (except at Sanpoil River locations, which are not accessible by boat). Once mussels have been found by camera observation, scuba diving or snorkeling will be conducted. If no mussels are visible by camera after all identified locations have been completely searched based on consultation with EPA oversight, or after a maximum LOE of two field days,[16] no transect will be surveyed by snorkeling or scuba diving. However, if there is reason to believe that mussels might be more easily seen by scuba diving and snorkeling team members than by the video camera, at least one transect will be surveyed. If no mussels are collected during the first transect survey conducted where no mussels were observed by camera, then no additional transects will be surveyed.

[16] One field day of camera work is defined as four hours of active camera searching.

- The maximum LOE is two field days for scuba diving or snorkeling at each sampling area, unless sufficient tissue mass is collected prior to this LOE. The maximum LOE for beach surveying is a total of 12 beaches per sampling area. Each beach will contain 150 m (approximately 500 ft) of shoreline, and will be surveyed from approximately 10 m (approximately 33 ft) above the waterline to the maximum wadeable water depth.
- A reconnaissance of Area 5 will be conducted using an underwater camera for a maximum LOE of two days in the field. The areas to be surveyed include Balcomb's Landing and the area between Abraham's Cove and the Spokane River on the east side of the UCR. The specific locations within these areas will be provided to TAI by EPA prior to sampling and may be modified in the field based on communication with EPA oversight present at the time of the reconnaissance. If mussels are observed by underwater camera, the LOE for diving to collect mussels will be determined in coordination with EPA oversight, and will not exceed the LOE identified in this QAPP addendum for other UCR sampling areas (i.e., two field days).
- Mussels collected during scuba diving from the EPA dive team's boat will be transferred to TAI's contractors either by handing over the samples while the EPA and TAI contractor vessels are tied together, or by the divers swimming to the TAI contractor's boat and handing over the samples. If conditions are too choppy for these options, then mussels will be transferred to TAI's contractors onshore.
- If the transfer of mussels from EPA to the TAI contractor vessel cannot be accomplished shortly after the divers have returned to the surface, then EPA will be responsible for holding the mussels in a cooler on wet ice.
- The mussels will be held inside the underwater collection bag until the cultural resource monitor has visually inspected the samples, per Section A4.5.
- Mussels collected during scuba diving and snorkeling will be processed in the same manner as described in SOP-3. Any decision to end sampling before this LOE is met will be made in consultation with EPA.
- EPA will provide the following information associated with diving or snorkeling to TAI on the day of sampling: 1) start and end location coordinates for each transect in latitude/longitude, and 2) water depth at start and end locations. EPA should indicate if spatial data has been differentially corrected. If not, TAI will request the raw GPS data from EPA.

A4.4.3 SOP-4 Crayfish Tissue Sample Collection

This section includes updates to SOP-4 for crayfish collection. In general, crayfish traps were deployed in clusters of three at the same approximate depth at each sampling location during the spring 2016 sampling event. Chicken, salmon, and cat food were used as bait. Changes to SOP-4 are as follows:

- A variety of depths will be targeted during crayfish sampling. For the first trap night, traps will be deployed at several sampling locations. At each location, three traps will be deployed along a depth gradient to determine whether crayfish prefer a particular depth within an area. If, based on the first trap night, trapping appears to be more successful at a particular depth, then traps placed the following night will be targeted at that depth. In addition, the mouth of tributaries (e.g., small bays with freshwater input or near the mouth of streams or rivers) may be targeted for the placement of traps if it appears that they may provide a desirable food source based on a reconnaissance of each area.
- Salmon will be used as bait. If logistically possible, bait will not be refrigerated for at least one day prior to sampling to create a stronger scent and improve sampling success.
- Traps will be checked twice daily (e.g., in the mornings and evenings) until the target number of crayfish or crayfish mass is collected, or for a maximum of three overnight soaking periods per trap per sampling area (i.e., a total of 90 trap nights). Once the targeted number of crayfish has been collected or the maximum period designated for trap deployment has been reached (whichever occurs first), all traps and ropes will be removed from the sampling area. Any decisions to end sampling before this LOE is met will be made in consultation with EPA. Depending on field crew availability and weather conditions, traps may also be checked at night if sampling is not successful after one or two nights.
- A total of two to six composite samples is targeted for collection in Areas 1-4. In addition, extra organisms or sample mass are targeted for certain sampling areas to supplement samples collected by TAI in spring 2016 (Table A4-4). In the Sanpoil River, one crayfish and an additional 93 g ww of crayfish tissue are targeted (i.e., additional composite samples are not targeted). The targeted mass of crayfish per sample is 4.5 or 60 g, depending on the sampling area (i.e., BERA-only versus BERA and HHRA sampling areas), and is detailed in Table A4-4.

A4.5 Cultural Resources Coordination Plan (QAPP Appendix D)

The cultural resources procedures for additional mussel sampling conducted on beaches proposed for September/October 2016 remain the same as those described in Section 4.2.1.2 of the Cultural Resources Coordination plan. For mussel sampling conducted by snorkeling or diving, a cultural resources monitor must be present at the time of sampling, either on EPA's dive boat or on a trailing TAI vessel. The cultural resources monitor will remain in radio communication with the divers and will be the first to open the sample collection bags and visually examine the samples once they have been brought to the surface. If any indications of artifacts or likely archaeological deposits are observed, the cultural resources monitor will record the location from which the materials were removed, photograph the materials, and follow any other necessary procedures as discussed in the Cultural Resources Coordination Plan.

A5 REFERENCES

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FIGURE

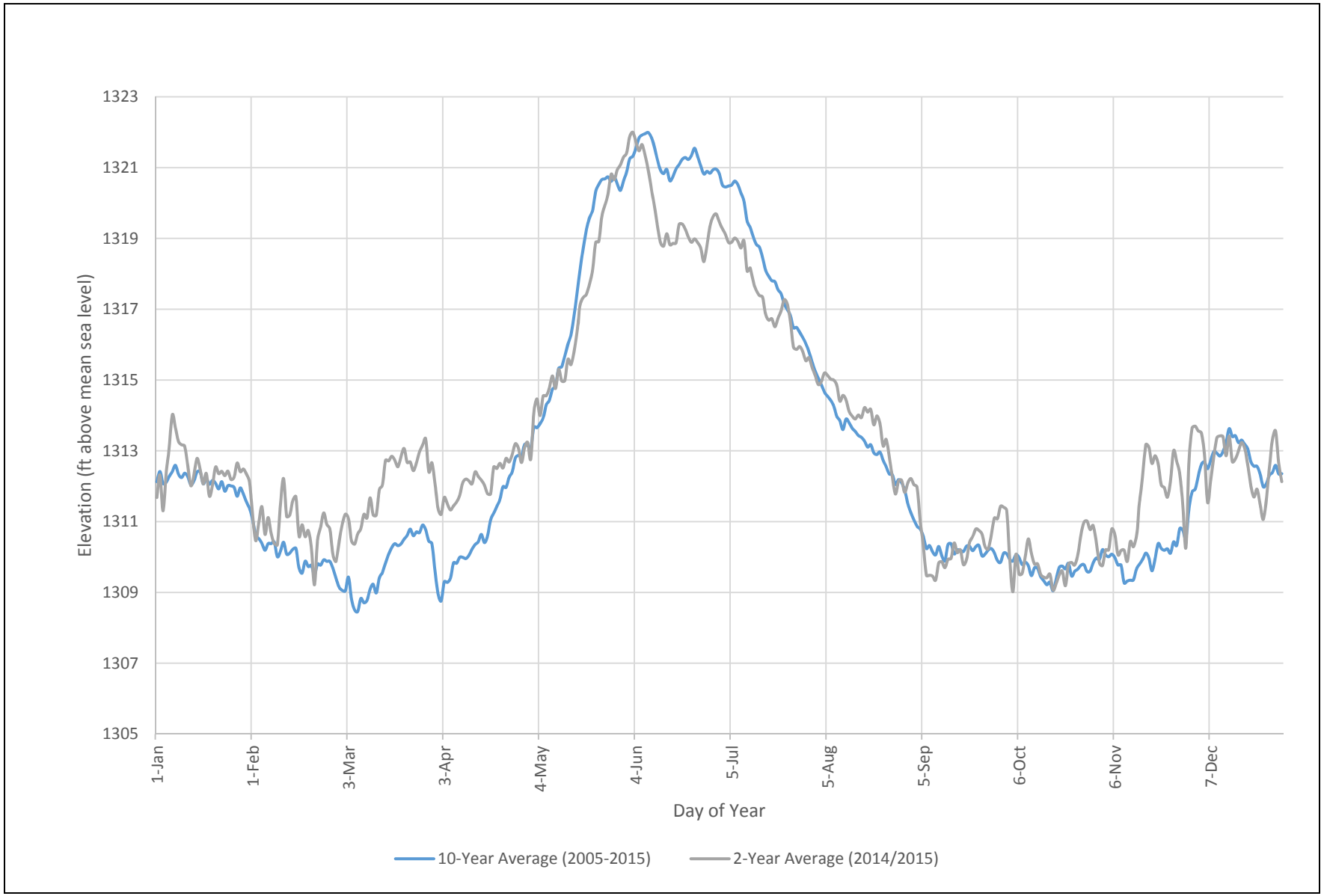

Figure A4-1. Upper Columbia River Elevations for the International Boundary Station at the U.S.-Canada Border

MAPS

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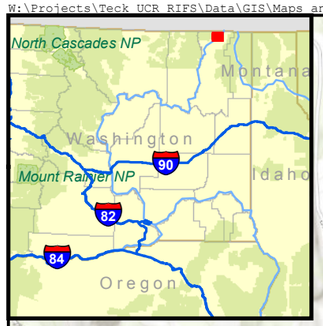


Deadman's Eddy, upstream end of gravel bar: 20 mussels

A1-MB03: 0 mussels

RM 739

Deadman's Eddy: 149 mussels

A1-MB02: 0 mussels

Deadman's Eddy: 7 mussels

A1-MB01: 0 mussels

RM 738

Deadman's Eddy: 14 mussels

A1-MB10: 0 mussels

A1-MB09: 0 mussels

Lower Sheep Creek: 0 mussels

A1-MB08: 0 mussels

A1-MB07: 0 mussels

Sheep Creek: 0 mussels

A1-MB12: 0 mussels

RM 737

Deep Creek Mouth: 0 mussels

Deep Creek Mouth: 0 mussels

A1-MB04: 0 mussels

Deep Creek Tributary: 0 mussels

A1-MB11: 0 mussels

RM 736

Northport Launch: 130 mussels

RM 735

A1-MB05: 12 mussels

A1-MB13: 0 mussels

RM 734

RM 733

A1-MB06: 0 mussels

Northport

Silver Crown Mountain

Legend

- Proposed Sampling Area
- Spring 2016 Mussel Sampling Transect

USFWS Mussel Sampling Transects

- 2012
- 2013
- 2009 Targeted Fish Sampling Area
- River Mile (USGS)

Windward environmental LLC

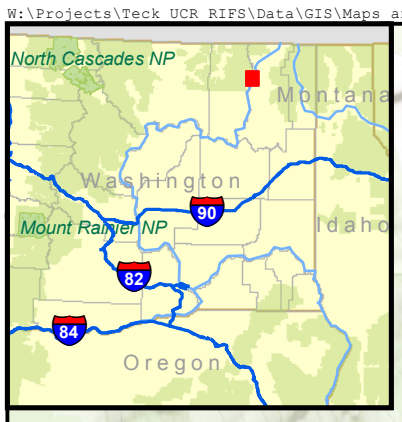
0 0.3 0.6 Km

0 0.15 0.3 Miles

N

Map A4-1. **Mussel Collection Results for Sampling Area 1**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-2 6284 Sampling Area 3 mussel results.mxd @ 07/29/2016



RM 706
RM 705
RM 704
RM 703
RM 702
RM 701
RM 700
RM 699

A3-MB13: 2 mussels
A3-MB04: 1 mussels
A3-MB05: 0 mussels
A3-MB02: 0 mussels
A3-MB03: 0 mussels
Hayes Island: 1380 mussels
A3-MB06: 5 mussels
A3-MB12: 1 mussels
A3-MB01: 4 mussels
Hayes Island: 461 mussels
A3-MB11: 0 mussels
A3-MB10: 0 mussels
A3-MB09: 0 mussels
A3-MB08: 0 mussels
A3-MB07: 0 mussels
Colville River: 212 mussels
Bradbury Beach: 11 mussels

Kettle Falls

Legend

- Proposed Sampling Area
- Spring 2016 Mussel Sampling Transect

USFWS Mussel Sampling Transects

- 2012
- 2013
- 2009 Targeted Fish Sampling Area
- County Lines
- River Mile (USGS)

Windward environmental LLC

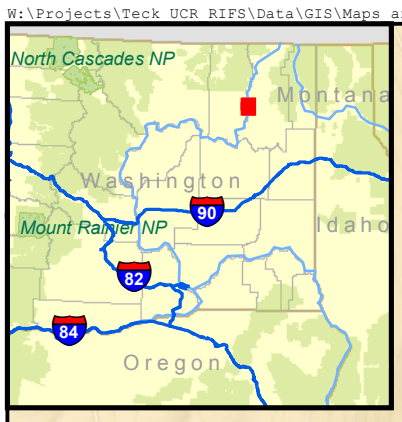
0 0.5 1 Km

0 0.25 0.5 Miles

N

Map A4-2. **Mussel Collection Results for Sampling Area 3**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-3 6285 Sampling Area 4 mussel results.mxd @ 07/29/2016



RM 678
RM 677
RM 676
RM 675
RM 674
RM 673
RM 672
RM 671

A4-MB05: 0 mussels
A4-MB04: 0 mussels
Inchelium: 45 mussels
A4-MB03: 0 mussels
Inchelium: 5 mussels
A4-MB02: 0 mussels
A4-MB01: 0 mussels
A4-MB09: 0 mussels
A4-MB13: 2 mussels
A4-MB12: 0 mussels
A4-MB08: 0 mussels
Bissell Island: 21 mussels
A4-MB07: 1 mussels
A4-MB06: 0 mussels
Bissell Island: 52 mussels
A4-MB17: 0 mussels
A4-MB16: 0 mussels
A4-MB10: 1 mussels
A4-MB11: 0 mussels
A4-MB15: 0 mussels
A4-MB14: 0 mussels

Colville Indian Reservation

Inchelium
Gifford
Addy - Gifford Rd
Bradeen Rd
Buck Canyon
Miles Rd
Spirit Ridge Way
Vista Ridge Way
Inchelium Hwy
Cobbs Creek Spur Rd
Cobbs Creek Rd
Cobbs Creek FDR Lake Rd
Hall Creek
Shaffer Rd
Short Cut Rd
Twin Lakes Rd
Blackbird Dr
Bridge Creek Rd
County Road 3
Ferry Crossing Landing Rd
Blue Willow Rd
Peone Ln
Silver Creek Rd
Covada Rd
Bourgeau Rd
Rattlesnake Mountain
County Road 59
Cameron Rd
25

Legend

- Proposed Sampling Area
- Spring 2016 Mussel Sampling Transect

USFWS Mussel Sampling Transects

- 2012
- 2013
- 2009 Targeted Fish Sampling Area
- County Lines
- Reservations
- River Mile (USGS)

Windward environmental LLC

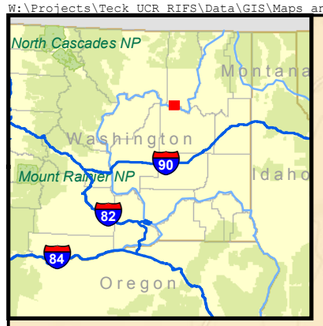
0 0.5 1 Km

0 0.25 0.5 Miles

N

Map A4-3. **Mussel Collection Results for Sampling Area 4**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-4 6287 Sampling Area 6 mussel results.mxd @ 07/29/2016



A6-MB06: 0 mussels
A6-MB03: 7 mussels
Covington Cove: 0 mussels
A6-MB09: 10 mussels
Covington Cove: 40 mussels
A6-MB01: 27 mussels
Colville Indian Reservation
A6-MB08: 14 mussels
A6-MB07: 11 mussels
A6-MB02: 0 mussels
RM 615
RM 616
RM 617
RM 618
RM 614
A6-MB05: 7 mussels
A6-MB04: 1 mussels
A6-MB10: 0 mussels
Keller Ln E
Gander Flats Dr N
21
Swawilla Basin Rd
2282 ft
2891 ft
1891 ft
2000 ft

Legend

- Proposed Sampling Area
- Human Access Point
- Spring 2016 Mussel Sampling Transect

USFWS Mussel Sampling Transects

- 2012
- 2013
- County Lines
- Reservations
- River Mile (USGS)

Windward environmental LLC

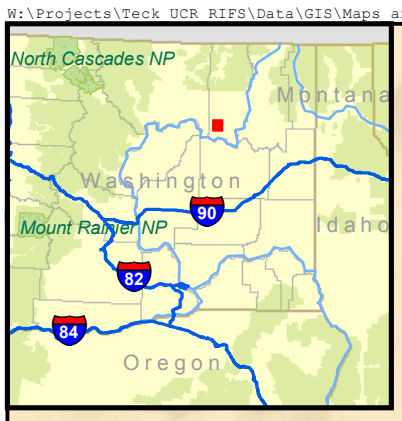
0 0.275 0.55 Km

0 0.125 0.25 Miles

N

Map A4-4. **Mussel Detail for Sampling Area 6**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-5 6289 Sanpoil River Reference Area mussel results.mxd @ 07/29/2016



Legend

- Proposed Sampling Area
- Spring 2016 Mussel Sampling Transect
- USFWS 2013 Mussel Sampling Transect
- Reservations

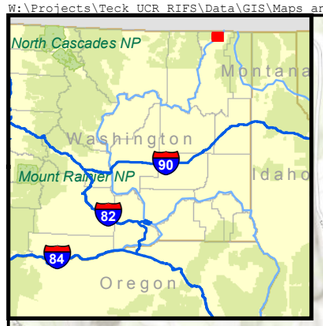
SR-MB10: 0 mussels
SR-MB09: 14 mussels
SR-MB04: 2 mussels
SR-MB05: 0 mussels
SR-MB03: 2 mussels
Silver Creek Sanpoil: 100 mussels
Keller
SR-MB02: 0 mussels
SR-MB01: 8 mussels
Colville Indian Reservation
SR-MB06: 0 mussels
SR-MB12: 0 mussels
SR-MB08: 6 mussels
SR-MB11: 2 mussels
SR-MB07: 0 mussels

Windward environmental LLC

Km
0 0.175 0.35
Miles
0 0.125 0.25
N

Map A4-5. **Mussel Collection Results for the Sanpoil River Reference Sampling Area**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-6 6282 Sampling Area 1 crayfish results.mxd @ 07/29/2016



A1-CT06: 0 crayfish
RM 739
A1-CT07: 0 crayfish
RM 738
A1-CT09: 0 crayfish
A1-CT12: 0 crayfish
RM 737
A1-CT10: 0 crayfish
Deadman's Eddy: 0 crayfish
A1-CT08: 0 crayfish
A1-CT11: 0 crayfish
RM 736
A1-CT13: 0 crayfish
Northport: 0 crayfish
RM 735
A1-CT05: 0 crayfish
A1-CT04: 0 crayfish
A1-CT03: 0 crayfish
RM 734
A1-CT02: 0 crayfish
A1-CT01: 0 crayfish
RM 733

Sheep Creek Branch Rd
Sheep Creek Rd
Northport Flat Creek Rd
Black Bear Way
Mitchell Rd
Quartz Creek
Mills Way
Goodere Creek
Northport-Waneta Rd
Kettle and Columbia Railway
Columbia Ave
Summit Ave
Center Ave
Burlington Northern & Santa Fe
Silver Crown Ave
Leroy Ave
Fir Ave
Aladdin Rd
Broderius Rd
Hwy Northport Rd
Deep Creek
Silver Crown Mountain
Northport
1930 ft
2449 ft
1932 ft

Legend

- Proposed Sampling Area
- Spring 2016 Crayfish Trap

USFWS Crayfish Trap Locations

- Deadman's Eddy
- Northport
- 2009 Targeted Fish Sampling Area
- River Mile (USGS)

Windward environmental LLC

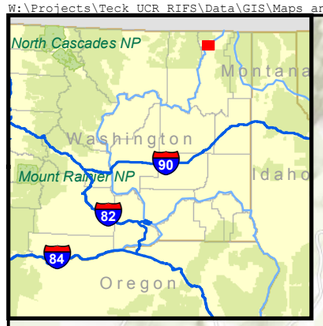
0 0.3 0.6 Km

0 0.15 0.3 Miles

N

Map A4-6. **Crayfish Collection Results for Sampling Area 1**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-7 6283 Sampling Area 2 crayfish results.mxd @ 07/29/2016



A2-CT13: 3 crayfish
A2-CT14: 1 crayfish
A2-CT15: 0 crayfish
A2-CT11: 0 crayfish
A2-CT06: 1 crayfish
A2-CT05: 0 crayfish
RM 721
A2-CT07: 0 crayfish
RM 722
A2-CT08: 0 crayfish
China Bar: 0 crayfish
RM 724
A2-CT10: 1 crayfish
RM 723
A2-CT12: 0 crayfish
A2-CT09: 0 crayfish
A2-CT04: 0 crayfish
RM 720
A2-CT03: 0 crayfish
A2-CT02: 0 crayfish
RM 719
A2-CT01: 1 crayfish
North Gorge: 2 crayfish
RM 718

Legend

- Proposed Sampling Area
- Spring 2016 Crayfish Trap

USFWS Crayfish Trap Locations

- China Bar
- North Gorge
- 2009 Targeted Fish Sampling Area
- River Mile (USGS)

Windward environmental LLC

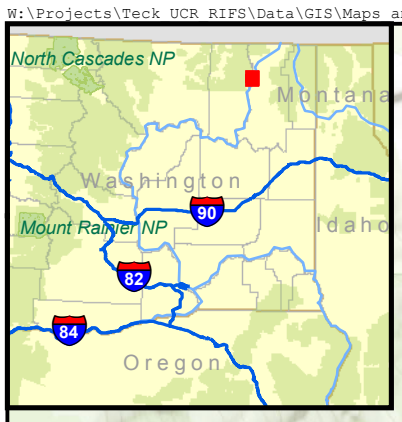
0 0.25 0.5 Km

0 0.25 0.5 Miles

N

Map A4-7. **Crayfish Collection Results for Sampling Area 2**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-8 6284 Sampling Area 3 crayfish results.mxd @ 07/29/2016



A3-CT06: 0 crayfish
RM 706
A3-CT05: 0 crayfish
Marcus Pingston Creek: 0 crayfish
RM 705
Marcus Nancy Creek: 0 crayfish
A3-CT11: 0 crayfish
A3-CT04: 0 crayfish
A3-CT07: 0 crayfish
RM 704
A3-CT12: 0 crayfish
A3-CT08: 0 crayfish
A3-CT14: 1 crayfish
A3-CT09: 0 crayfish
A3-CT03: 0 crayfish
A3-CT10: 0 crayfish
RM 703
Marcus East of St. Paul's Mission: 0 crayfish
A3-CT02: 1 crayfish
RM 702
A3-CT13: 1 crayfish
RM 701
A3-CT01: 1 crayfish
RM 700
Kettle Falls: 7 crayfish
RM 699
Colville River (2 Km upstream): 4 crayfish

Legend

- Proposed Sampling Area
- Spring 2016 Crayfish Trap

USFWS Crayfish Trap Locations

- Colville River (2 Km upstream)
- Kettle Falls
- Marcus East of St. Paul's Mission
- Marcus Nancy Creek
- Marcus Pingston Creek
- 2009 Targeted Fish Sampling Area
- County Lines
- River Mile (USGS)

Windward environmental LLC

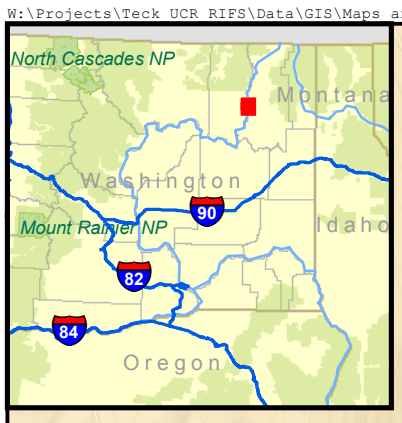
0 0.5 1 Km

0 0.25 0.5 Miles

N

Map A4-8. **Crayfish Collection Results for Sampling Area 3**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-9 6285 Sampling Area 4 crayfish results.mxd @ 07/29/2016



RM 678
RM 677
RM 676
RM 675
RM 674
RM 673
RM 672
RM 671

Daisy: 13 crayfish
A4-CT11: 0 crayfish
A4-CT22: 0 crayfish
A4-CT12: 0 crayfish
A4-CT23: 0 crayfish
A4-CT21: 0 crayfish
A4-CT20: 0 crayfish
A4-CT10: 0 crayfish
A4-CT09: 0 crayfish
A4-CT06: 0 crayfish
A4-CT08: 0 crayfish
A4-CT07: 0 crayfish
A4-CT17: 1 crayfish
A4-CT19: 0 crayfish
A4-CT18: 0 crayfish
A4-CT04: 1 crayfish
A4-CT16: 0 crayfish
A4-CT05: 0 crayfish
A4-CT03: 0 crayfish
Cloverleaf: 10 crayfish
A4-CT15: 1 crayfish
A4-CT02: 0 crayfish
A4-CT01: 1 crayfish
A4-CT13: 0 crayfish
A4-CT14: 0 crayfish
A4-CT24: 0 crayfish
A4-CT25: 0 crayfish
Gifford: 17 crayfish

Colville Indian Reservation

Gifford
Inchelium
Buck Canyon
Miles Rd
Bradeen Rd
Addy - Gifford Rd
Vista Ridge Way
Spirit Ridge Way
Stranger Creek
Inchelium Hwy
Cobbs Creek Rd
Cobbs Creek Spur Rd
Hall Creek
Hemming Rd
FDR Lake Rd
Shaffer Rd
Short Cut Rd
Blackbird Dr
Twin Lakes Rd
Bridge Creek Rd
County Road 3
Ferry Crossing Landing Rd
Blue Willow Rd
Peone Ln
Silver Creek Rd
Covada Rd
Bourgeau Rd
Rattlesnake Mountain
County Road 59
Cameron Rd

Legend

- Proposed Sampling Area
- Spring 2016 Crayfish Trap

USFWS Crayfish Trap Locations

- Cloverleaf
- Daisy
- Gifford
- 2009 Targeted Fish Sampling Area
- County Lines
- Reservations
- River Mile (USGS)

Windward environmental LLC

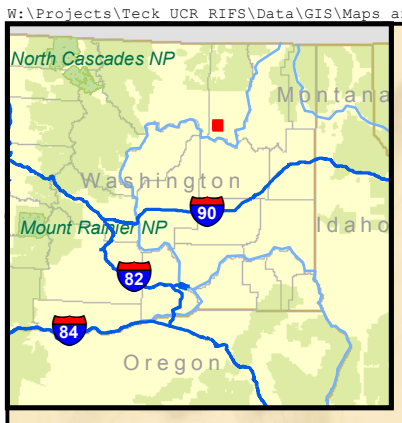
0 0.5 1 Km

0 0.25 0.5 Miles

N

Map A4-9. **Crayfish Collection Results for Sampling Area 4**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-10 6289 Sanpoil River Reference Area crayfish results.mxd @ 07/29/2016



Legend

- Proposed Sampling Area
- Spring 2016 Crayfish Trap
- Reservations

SR-CT11: 2 crayfish
SR-CT10: 0 crayfish
SR-CT12: 1 crayfish
SR-CT09: 1 crayfish
SR-CT08: 2 crayfish
SR-CT07: 1 crayfish
SR-CT06: 1 crayfish
SR-CT05: 0 crayfish
SR-CT16: 1 crayfish
SR-CT04: 1 crayfish
SR-CT03: 0 crayfish
SR-CT02: 1 crayfish
SR-CT15: 0 crayfish
SR-CT01: 1 crayfish
SR-CT13: 0 crayfish
SR-CT14: 0 crayfish

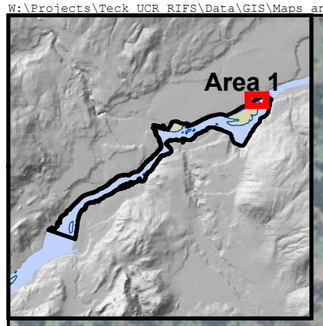
Keller
Colville Reservation
Colville Indian Reservation
Alice Creek Rd
Meadow Creek Rd
Meadow Creek
Silver Creek Rd
Keller School Rd
Community Church Rd
Mountain Ridge Homes
Sanpoil Homes Rd
Meadow Creek Homes Rd
Alice Flats Rd
E Sanpoil Rd
Jack Creek Rd
Audrey Ln
Copper Creek Rd
Copper Creek
WA-21
1280 ft

Windward environmental LLC

0 0.175 0.35 Km
0 0.125 0.25 Miles
N

Map A4-10. **Crayfish Collection Results for the Sanpoil River Reference Sampling Area**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-11 6282 Sampling Area 1 proposed mussel - Deadmans Eddy Upstrm.mxd @ 07/29/2016



A1-MB03: 0 mussels

Deadman's Eddy, upstream end of gravel bar: 20 mussels

1285 ft
1280 ft
1275 ft
1270 ft
1265 ft
1255 ft
1260 ft
1290 ft

Legend

- Spring 2016 Mussel Sampling Transect
- USFWS 2013 Mussel Sampling Transect

Windward environmental LLC

Meters
0 15 30

Yards
0 15 30

N

Map A4-11. **Proposed Mussel Location for Sampling Area 1 – Upstream of Deadman's Eddy**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-12 6282 Sampling Area 1 proposed mussel - Deadmans Eddy.mxd @ 07/29/2016

Windward environmental LLC

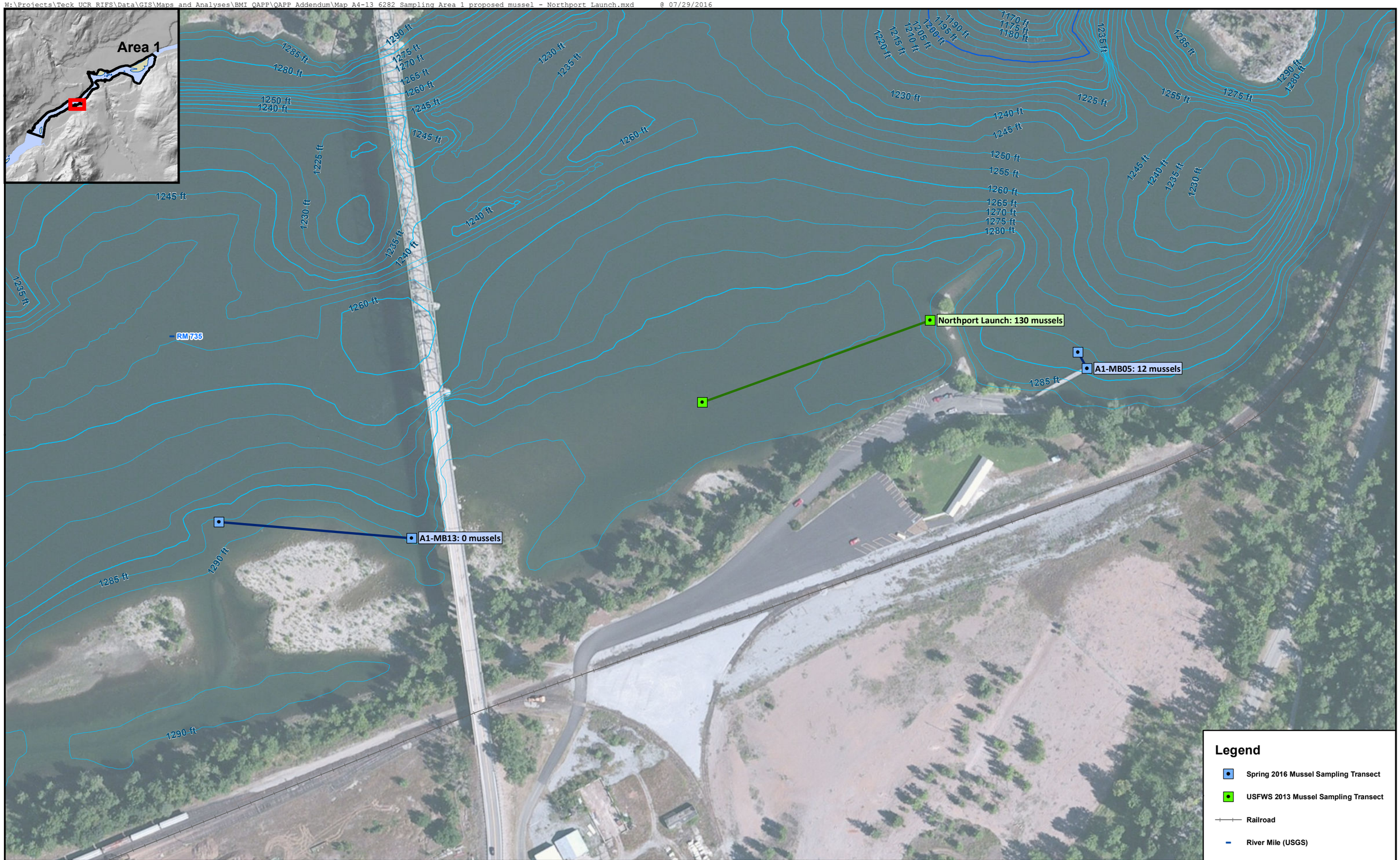
Meters
0 30 60

Yards
0 30 60

N

Map A4-12. **Proposed Mussel Location for Sampling Area 1 –Deadman's Eddy**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-13 6282 Sampling Area 1 proposed mussel - Northport Launch.mxd @ 07/29/2016



Windward environmental LLC

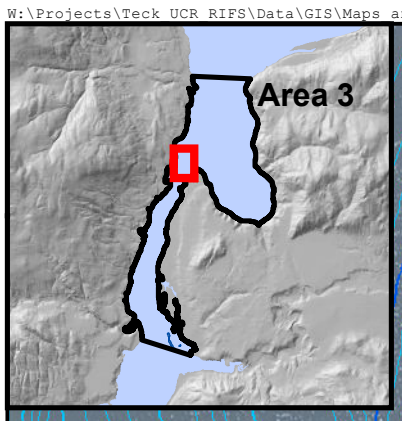
Meters 0 25 50

Yards 0 25 50

N

Map A4-13. **Proposed Mussel Location for Sampling Area 1 – Northport Launch**
Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-14 6284 Sampling Area 3 proposed mussel - Hayes Island.mxd @ 07/29/2016



A3-MB06: 5 mussels

Hayes Island: 1380 mussels

Hayes Island: 461 mussels

A3-MB01: 4 mussels

RM 704

1280 ft
1260 ft
1240 ft
1220 ft
1200 ft
1180 ft
1160 ft
1140 ft
1120 ft
1100 ft
1080 ft
1060 ft
1040 ft

Legend

- Spring 2016 Mussel Sampling Transect

USFWS Mussel Sampling Transects

- 2012
- 2013
- County Lines
- River Mile (USGS)

Windward environmental LLC

Meters: 0 45 90

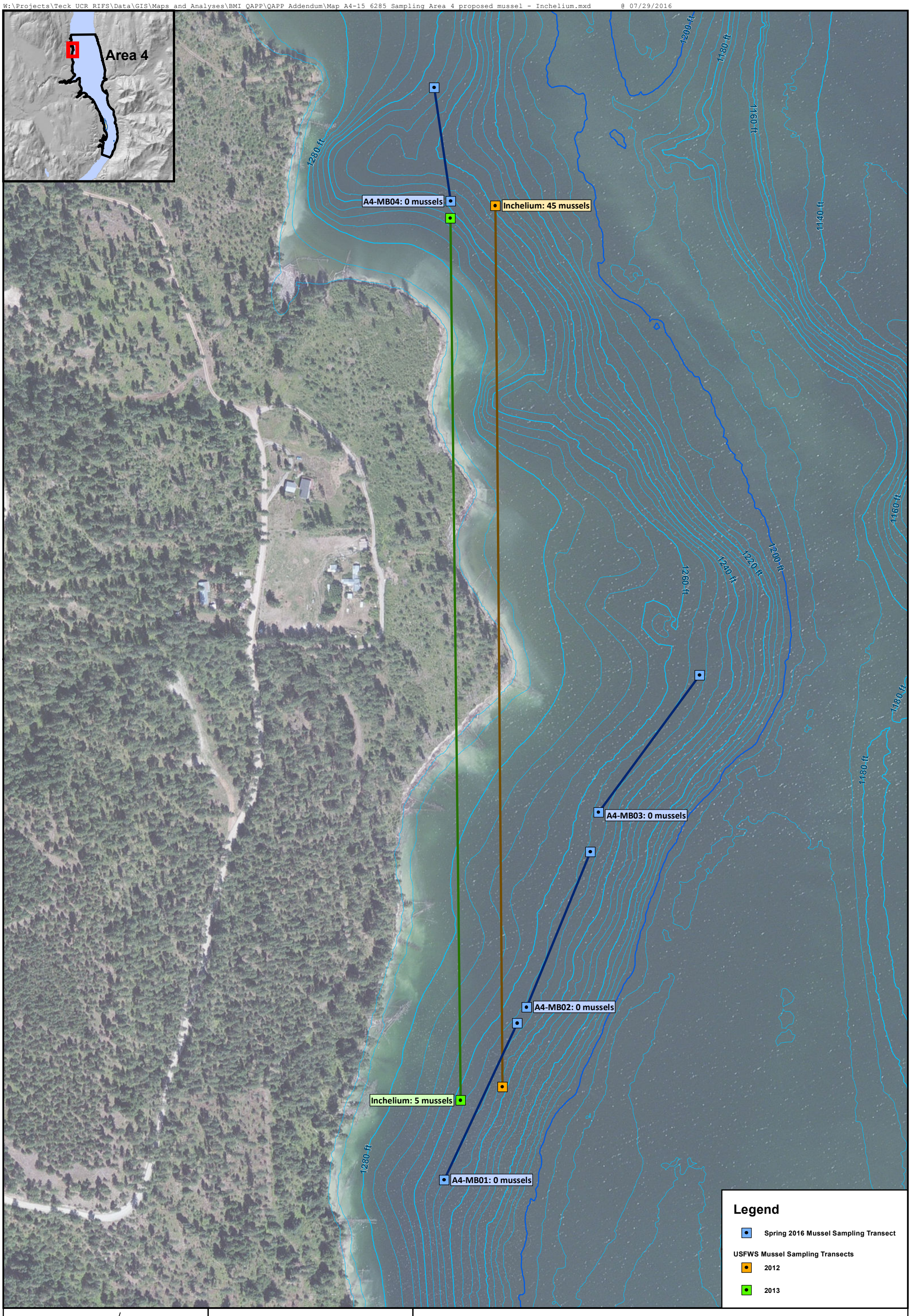
Yards: 0 40 80

N

Map A4-14. **Proposed Mussel Location for Sampling Area 3 – Hayes Island**

Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-15 6285 Sampling Area 4 proposed mussel - Inchelium.mxd @ 07/29/2016



Windward environmental LLC

Meters 0 55 110

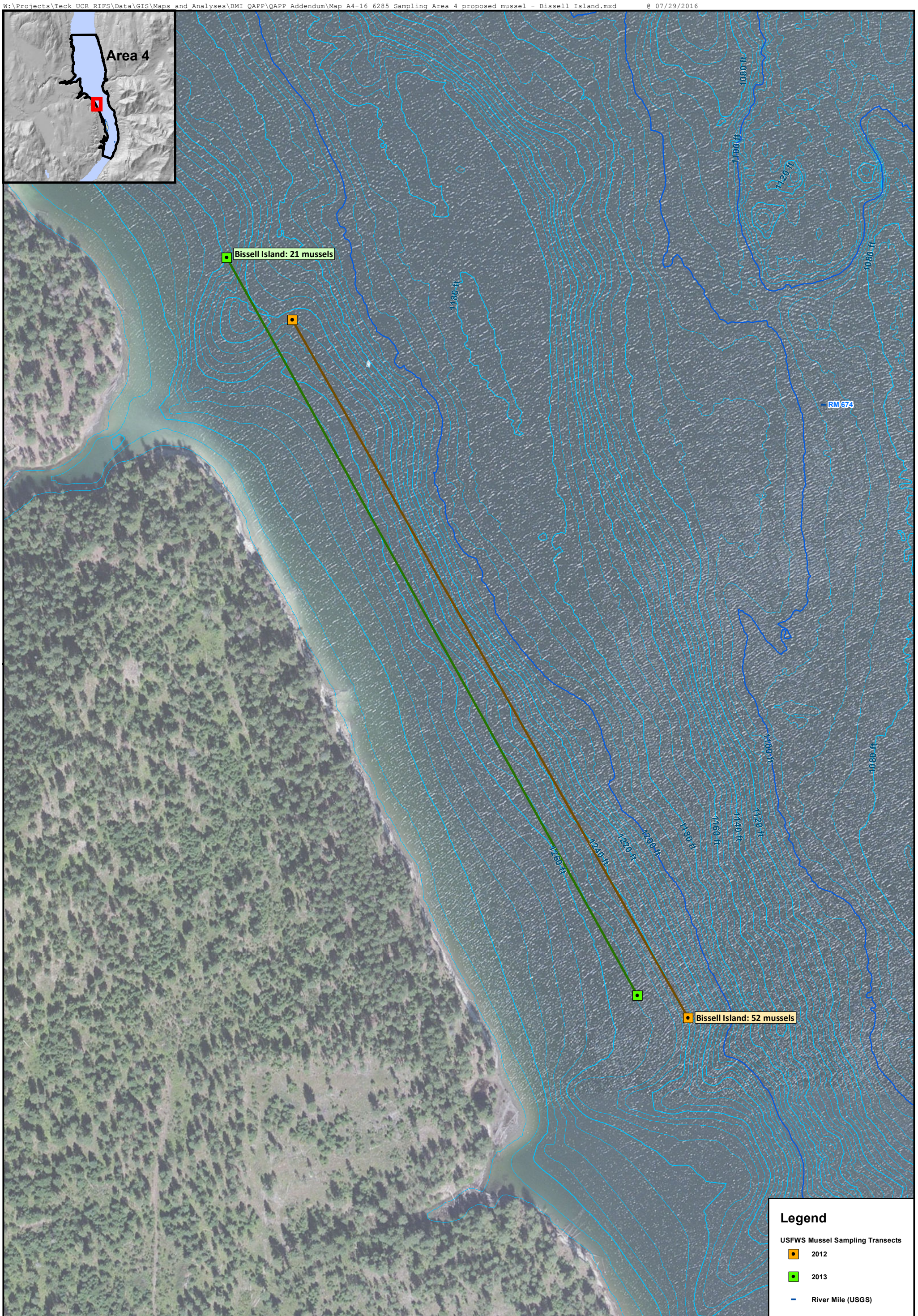
Yards 0 50 100

N

Map A4-15, **Proposed Mussel Location for Sampling Area 4 – Inchelium**

Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-16 6285 Sampling Area 4 proposed mussel - Bissell Island.mxd @ 07/29/2016



Windward environmental LLC

0 45 90 Meters

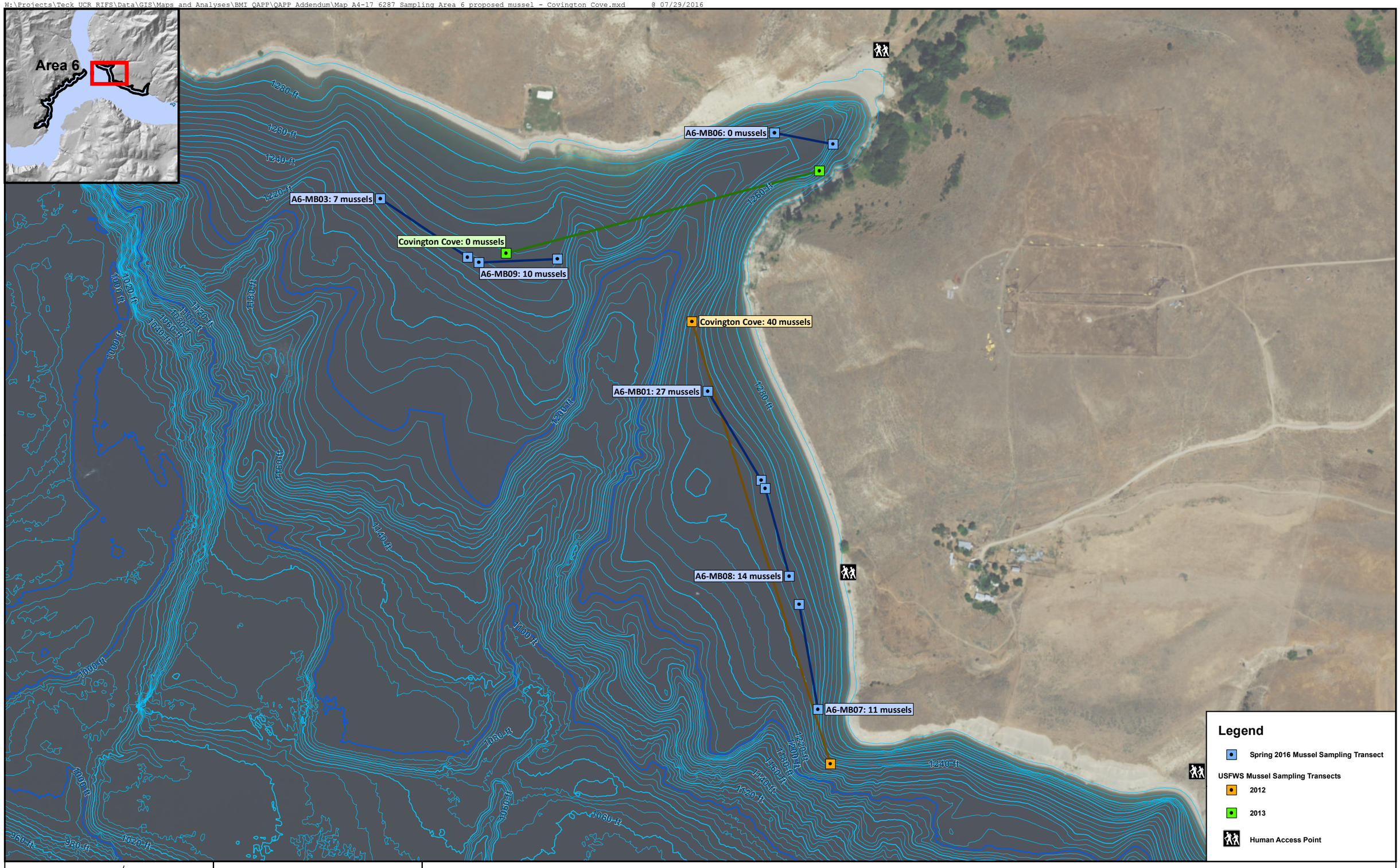
0 40 80 Yards

N

Map A4-16, **Proposed Mussel Location for Sampling Area 4 – Bissell Island**

Upper Columbia River, WA

W:\Projects\Teck UCR RIFS\Data\GIS\Maps and Analyses\BMI QAPP\QAPP Addendum\Map A4-17 6287 Sampling Area 6 proposed mussel - Covington Cove.mxd @ 07/29/2016



Windward environmental LLC

Meters
0 62.5 125

Yards
0 65 130

N

Map A4-17. **Proposed Mussel Location for Sampling Area 6 – Covington Cove**
Upper Columbia River, WA

W:\Projects\Teck_UCR_RIFS\Data\GIS\Maps_and_Analyses\BMI_QAPP\QAPP Addendum\Map A4-18 6289 Sanpoil River Reference Area proposed mussel - Silver Creek.mxd @ 07/29/2016

Windward environmental LLC

Map A4-18. **Proposed Mussel Location for the Sanpoil River – Near the Silver Creek Road Crossing**
Upper Columbia River, WA

W:\Projects\Teck_UCR_RIFS\Data\GIS\Maps_and_Analyses\BMI_QAPP\QAPP Addendum\Map A4-19 6289 Sanpoil River Reference Area proposed mussel - Copper Creek.mxd @ 07/29/2016

Legend

- Spring 2016 Mussel Sampling Transect
- Reservations

Windward environmental LLC

Meters 0 15 30

Yards 0 15 30

N

Map A4-19. **Proposed Mussel Location for the Sanpoil River – Near Copper Creek**
Upper Columbia River, WA

TABLES

Table A4-1. Summary of Number of Mussel and Crayfish Composite Samples

	Mussel Composite Samples			Crayfish Composite Samples		
Sampling Area	Target	Actual - Spring 2016	Proposed - Summer/Fall 2016	Target	Actual - Spring 2016	Proposed - Summer/Fall 2016
1	6	3	3	6	0	6
2	6	6	0	6	2	4
3	6	4	2[a]	6	4	2[a]
4	6	0	6	6	1	5
5	6	0	0[b]	6	6	0
6	6	2[c]	4[d]	6	6	0
Buffalo Lake[e]	6	0	0[e]	6	6	0
Sanpoil River	6	3	3[d]	6	6	0[f]
Total	**48**	**18**	**18**	**48**	**31**	**17**

Notes:

[a] In addition to composite samples targeted for this area, additional organisms are targeted to supplement proposed samples collected in spring 2016 that are comprised of one organism (see Table A4-4 for details).

[b] Although Area 5 is not a targeted sampling area for mussels, a limited reconnaissance effort will be conducted using the underwater camera to evaluate the potential presence of mussels at depths deemed accessible by the EPA dive team (see Sections A4.1.2 and A4.4.2). EPA has stated that presence of mussels may indicate a complete and significant exposure pathway for ecological receptors that might consume mussels in this area. If mussels are observed by underwater camera, the LOE for diving to collect mussels will be determined in coordination with EPA oversight. Composite mussel samples from Area 5 would be analyzed for target analyte list metals, total mercury, and percent moisture.

[c] At Area 6, *Corbicula* clams were collected in addition to mussels. Four more composite samples are possible for this area if the clams are analyzed for metals, however, collecting more mussels at Area 6 is preferred. The *Corbicula* may be analyzed if the target number of mussel composite samples are not collected in summer/fall 2016.

[d] In addition to composite samples targeted at these areas, additional tissue mass is targeted for collection to supplement proposed composite samples collected in spring 2016 that do not have enough mass to analyze for all target analytes (see Table A4-4 for details).

[e] Due to lack of suitable sampling habitat at Rebecca Lake, Buffalo Lake was used as an alternate reference area in spring 2016, however, suitable mussel habitat was also not observed at Buffalo Lake. For this reason, the Sanpoil River is the only reference area proposed for mussel sampling in summer/fall 2016.

[f] For crayfish in the Sanpoil River, no additional composite samples are targeted, however, an additional organism and additional tissue mass are targeted to supplement proposed composite samples collected in spring 2016 (see Table A4-4 for details).

Table A4-2. Mussel Sampling Summary by Area

Area	1	2	3	4	5	6	RL/BL	SR		
Type of Area	BERA	BERA, HHRA	BERA	BERA	BERA, HHRA	BERA, HHRA	Reference	Reference	Total	Average
USFWS April-May 2012[a]										
Surveyed by USFWS 2012	yes	yes	yes	yes	no	yes	no	no	NA	NA
No. Locations Surveyed	1	2	1	2	NA	1	NA	NA	7	1.4
No. Locations with Mussels Collected	1	2	1	2	NA	1	NA	NA	7	1.4
Average No. Mussels/Transect Meter	0.02	0.16	3.1	0.07	NA	0.06	NA	NA	NA	0.7
USFWS April-May 2013 and September 2013[b]										
Surveyed by USFWS in 2013	yes	yes	yes	yes	no	yes	no	yes	NA	NA
No. Locations Surveyed	9	2	1	2	NA	1	NA	1	16	2.7
No. Locations with Mussels Collected	4	2	1	2	NA	0	NA	1	10	1.7
Average No. Mussels/Transect Meter	0.25	0.28	10	0.02	NA	0	NA	1.2	NA	2.0
TAI April-May 2016										
No. Locations Surveyed	13	12	13	17	20	10	12	12	109	13.6
No. Locations with Mussels Collected	1	4	5	3	1	8	NA	6	28	4.0
Average No. Mussels/Transect Meter[c]	0.08	0.06	0.02	0.00	0.00	0.06	0	0.04	NA	0.03
Average Grams Live Mussel/Transect Meter	1.3	1.5	0.23	0	0	0.08	0	0.29	NA	0.4

Notes:

USFWS numbers are for locations or samples only within the designated area.

[a] All mussels collected by USFWS in 2012 were dead.

[b] Most mussels collected by USFWS in 2013 were dead, except for those from the Sanpoil River.

[c] Based on live and dead mussels.

BERA - baseline ecological risk assessment

HHRA - human health risk assessment

NA - not applicable

No. - number

RL/BL - Buffalo Lake reference area

SR - Sanpoil River reference area

USFWS - U.S. Fish and Wildlife Service

Table A4-3. Crayfish Sampling Summary by Area

	Area	1	2	3	4	5	6	RL/BL	SR		
	Type of Area	BERA	BERA, HHRA	BERA	BERA	BERA, HHRA	BERA, HHRA	Reference	Reference	Total	Average
USFWS July-October 2012											
Sampled by USFWS 2012		yes	yes	yes	yes	no	no	no	no	NA	NA
No. Trap Locations		34	60	78	39	NA	NA	NA	NA	211	NA
No. Crayfish/Trap Night		0	0.03	0.02	1.01	NA	NA	NA	NA	NA	0.26
TAI April-May 2016											
No. Trap Locations		13	15	14	25	26	15	11	17	136	17
No. Trap Nights		91	95	94	90	150	90	90	117	817	102
No. Crayfish/Trap Night		0	0.074	0.043	0.044	0.10	0.22	0.58	0.10	NA	0.15
Grams Crayfish/Trap Night		0	2	1	1	4	8	16	3	NA	4

Notes:

USFWS numbers are for locations or samples only within the designated area.

BERA - baseline ecological risk assessment

HHRA - human health risk assessment

NA - not applicable

No. - number

RL/BL - Buffalo Lake reference area

SR - Sanpoil River reference area

USFWS - U.S. Fish and Wildlife Service

Table A4-4. Target Number of Composite Samples and Tissue Mass for Collection in Summer/Fall 2016

				Number of Composite Samples				Tissue Mass Needed for Chemical Analysis per Composite Sample[c] (g ww)		Number of Additional Organisms to Supplement Single Organism Samples		Supplement Samples with Partial Analyte List (g ww)	
				Mussels	Crayfish								
Sampling Area	Area Type	HHRA[a]	BERA[b]	Soft Tissue	Whole Body Minus Stomach and Carapace	Stomach and Carapace Only	Whole Body (All Parts)	Mussels	Crayfish	Mussels	Crayfish	Mussels	Crayfish
1	Site		X	3[d]	NA	NA	6[d]	4.5	4.5	NA	NA	NA	NA
2	Site	X	X	0	4	4	calculated[e]	NA	60	NA	NA	NA	NA
3	Site		X	2[d]	NA	NA	2[d]	4.5	4.5	2	4	NA	NA
4	Site		X	6[d]	NA	NA	5[d]	4.5	4.5	NA	NA	NA	NA
6	Site	X	X	4	NA	NA	0	30	NA	NA	NA	7.6[f]	NA
Sanpoil River	Reference	X	X	3	NA	NA	0	30	NA	NA	1[g]	39.9[h]	93[g]

Notes:

[a] For crayfish, the HHRA will only include samples for whole body minus stomach and carapace.

[b] For crayfish, the BERA will include data representing whole body samples, which, if not analyzed as whole body samples, will be calculated as described in footnote e of this table.

[c] EPA splits and field splits are targeted for analysis on a subset of 15 percent and 5 percent of the total number of samples, respectively. Field replicates may also be collected if sufficient mass is available. Each sample analyzed as a split or a replicate will need twice the targeted sample mass.

[d] Sample types that will only be used in the BERA (i.e., all mussel and crayfish samples from Areas 1, 3, and 4) will be analyzed for TAL metals, total mercury, and percent moisture. Analysis of methylmercury, inorganic arsenic, PCB congeners, dioxins/furans, and percent lipids will not be conducted for these samples because these analytes are only of concern for the HHRA.

[e] Whole body tissue concentrations will be calculated based on a weighted sum of whole body minus stomach and carapace, and stomach and carapace only samples. Crayfish samples for whole body minus stomach/carapace and stomach/carapace only samples will be comprised of the same individuals.

[f] Mass needed for analysis; the mass targeted for collection is 15.2 g ww (assuming the shell is 50 percent of the total weight).

[g] For crayfish in the Sanpoil River reference area, no additional composite samples are targeted, however, an additional organism and 93 g ww of tissue is targeted. The 93 g ww of tissue is necessary to supplement three samples collected in spring 2016. Therefore, a minimum of three crayfish weighing at least 28 g ww, 30 g ww, and 35 g ww are targeted, plus one additional organism.

[h] Mass needed for analysis; the mass targeted for collection is 79.8 g ww (assuming the shell is 50 percent of the total weight).

BERA - baseline ecological risk assessment

HHRA - human health risk assessment

NA - not applicable

APPENDIX A

EPA DIVE PLAN

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

DIVE PLAN

From: Rob Pedersen, Deputy UDO, Divemaster

Date of Original Request: **8/24/2016**

Dive Dates **9/7-14/2016**

Approval

Thru: Sean Sheldrake, UDO

To: Mark Filippini, Unit Manager, OERA

David Allnut, Director OERA

Project: **Support for Upper Columbia River (UCR) SF/Risk Assessment**
Mussel collection for tissue analysis.

Requesting Office/Point of Contact: Dustan Bott, ECL
Account Number: **1TR2B 303DD2 10NZBB00 Removal o/s**
Location: North of Northport (vic. Dead Man's Eddy) to confluence with the Spokane River; Sanpoil River
Approx. 48.9495° N Lat; -117.4105° W Long. to 47.9076° N Lat; -118.3413° W Long.

I have read and understand the dive plan and tethered SCUBA / surface supplied diving SOP. **Diver Initials:**

***JUSTIFICATION FOR HAZARDOUS DUTY**
This dive plan conforms to the elements in EPA Order 3100.3A and meets the requirements specified in 5 CFR 550, Subpart I, Appendix A, Underwater Duty and/or Exposure to Hazardous Agents as noted directly below. A hazard pay differential of 25% is warranted. A general "Request for Approval of a Hazard Pay Differential" form is on file with UDO, Deputy UDOs, & RHSO

APPLICABLE EXPECTED HAZARDOUS CONDITIONS *(check all that apply)*
(X) Underwater duty: Diving required in scientific and engineering pursuits, when:
(X) at a depth of 20 feet or more below the surface; or
(X) visibility is restricted; or
(X) in rapidly flowing or cold water; or
( ) vertical access to the surface is restricted by ice, rock, or other structure (e.g. entanglements); or
( ) testing or working with hardware which presents special hazards (e.g., high voltage equipment or underwater mockup components in an underwater space simulation study). **EXPLAIN**: _____.
Exposure to Hazardous Agents, work with or in proximity to:
( ) Toxic chemical materials. Toxic chemical materials when there is a possibility of leakage or spillage.
( ) Virulent biologicals. Materials of micro-organic nature which when introduced into the body are likely to cause serious disease or fatality and for which protective devices do not afford complete protection.

OBJECTIVES AND LOGISTICS

Scientific Objectives: The following dives will be conducted under the OSHA Scientific Diving Exemption, 1910 Subpart T Appendix B. Divers will collect mussels for tissue analysis in a Risk Assessment and Remedial Design for Upper Columbia River cleanup efforts.

Figure 1. General Map of area.

Problem Statement and Purpose: The EPA R10 Dive Unit will assist the Office of Environmental Cleanup in data collection within the Upper Columbia River.

Alternatives to Diving: Divers are needed to visually identify target macroinvertebrates (fresh water mussels). Insufficient mussels (body mass) were collected in the spring of 2016. No remotely operated vehicle (ROV), or other alternatives to diving (such as dredging which negatively impacts the river benthos) can achieve mussel collection in waters too deep for snorkeling.

Value to EPA: Use of the Region 10 Dive Unit will avail Programmatic (ECL, OERA) and scientific expertise (with data collection to support Risk Assessments) to the dive operation and is not otherwise available from private contractors.

Scientific Observations/Data collection:

There are five Sampling Areas. The sample areas are described in the Upper Columbia River Quality Assurance Project Plan – Macroinvertebrate Tissue Study, April 2016 (QAPP) Addendum (original QAPP - Macroinvertebrate Tissue Study QAPP Addendum No. 1, September 2016). The EPA Dive Unit will be collecting fresh water mussels (no clams or crayfish). Table 1 is based on the QAPP; the Sampling Areas are: 1*, 3, 4, 6, and the background site, the Sanpoil River*.
*Based on information from Teck American, Inc., diving will not be needed to collect mussels from Area 1 and the Sanpoil River.

Mussel collection areas are based, in part, on the snorkel diving results from surveys and mussel collections performed by the USFWS (for the USFWS sampling protocols refer to Appendix 1). The recon vessel will be deploying a ROV to locate mussels and then place a marker buoy for the divers. If the ROV fails to find mussels, the divers will survey the previously successful USFWS transects.

Once on site, the vessel Captain will secure the boat up stream of the target survey area so that the divers can be tended (via a hard-wired tethered communication (comm) line) from the stern of the vessel. This could be achieved by use of several anchors.

The Cultural Resource monitor will check the material collected by the diver. Any mussels placed in a bucket of water will be covered and labeled; the Cultural Resource monitor will be the first person to open the bucket prior to processing on the support vessel. The pre-dive briefing will include a discussion of cultural resources. Divers will understand that if an object of suspected anthropological origin is found that the dive will be aborted, the GPS locations will be documented and the Cultural Resource Officer will be notified. Dives will not be digging into the benthos.

Once the diver enters the water, the tender will belay them to the downstream portion of the survey area. The diver will search for and collect fresh water mussels while communicating with the tender to be drawn up or let down-current (by the amount of tether line between the tender and diver); the diver will also perform lateral sweeps to search for mussels.

The collection areas will be documented with the vessel's GPS, correcting for the length of tether to diver and compass bearing to the diver's survey area. Transects will not be place or measured. The tether length is 300 feet and is marked in ten foot increments. The diver can work as a type of pendulum on the tether and can survey from side to side. Potentially, on one dive, a diver can survey approximately 100 meters and incorporate arcs at specific distances along the 300 foot tether. The diver will adjust their buoyancy to stay off the river bottom and close enough to see the bottom based on visibility. If the diver spots mussels and begins a collection, the diver will communicate with the tender and the location will be documented as described above.

-Surveyors will slowly swim above the substrate using both visual and tactile (hand grubbing or probing the substrate up to one inch in depth).
-Mussels will be gently removed from the substrate and collected in mesh goody bags and brought back to the boat. Enough mussels will be collected from each area to satisfy the quantity of mussel body tissue mass stipulated in Table 1.
-The goody bag with the mussels will be stored in a bucket of water dipped from the site.
-Buckets will be lidded and labeled and placed in the shade.
-Mussels will be transferred to the contractors sample processing vessel following QAPP procedures.
-In the event that buckets cannot be transferred within an hour, the bucket water will be replaced/refreshed.
-If the diver has an opportunity to pass a collection to the processing vessel or the boats are rafted together, the processing vessel must be out of gear.

Table 1. Mussel Sampling Areas. (Additional mussels will be collected for sample splits – TBD.)

Mussel Sampling Areas and Locations Proposed for Summer/Fall 2016										
				Targets for Summer/Fall 2016 Sampling						
Sampling Area	Area Type	HHRA	BERA	Number of Composite Samples	Approximate Total Number of Mussels[a,b]	Estimated Total Whole Body Mass from Targeted Number of Mussels (g)	Required Total Whole Body Mass (g)	Area Access	Proposed Sampling Locations	Approximate Depth of Proposed Sampling Locations[c] (ft)
1	Site		X	3	15	75	27	Boat: Northport Community launch	Northport Launch, upstream of Deadman's Eddy[d]	Northport Launch: 0-10 Upstream of Deadman's Eddy: 0-10
3	Site		X	2	12[e]	60	18	Boat: Kettle Falls Marina launch	Hayes Island	15-80
4	Site		X	6	30	150	54	Boat: Gifford/Inchelium Ferry launch	Inchelium, Bissel Island	Inchelium: 0-60 Bissel Island: 10-60
6	Site	X	X	4	52	260	255.2[f]	Boat: Two Rivers Marina	Covington Cove	5-60
Sanpoil River	Reference	X	X	3	52	260	259.8[g]	Land[h]	Various[i]	Unknown; likely <5[i]

Notes:

[a] Represents the approximate number of mussels needed to meet required total whole body mass and collect a minimum of five mussels per composite, assuming each mussel weighs an average of 5 g. Note that this is an estimate based on 2016 spring sampling of these areas, and actual numbers and mass collected will need to be verified in the field based on Table A4-4 of the QAPP. addendum .

[b] Numbers of mussels that may be needed for EPA splits and field splits are not included.

[c] Based on an estimated water level for summer/fall 2016 of 1280 feet (ft) above mean sea level and the Columbia River batyhmetry layer.

[d] In Area 1, sampling is also proposed for Deadman's Eddy, however, diving/snorkeling is not expected for this location (i.e., shoreline surveys are anticipated to be sufficient) due to safety concerns.

[e] Includes an additional two mussels to supplement single organism samples collected in spring 2016

[f] Includes an additional 15.2 g to supplement samples collected in spring 2016 without enough mass to analyze for the full analyte list.

[g] Includes an additional 79.8 g to supplement samples collected in spring 2016 without enough mass to analyze for the full analyte list.

[h] The Sanpoil River sampling locations will likely be accessed by land. Access will be assessed during field reconnaissance.

[i] In the Sanpoil River, proposed sampling locations are near the Silver Creek road crossing, TAI 2016 sampling locations SR-MB012 and SR-SR-MB09, and several locations (to be selected in the field) between TAI 2016 sampling locations SR-MB01 and SR-MB05. The water depth at these locations during summer/fall 2016 is not known. It is anticipated that mussels will be collected from shore or by snorkeling.

BERA - baseline ecological risk assessment
g - grams
HHRA - human health risk assessment
na - not applicable

Area 1/Deadman's Eddy
48.946174 -117.719451
48.842119 -117.720173

Area 1/Northport
N **48.9222313 -117.772720** S **48.921784 -117.774808**

Area 3/Hayes Island
48.63441 -118.114414

Area 4/Inchelium
N **48.334061 -118.188036** S **48.327340 -118.188417**

Area 4/Bissell Island
48.290557 -118.161832

Area 6/Covington Cove
N **47.9499232 -118.668118** S **47.942934 -118.665440**

Figure 2a. Sampling Area 1, Deadman's Eddy, Upstream of Gravel Bar.
Approx. DmE N: **48.946174 -117.719451**

Figure 2b. Sampling Area 1, Deadman's Eddy. DmE E: **48.842119 -117.720173**

Figure 2c. Sampling Area 1, Northport Launch.
Approx. N **48.9222313 -117.772720** S **48.921784 -117.774808**

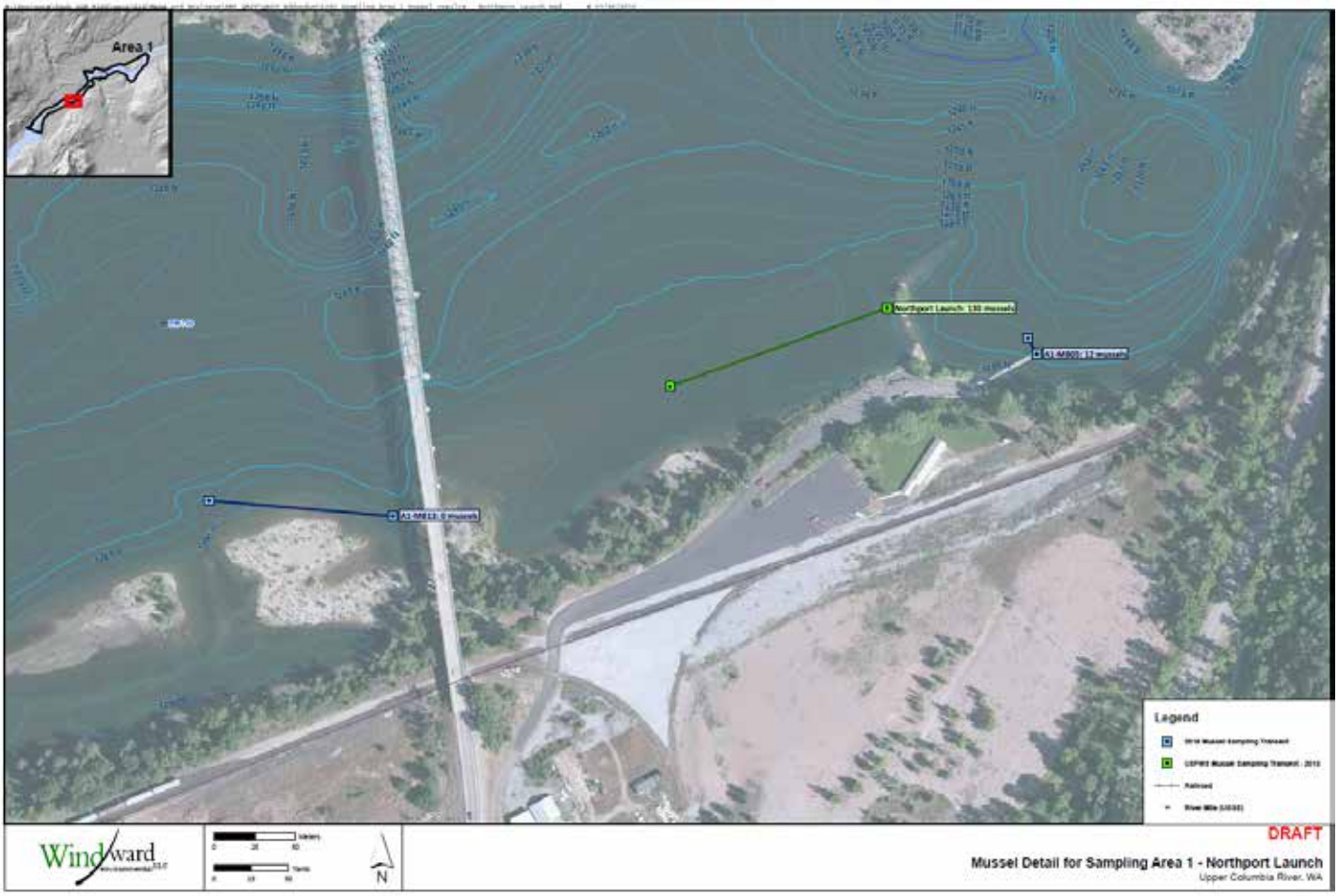


Figure 3. Sampling Area 3, Hayes Island.
Approx. **48.63441 -118.114414**

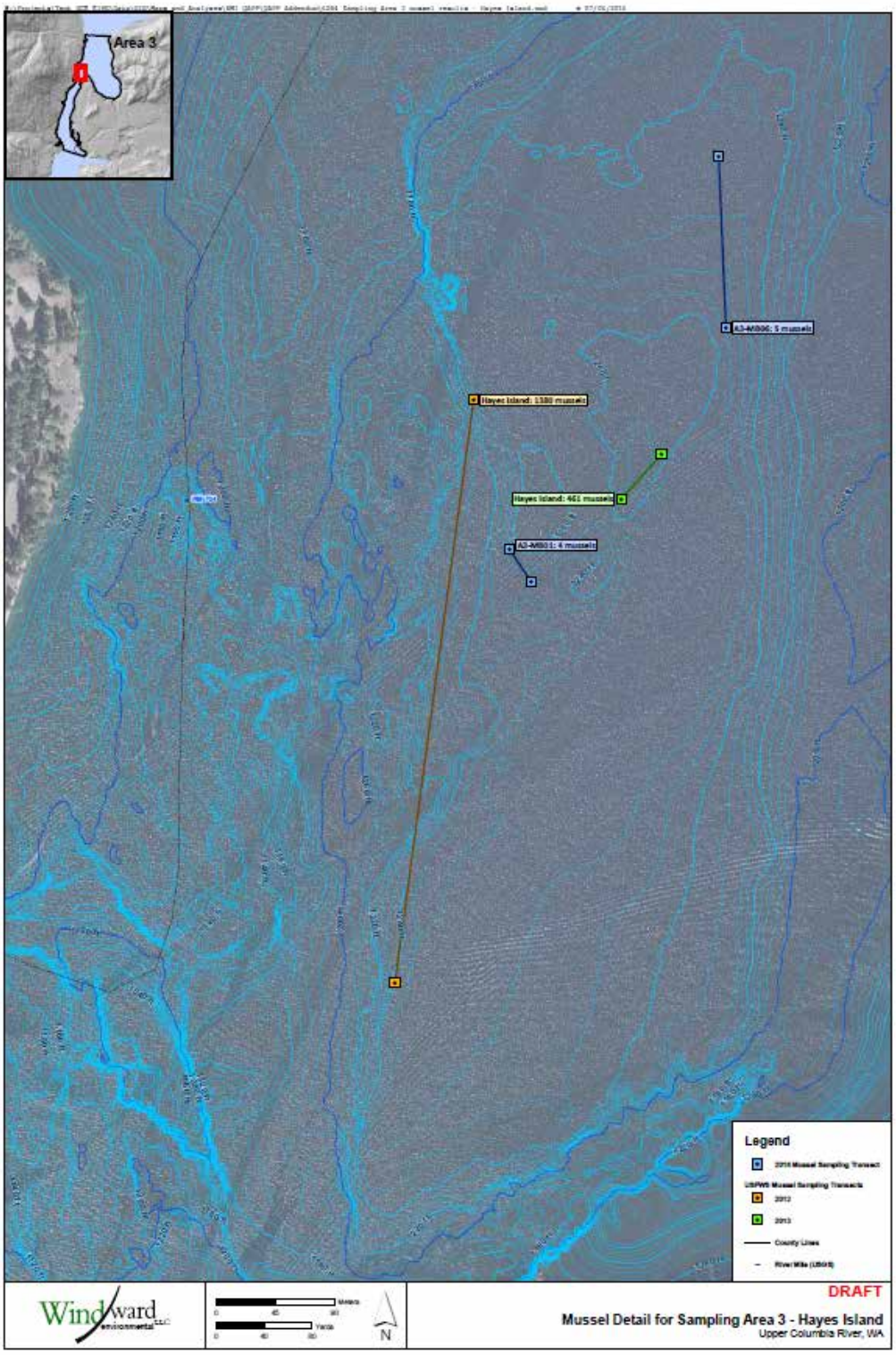


Figure 4a. Sampling Area 4, Inchelium.
Approx. N **48.334061 -118.188036** S **48.327340 -118.188417**

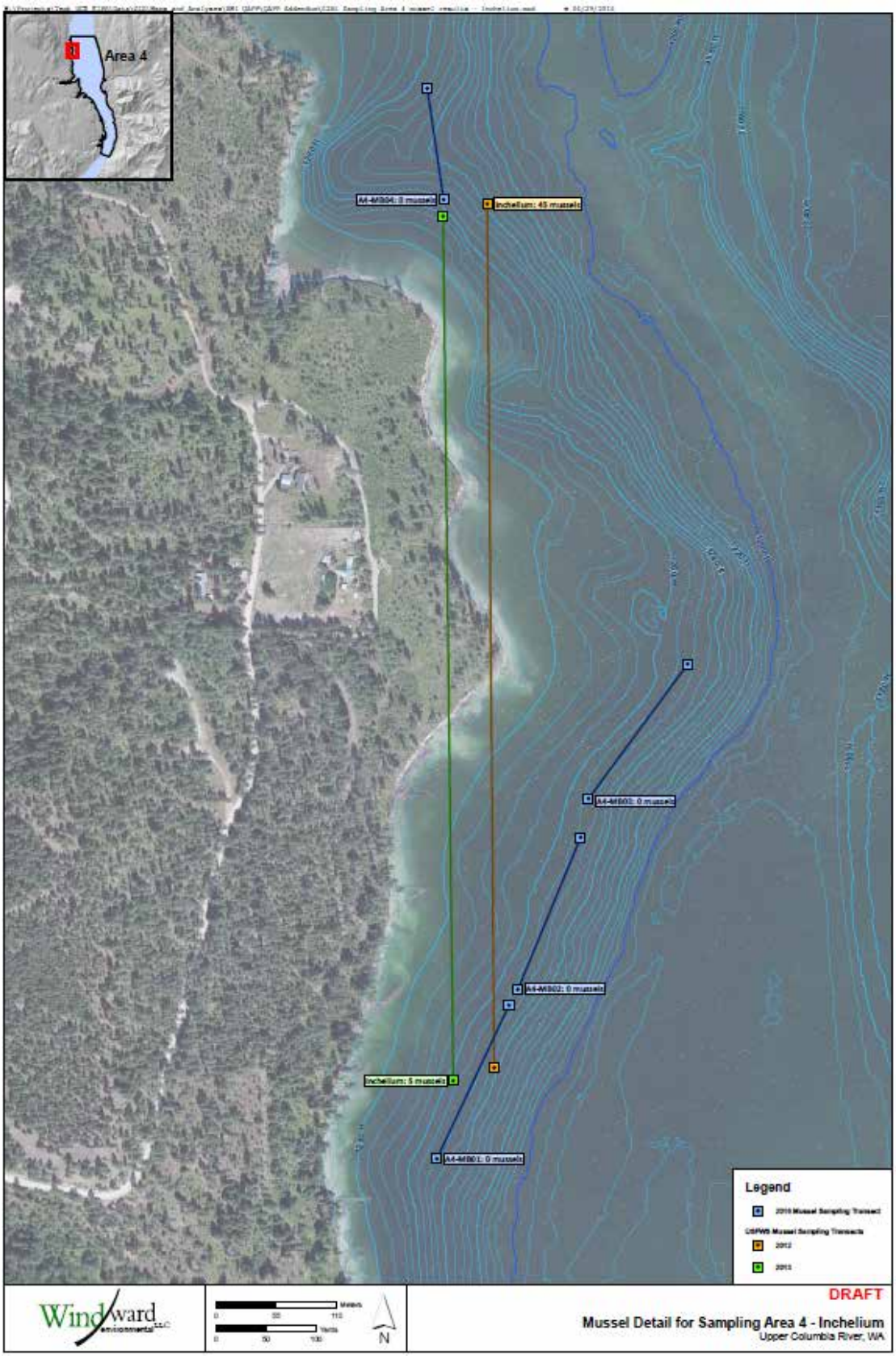


Figure 4b. Sampling Area 4, Bissell Island.
Approx. **48.290557 -118.161832**

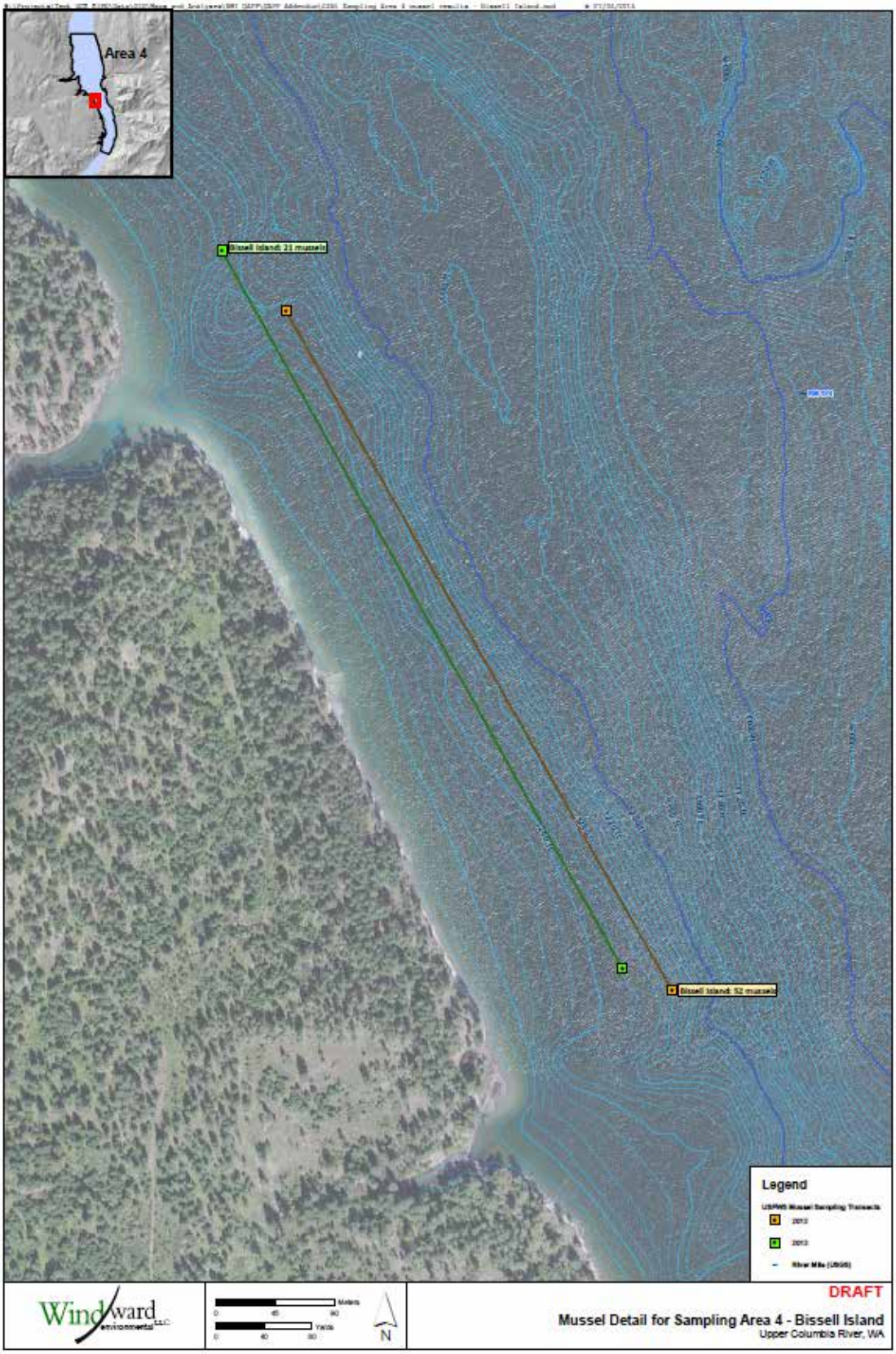
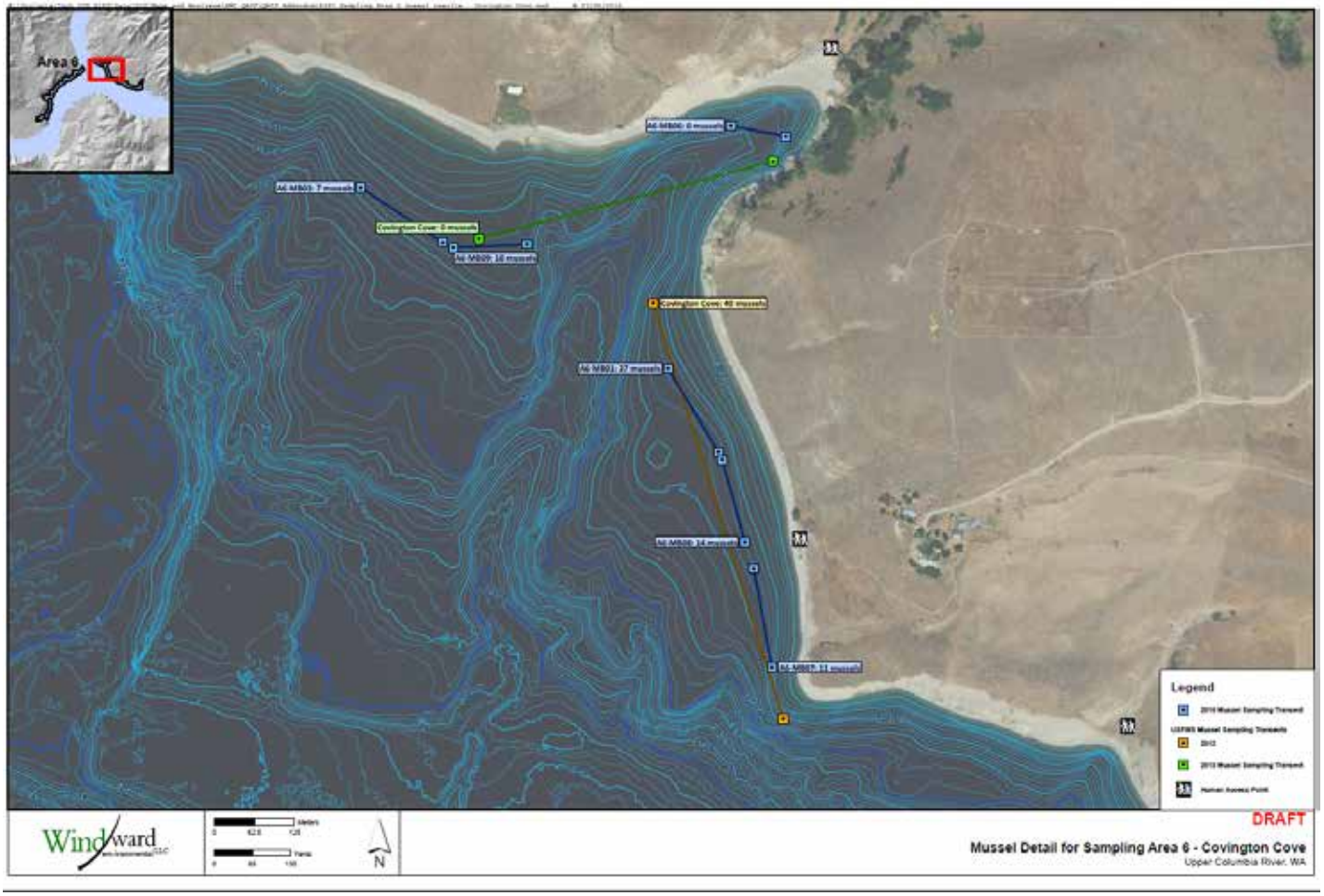


Figure 5. Sample Area 6, Covington Cove (near Sanpoil R. confluence).
N **47.9499232 -118.668118** S **47.942934 -118.665440**

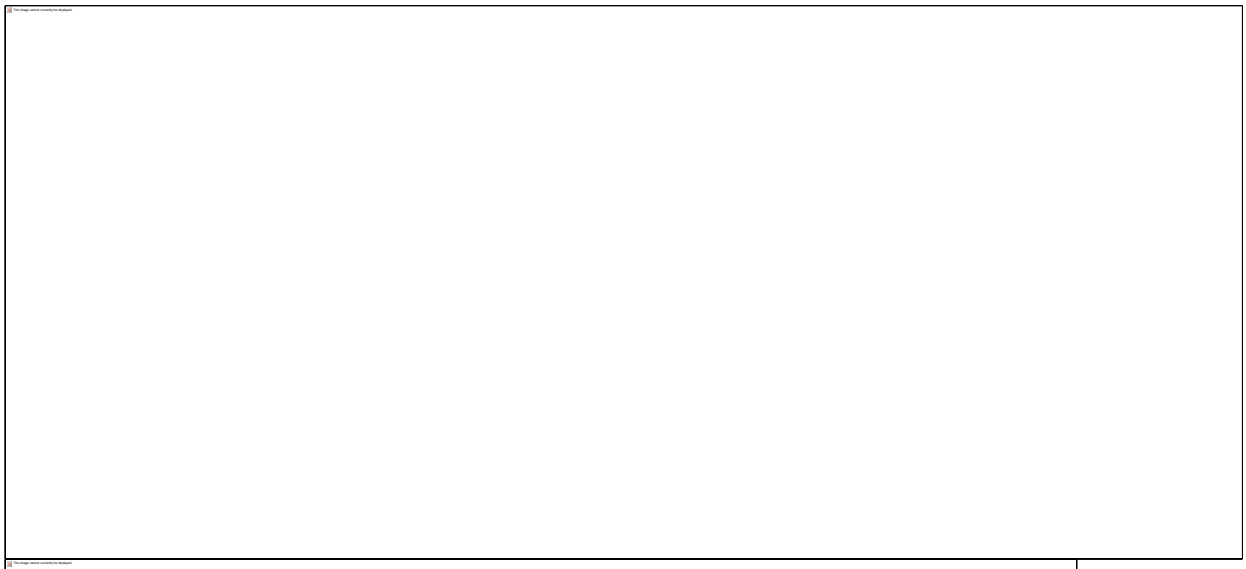


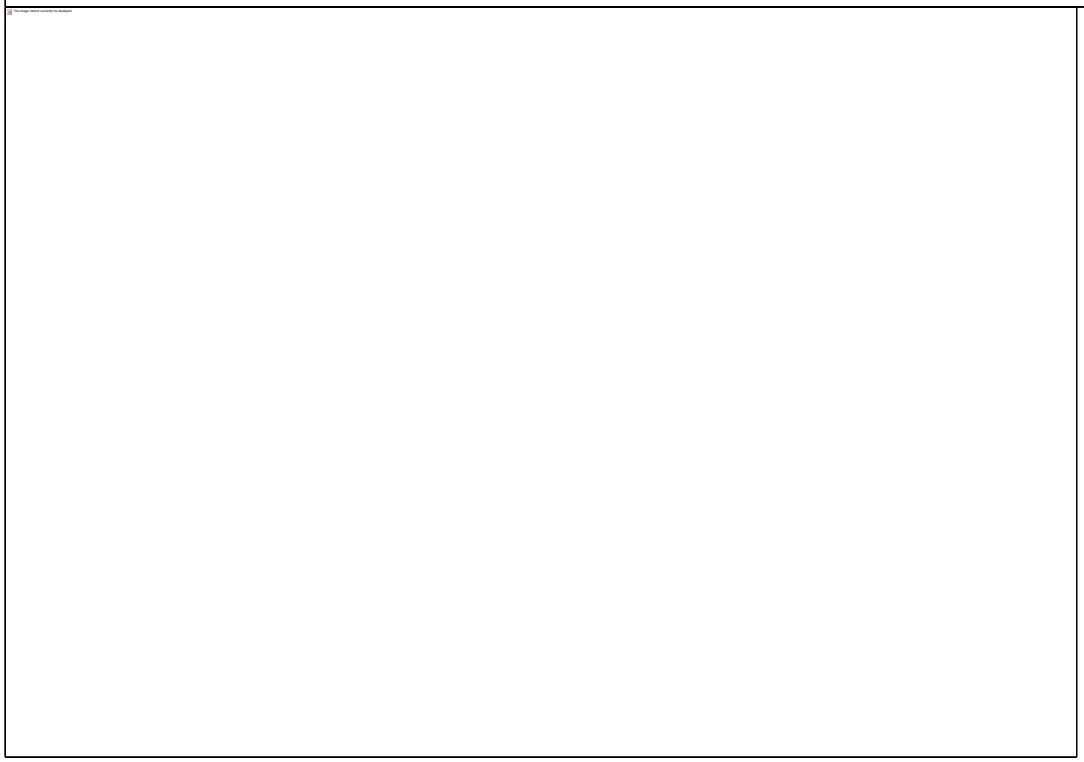
Photo/video shot list: Video with stills collected as screen shots will be taken at selected sites using a GoPro camera via screen grabs.

Pollution Sources: A wide range of industrial pollutants are of potential concern in the Upper Columbia River. The Teck Cominco smelter range of pollutants may include heavy metals, such as arsenic, cadmium, copper, lead, mercury, and zinc, as well as other chemicals including dioxins, furans, and polychlorinated biphenyls.

Dive dress Dive Protocol: Diving operations will be conducted using tethered comm gear with Nitrox in the main tank and standard air in the pony bottle. BCs and pony bottles, KM blocks, safety sausages, and knives will be in standardized mounting locations. Pony bottle size will be chosen based on chart below. Divers will use 200 or 300 foot tethers depending on anchorage and level of protection from other vessel traffic and be in Viking dry suits with dry hood and dry gloves. Communications gear will be hard-wired to an AGA full face mask.
The dives will be controlled by dive computers and the Dive Master; each diver will dive with two computers. On dive day, the percent O_2 in the NITROX cylinders will be measured and recorded. Divers' computers will be set to the oxygen level in the dive tank. Divers may op to dive in wet suits.
Additionally, dive computers will be set for diving at altitude (Upper Columbia River surface elevation is approximately 1300' above sea level). Instructions:

Suunto altitude settings Vyper/Cobra:





Suunto altitude settings Zoop:

2	More conservative. Several risk factors or conditions exist.

In addition to the personal setting, Suunto Zoop Novo can be adjusted for diving at different altitudes. This adjusts the decompression calculation according to the selected altitude adjustment.

Altitude adjustment	Explanation
0	0 – 300 m (0 – 980 ft) (default)
1	300 – 1500 m (980 – 4900 ft)
2	1500 – 3000 m (4900 – 9800 ft)

To change the personal and altitude adjustment settings:

1. While in a dive mode, keep [DOWN] pressed.
2. Press [SELECT] to enter **Personal Altitude** settings.

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EGS selection: 13 may be used for 30' or less dives, 19 for 60 feet or less; 30 for deeper dives (5 minute reserve target). Pony bottle size will be determined at each site based on maximum planned dive depth.

Bail out Bottle Size	Starting Pressure	Time @ Depth 30FSW	Time @ Depth 40FSW	Time @ Depth 60FSW	Time @ Depth 80FSW	Time @ Depth 100FSW	Time @ Depth 120FSW
13	**3000**	5.8	5.0	3.9	3.2	2.8	2.4
19	**3000**	8.5	7.3	5.8	4.7	4.0	3.5
30	**3000**	13.4	11.6	9.1	7.5	6.4	5.5

Decontamination Required: Potable water rinse.

Air testing verified with a test within the last 6 months for tank filling against CGA Grade E standards: May 2016.

Potential Hazards and Mitigation:

1. **Boat traffic.** Boat traffic will be managed by use of dive flags, boat positioning, and constant monitoring of VHF marine traffic channels (see below). Boat traffic is expected to be extremely limited due to the river mile where the gage is located.
2. **Entanglement with loose lines.** The divemaster will go through hand and body positioning throughout the dive to emphasize ways to keep entanglement prone areas clear of lines (e.g., tank yokes).
3. **Nitrox Diving:** The Divemaster will brief all divers on signs and symptoms of acute oxygen toxicity

using mnemonic VENTID CON (Vision blurring, Ears ringing, Nausea, Tingling, Irritability, Dizziness, and Convulsions). Divers will track their dive time via the latest dive tables and/or via dive computers reflecting the exact oxygen percentage being dived. To mitigate exposure, the following measures will be employed: use of full face masks, light work, shallow dives, minimizing the duration of the exposure, and close diver monitoring for acute oxygen toxicity. **The MOD for 32% oxygen at 1.4 ATA = 110 feet**.

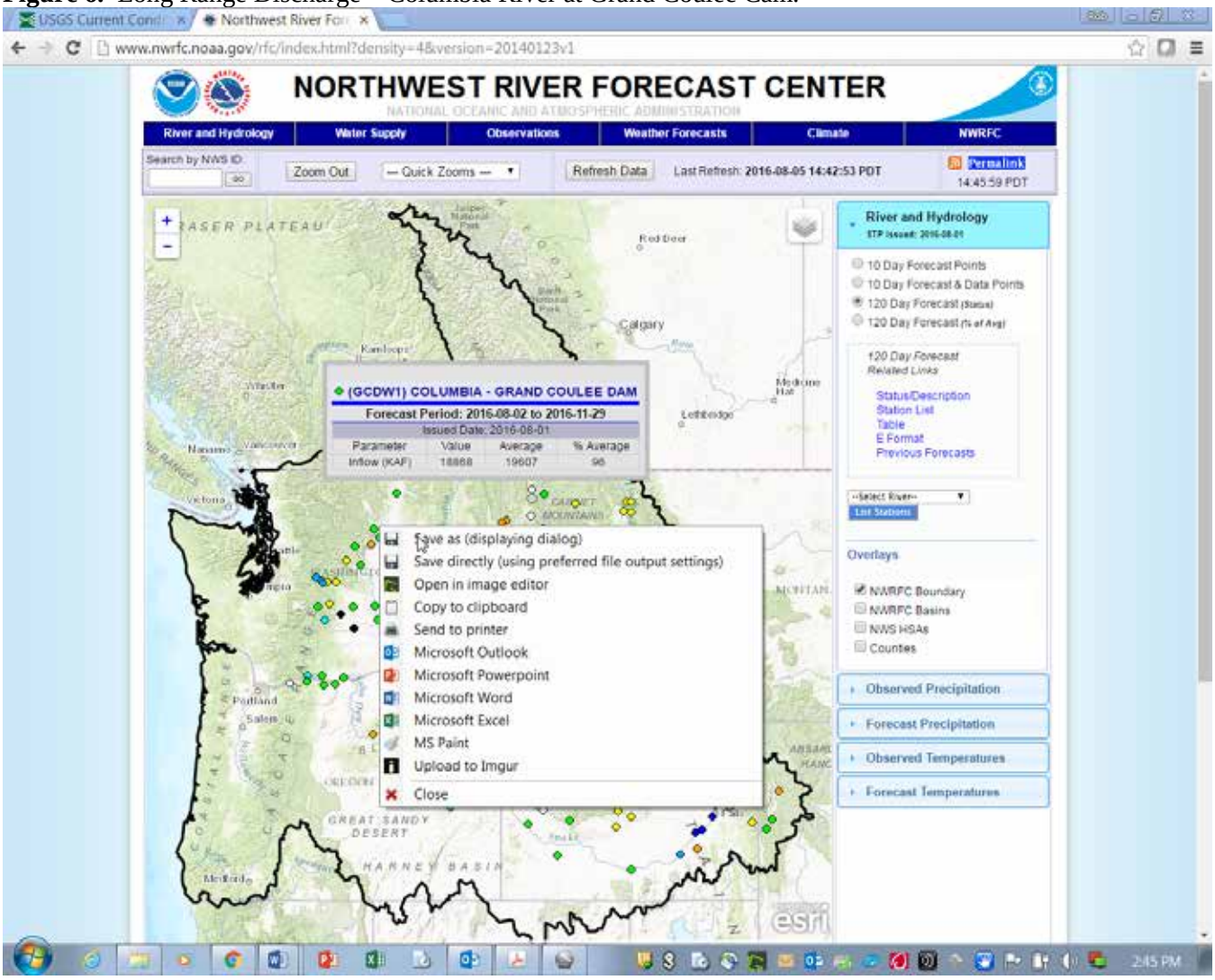
4. **Bounce diving:** The divemaster will minimize the number of ascents and descents to the extent possible. As described above however, up to three dives may be necessary at some station locations depending on the particular circumstances.
5. **Overhead hazards.** Divers will not be present in the water when overhead hazards are present, e.g., loose I-beam, CTD, or other large objects such as piers or docks.
6. **Contaminant tracking on vessel:** Contamination is not considered an issue on these dives. Divers will be fully encapsulated and use only decon. compatible equipment. If Wooldive operations are required, swim step decon will be emphasized and containment of the tethered line which will be covered with sediment.
7.

Maximum Expected Water Depth: 60 feet*. * No divers will be deployed deeper than 20' unless, with the discretion of the Dive Master – visibility is excellent 10'+ and river current is easily managed with tethered diving. EGS bottle sizing will be adjusted as needed for target depths.
Maximum Expected Water Current: Up to 2 knots depending on prior rainfall and river stage.
Maximum Expected Horizontal Visibility: 10 feet

Weather: Project divemaster will check weather reports on the day of dive to determine if dive operations may proceed safely, and if wind warrants a change in anchorage protocol (e.g., moving from 2 point to 3 point anchors).

Diving Platform: EPA research vessel *Wooldive*. Trailered from the lab to the remote operations base (Comfort Inn/Colville or the White Willow Motel/Spokane Indian Reservation) and to the Sample Area launch sites.

Figure 6. Long Range Discharge – Columbia River at Grand Coulee Cam.



PERSONNEL

Divemaster: Rob Pedersen (RP) 9/7-14
Diver: Kris Leefers (KL) 9/7-14, Sean Sheldrake 9/7-10 (SS), Brent Richmond 9/7-10 (BR), Rob Rau 9/11-14 (RR)

Today's Date: 7/9/2016

Diver Certifications

Diver	*Requirement*	*Required to dive*									
		Recent Dive*	**First Aid**		**CPR/AED**		**8 hour H&S/ hazwoper**	**Med Monitor-ing**
	Frequency Required	within 6 weeks recomm.; within 3 months required	1 year or two year	yr	1 year or two year	yr	every year	every year
RP		7/262016	11/19/2014	2	12/8/2015	2	11/3/2015	1/28/2016
SS		7/28/2016	11/19/2014	2	12/8/2015	2	11/3/2015	2/22/2016
BR		5/17/2016	11/19/2014	2	12/8/2015	2	11/3/2015	2/10/2016
RR		8/10/2016	11/19/2014	2	12/8/2015	2	11/3/2015	2/21/2016
KL		7/17/2016	11/19/2014	2	12/8/2015	2	11/3/2015	1/28/2016

Brent R. may need a requalification dive prior to work diving.

LAST DIVE IN SURFACE SUPPLY/TETHERED SCUBA

All divers completed a dive in the same mode in the last 3 months and a rescue drill within the prior year? Yes.

If "NO", diver(s) to complete safety drill prior to commencement of work diving (list names): SS, KL, RR, BR. Safety drills may include: 1) going off comms and restoring comms connection, 2) checking primary and EGS gauges and quickly verifying emergency gas manifold block position, and 3) going off the tending line through unplugging the comm cable from the full face mask, and then subsequently the diver harness while under tension at the surface.

Cox'n **Brent Richmond/Chris Castner**

Tenders: **Divers**

CONTACT INFORMATION

OEA dive cell phone:	206-369-7500
Rob Pedersen:	206-553-1646 desk; 206-920-0758 personal cell
Sean Sheldrake:	206-553-1220 desk; 206-225-6528 work cell
Brent Richmond	360-871-8711 desk; 360-337-9486 personal cell
Chris Castner	206-553-8515 desk; 206-300-7614

Other Cell Phone Contacts:
Rob Rau 206-458-8301
Kris Leefers 517-898-3704

SCHEDULE

Depart EPA office - 9/6			**0930 AM**
			From Colville (in/out Colville Comfort Inn 9-6/9-10)
Dive - 9/7	**Area 1/Northport**		**Depart motel 0730**
9/8	**Area 3/Kettle Falls**		**Depart motel 0800**
9/9-10	**Area 4/Gifford/Inchelium**		**Depart motel 0730**
			From Two Harbors (in/out White Willow Motel 9-10/9-15)
9/11-14	**Area 6 & Sanpoil River**		**Depart motel 0800**
Return to (unload) - 9/15			**Depart motel 0800**

PRE/POST DIVE TASKS

Boat Prep **(BR/CC):**

1. Fill vessel freshwater tank and a cooler for gear soaking
2. Dive flags and pole
3. Ladder
4. Drinking water on boat (divers will bring refillable bottles as primary, disposable water bottles as backup)
5. Load 6 tanks on vessel
6. Charge and load Diver Recall
7. Verify nitrox sensor on monitor is operational.
8. Bring several anchor choices for variable substrate (high energy vs low energy river bottom) and be prepared for 3 anchor points (2 anchor points will be used if wind allows)

Prep. Field equip:

Prep. Dive equip (***day(s) before loading***):

1. Video camera (GOPRO,)-charge ***set time and date, clear card*** follow prep checklist including clock sync to GPS with photo—NIGHTLY –CHECK VIDEO FOOTAGE, SWITCH TAPES (?), CHECK CONNECTIONS, CHARGE MONITOR, LIGHT PODS, CAMERA/DIVER INITIALS / **SS/RR**
2. Prep. Surface camera (charge all batteries, ***set time and date, clear card***) / **KL**
3. Lights- solas, handheld, nite riders, charge/ **SS/RR**
4. Kirby bailout blocks/AGA regs/AGAs connected (match #'s and/or replace labels)/test, leave AGAs on for transit. / **RP**
5. Tethered comm. All batteries charged, one set installed/prepped /DIVER INITIALS THIS MUST BE DONE FOR ALL DIVES FOR THE TETHERED RESCUE DIVER AT A MINIMUM. / **RP**
6. Test AGAs (4) / **RP**

Post dive:

1. Clean AGA masks & regulators – **All**
2. Fill Tanks – TBD

Equipment Required - See separate Equipment Loading Checklist.

SAFETY AND SECURITY NOTIFICATIONS

USCG Notifications (33 USC 1221):
CG Notice Prior to start of dive operations **Needed? ____Yes __X__ No**
Done? Diver Initials_ Date___[DATE]_____
Advanced notification of USCG for dives near sensitive areas (e.g., port facilities, bridges) or in high traffic lanes/ areas. Call 24hr. Vessel Traffic 206-217-6051 and email sectorseattlewwm@uscg.mil
Advanced notification to USCG 206.217.6002 and email: hlswatch@pacnorwest.uscg.mil
(*For emergency operations with little notice-- you should call the number above for one week ahead* ***only*** *for normal operations.* USE THIS NUMBER FOR LESS THAN 24 HOURS NOTICE)

CG Notice to Mariners **Needed? ____Yes _x___ No Done? Diver Initials_____**
206-220-7280, email D13-PF-LNM@uscg.mil. **ALL IN CHANNEL OR NEAR CHANNEL DIVES SHALL REQUEST A NTM (SEE NAV CHART)**

CG Notice During Dive Operations **Needed? ____Yes __x__ No**
Dive Operation start and end : Call 206.217.6051 and notify USCG of start and end of dive operations. Example script, "*This is the EPA Vessel Monitor, MMSID 338069238; we are commencing dive operations near XXXXXX. Please verify you can see our vessel on your AIS screen.*" **ALL IN CHANNEL OR NEAR CHANNEL DIVES SHALL NOTIFY USCG AT THE START AND END OF OPS.**

VHF shall monitor 13, 14, 16 for in or near channel dives. AIS will be on with antenna installed for all Monitor dives. For operating out of a small boat, checkout a handheld VHF from MEL (Brent Richmond) as appropriate.

Washington State Ferries **Needed? ____Yes _X_ No Done? Diver Initials___Date_____**
Call Washington State Ferry Operations Center 206-515-3456 for dives in/near ferry lanes

EMERGENCY INFO./DIVE ACCIDENT MANAGEMENT PLAN

Emergency Call in Script (from NOAA 2009 DMT)

"I am an EPA [Divemaster, Dive Medic] and I am calling to report a diving related emergency requiring immediate medical assistance. The victim is a ___ (age) year old (gender) who is _____(conscious/unconscious), with the following symptoms after diving with compressed gas….(describe pain, dizziness, etc.)

"We have placed the victim in a supine position and have initiated basic first aid. We have also completed a field neurological exam. With the following results….(note any deficits). The victim is on 100% oxygen by mask, and we have rendered the following additional treatment (CPR, fluids, medications, etc.)

Last vital signs are as follows…."

Temp: _____ Pulse:_____ Resp:_____ B/P: _____/_____

"We are at the following location….. (location of diver/landmarks) and request immediate medical transport to (receiving facility of choice) via (air/ground) transport."

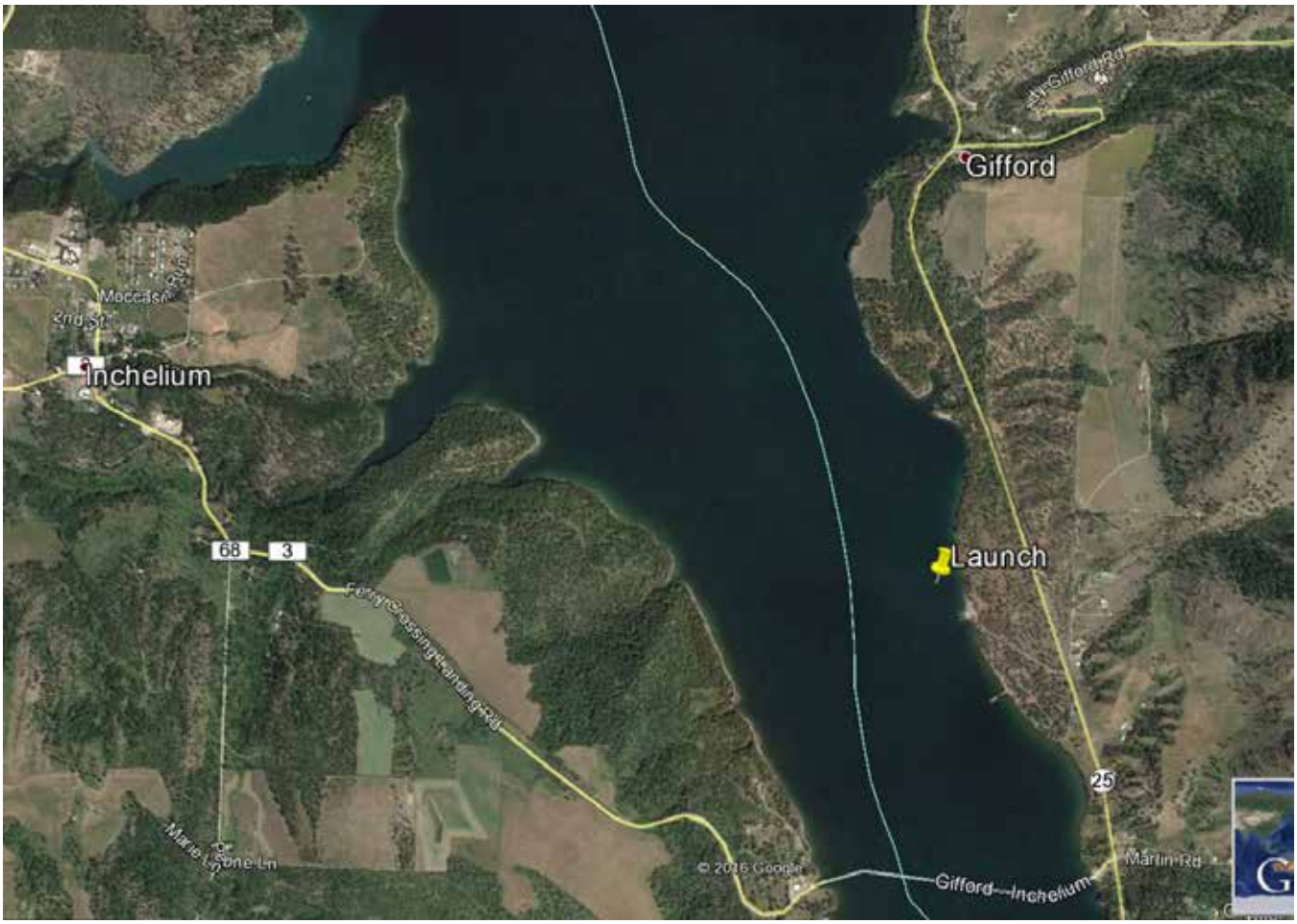
Note: Do not terminate call...the receiving unit will end the call.

Source of EMERGENCY TRANSPORTATION:
911 for all accidents VIA CELL PHONE (primary) OR VHF (backup) OR satellite phone

Egress Point and Method of Egress: 9/7
Northport Community Launch
Park Road, Northport WA – off Hwy 25

<u>Emergency Egress:</u> 9/8
Kettle Falls Marina Launch
1390 W. Williams St. Kettle Falls, WA 99141

<u>Emergency Egress:</u> 9/9-10
Gifford/Inchelium Boat Launch
3361 Washington 25, Northport, WA 99157

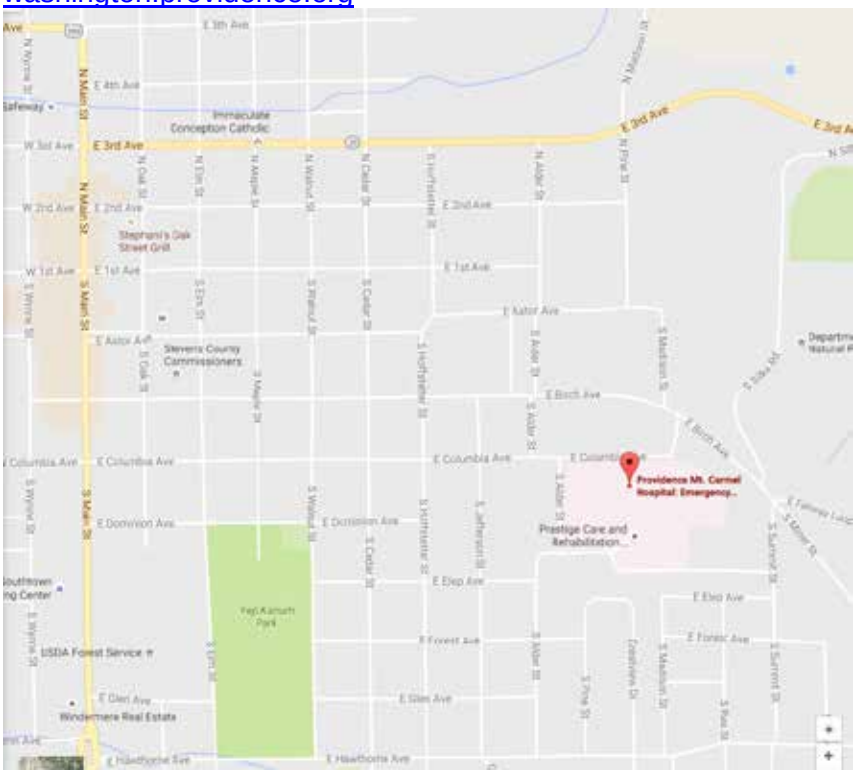



Gifford Campground Rd
25

<u>Emergency Egress:</u> 9/11-14
Across the Spokane River from Two Rivers Marina

Nearest MEDICAL Facility:

From Colville
Providence Mount Carmel Hospital
982 E Columbia Ave
Colville, WA 99114
(509) 685-5100
washington.providence.org

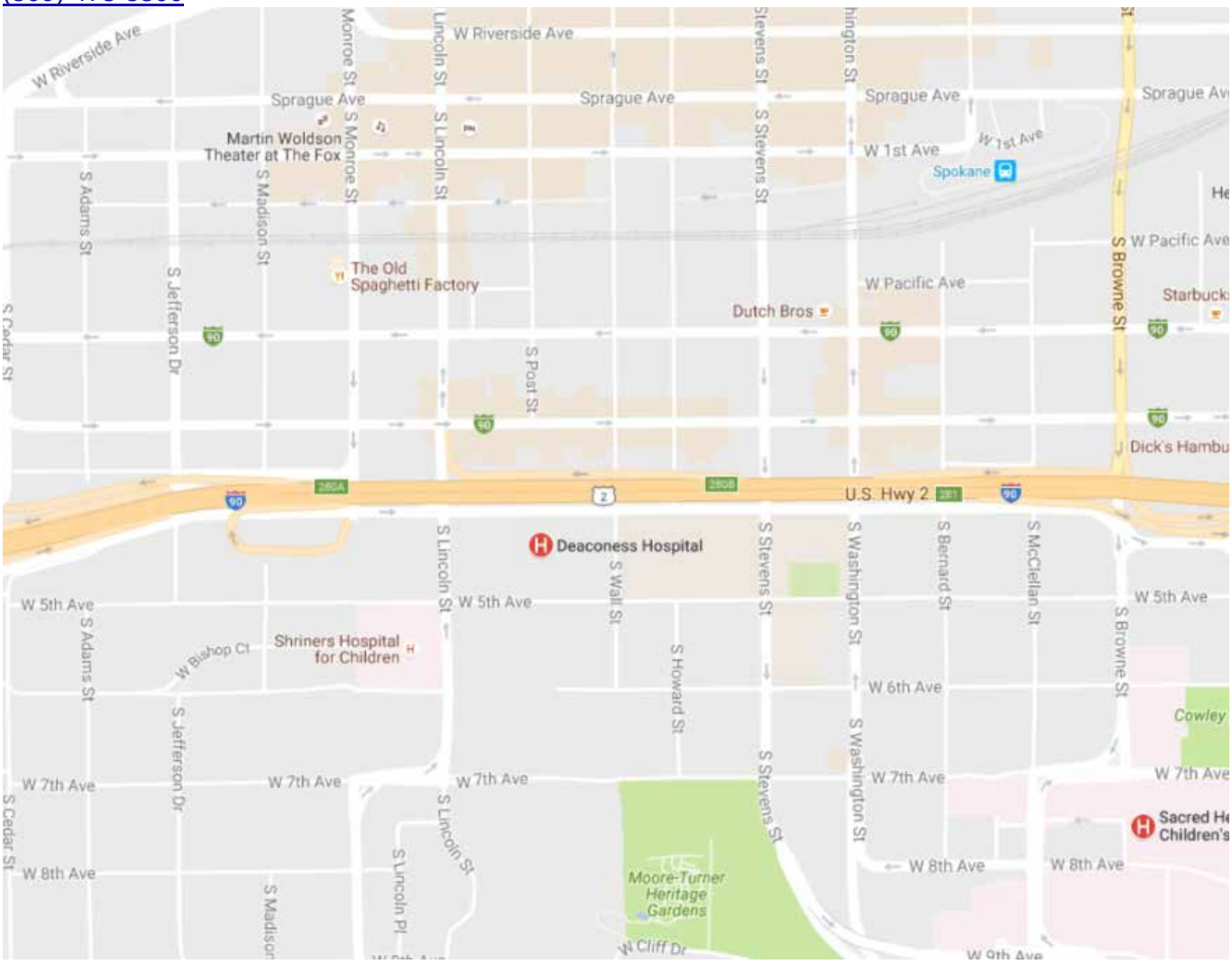


From Two Harbors

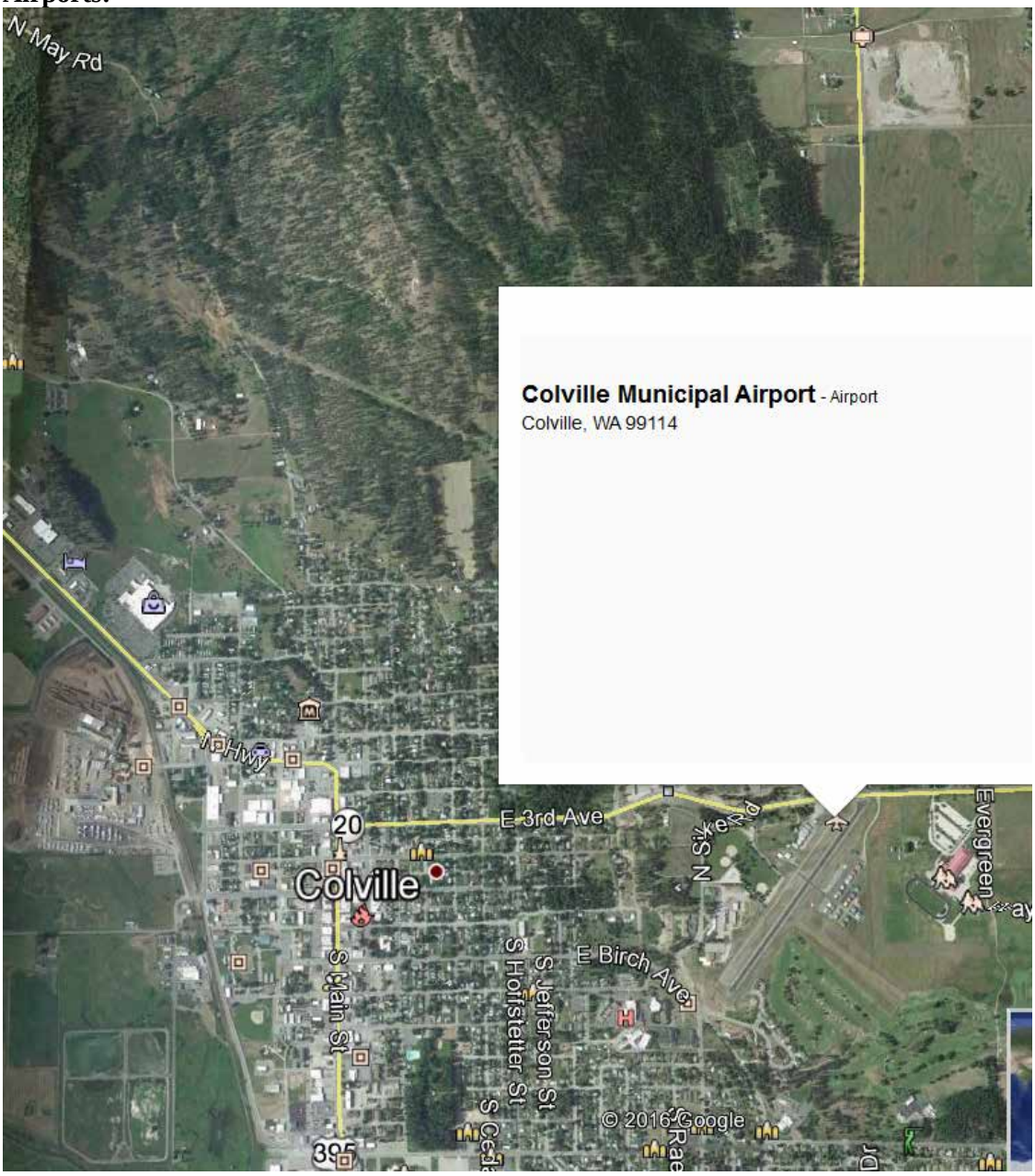
Deaconess Hospital

800 W 5th Ave, Spokane, WA 99204

(509) 473-5800



Airports:


N May Rd
Colville Municipal Airport - Airport
Colville, WA 99114
Hwy
20
E 3rd Ave
Colville
S Main St
S Hofstetter St
S Jefferson St
E Birch Ave
N Ke
Evergreen
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395

Nearest Hyperbaric Chamber: Virginia Mason Hospital - 206-583-6433 (Chamber phone is 206-583-6543)
Address: admission is through the Emergency Room on Spring Street at the corner of Terry and Spring streets

Primary: Virginia-Mason Medical Center 1202 Terry Ave, Seattle, WA
Hyperbarics Department: (206) 583-6543
24-hour emergency line: (206) 583-6433
(admission is through the Emergency Room on Spring Street)

Secondary: Diver's Institute of Technology
4315 11th Ave. NW, Seattle, WA
Chamber phone: (206) 783-5542

Driving Directions From Kettle Falls to Virginia Mason Hospital:

5 h 30 min (318 miles)

via I-90 W

5 h 11 min without traffic

964 Sherman Pass Scenic Byway
Kettle Falls, WA 99141

- Head southwest on US-395 N toward WA-25 N
  1 s (43 ft)
- Continue on WA-25 S to Lincoln County
  1 h 31 min (77.7 mi)
- Turn right onto US-2 W
  45 min (43.1 mi)
- Get on I-90 W from WA-283 S
  54 min (47.2 mi)
- Follow I-90 W to 7th Ave in Seattle. Take exit 2C from I-90 W
  2 h 15 min (150 mi)
- Continue on 7th Ave. Take Seneca St to Terry Ave
  3 min (0.4 mi)

1202 Terry Avenue
Seattle, WA 98101

Notes:

(1) Emergency helicopter transport in Puget Sound is available through the U.S. Coast Guard (Channel 16 or telephone 220-7001 *or *CG* in Seattle).

(2) Diver's Alert Network: For diving emergencies use 1-919-684-9111, for non-emergency diving questions during normal working hours use 1-919-684-2948.

FOLLOWING INCIDENT; DIVEMASTER TO NOTIFY:

1. Unit Diving Officer, Sean Sheldrake, 206.619.3046 cell
2. Regional SHEMP manager, Grady Maxwell, 206.399.9394 cell,
3. Diving Safety Board Chairman, Alan Humphrey (609) 865-4546 cell
4. Diver supervisor (see blue field emergency form).
5. Dive unit management sponsor, Mark Filippini, ESU, 206.409.3655 cell.
6. SHEMD contact: Dave Gibson: (202) 497-4486

Backup Line pull signals (if using tether), Navy Diving Manual, Rev. 5, 2005

Table 8-3. Line-Pull Signals.

From Tender to Diver		Searching Signals (Without Circling Line)	
1 Pull	"Are you all right?" When diver is descending, one pull means "Stop."	7 Pulls	"Go on (or off) searching signals."
2 Pulls	"Going Down." During ascent, two pulls mean "You have come up too far; go back down until we stop you."	1 Pull	"Stop and search where you are."
3 Pulls	"Stand by to come up."	2 Pulls	"Move directly away from the tender if given slack; move toward the tender if strain is taken on the life line."
4 Pulls	"Come up."	3 Pulls	"Face your umbilical, take a strain, move right."
2-1 Pulls	"I understand" or "Talk to me."	4 Pulls	"Face your umbilical, take a strain, move left."
3-2 Pulls	"Ventilate."		
4-3 Pulls	"Circulate."		
From Diver to Tender		**Searching Signals (With Circling Line)**	
1 Pull	"I am all right." When descending, one pull means "Stop" or "I am on the bottom."	7 Pulls	"Go on (or off) searching signals."
2 Pulls	"Lower" or "Give me slack."	1 Pull	"Stop and search where you are."
3 Pulls	"Take up my slack."	2 Pulls	"Move away from the weight."
4 Pulls	"Haul me up."	3 Pulls	"Face the weight and go right."
2-1 Pulls	"I understand" or "Talk to me."	4 Pulls	"Face the weight and go left."
3-2 Pulls	"More air."		
4-3 Pulls	"Less air."		
Special Signals From the Diver		**Emergency Signals From the Diver**	
1-2-3 Pulls	"Send me a square mark."	2-2-2 Pulls	"I am fouled and need the assistance of another diver."
5 Pulls	"Send me a line."	3-3-3 Pulls	"I am fouled but can clear myself."
2-1-2 Pulls	"Send me a slate."	4-4-4 Pulls	"Haul me up immediately."
ALL EMERGENCY SIGNALS SHALL BE ANSWERED AS GIVEN EXCEPT 4-4-4			

NOTE: A high pitch squealing sound on the surface unit indicates the ema2 plug has been unplugged from the AGA mask. Instruct the diver to reconnect these via the DIVER RECALL.

Medical Treatment for a <u>CONSCIOUS</u> Diver (Source: NOAA DMT Course 2007)

- **ABC's**
- **Administer 100% Oxygen**
- **Cut exposure suit open/remove if wet to keep patient dry/warm**
- **Place in position of comfort**
- **Give one (1) aspirin (325 mg) orally***
- **Take vitals every 5 min if unstable; 15 min if stable***
  -Pulse/per min
  -Blood Pressure
  -Respirations/per min
- **Gather dive history info. from buddy***
- **Perform neurological exam ***
- **Contact EMS**
- **Administer 0.5 liters of water orally per hour x 2 hours then reduce to 100-200 ml per hr thereafter**

Note deficiencies on blue card.

Medical Treatment for an <u>UNCONSCIOUS</u> Diver

- **ABC's / Contact EMS**
- **Administer 100% Oxygen**
- **Cut exposure suit open/remove if wet to keep patient dry/warm**
- **Lateral recumbent position (on side)**
- **Take vital signs every 5 min if unstable and every 15 min if stable***
  -Pulse/per min
  -Blood Pressure
  -Respirations/per min
- **Gather dive history info. from dive buddy and/or eye witnesses***
- **Perform neurological exam***

Note deficiencies on blue card.

Diving Injury and First Aid Matrix

CONDITION	CAUSE/EFFECT	SIGNS/SYMPTOMS	FIRST AID
Hypercapnia	Skip Breathing or equipment problems Increased carbon dioxide in body	None, increased depth of respiration,headache, nausea, mental depression, dizziness,air hunger, stupor, unconsciousness	CPR is necessary Administer fresh air or 100% oxygen
Pneumothorax	Overexpansion of lungs by holding breath on ascent Air forced into pleura cavity	Sudden severe chest pain, difficulty breathing, leaning to affected side, shock, cyanosis, shock	Supine position, ABC's 100% oxygen, transport to medical facility. May need recompression therapy.
Carbon Monoxide Poisoning	Breathing air contaminated with carbon monoxide Normally from exhaust fumes compressed into tank	None, clumsiness, dizzy, nausea, weakness, bad judgement, confusion, unnaturally red lips and nail beds	CPR is necessary Administer fresh air or 100% oxygen
Air Embolism	Overexpansion of lungs by holding breath on ascent Air forced into venous circulatory system	Chest pain, shortness of breath, dizzy,convulsions, unconsciousness, motor or sensory deficits, death	Supine position, ABC's, 100% oxygen, transport to recompression chamber, treat for shock
Ruptured Ear Drum	Changing depth without equalizing or a blocked eustachian tube. Allows water to enter middle ear	Pain in ear, vertigo, hearing loss, tinnitus, blood in ear or mouth, water in middle ear	Discontinue diving, put nothing in ears and keep dry. see Ear-Nose-Throat doctor
Decompression Sickness	Too rapid an ascent. Nitrogen comes out of solution and forms bubbles which lodge in tissues and other body parts	Joint pain, tenderness, staggers, weakness, visual problems, extreme fatigue, paralysis, itching skin, paraesthesia, mottling	Supine position on left or right side, ABC's, 100% oxygen, transport to recompression chamber, treat for shock
Hypothermia	Lowered body temperature due to inadequate insulation	Shivering, slurred speech, memory lapses, cyanosis, mental impairment, fumbling hands, decreased pulse and breathing	Rewarm in warm water w/o extremities, handle gently, insulate, hot-packs in vital areas
Hypoxia	Lack of oxygen normally due to inadequate % of oxygen in breathing gas.	Impaired concentration, confusion/judgement, drowsiness, weakness, lessened stamina, cyanosis	ABC's, administer gas supply with adequate % of oxygen
Nitrogen Narcosis	Breathing compression air at depths deeper than 60 fsw . Increased partial pressure of nitrogen in body	Elation, euphoria, impaired judgement, lightheadedness, sense of detachment, increased self-confidence	Reduce partial pressure of nitrogen by ascending

TO BE FILLED OUT FOR PATIENT ASSESSMENT

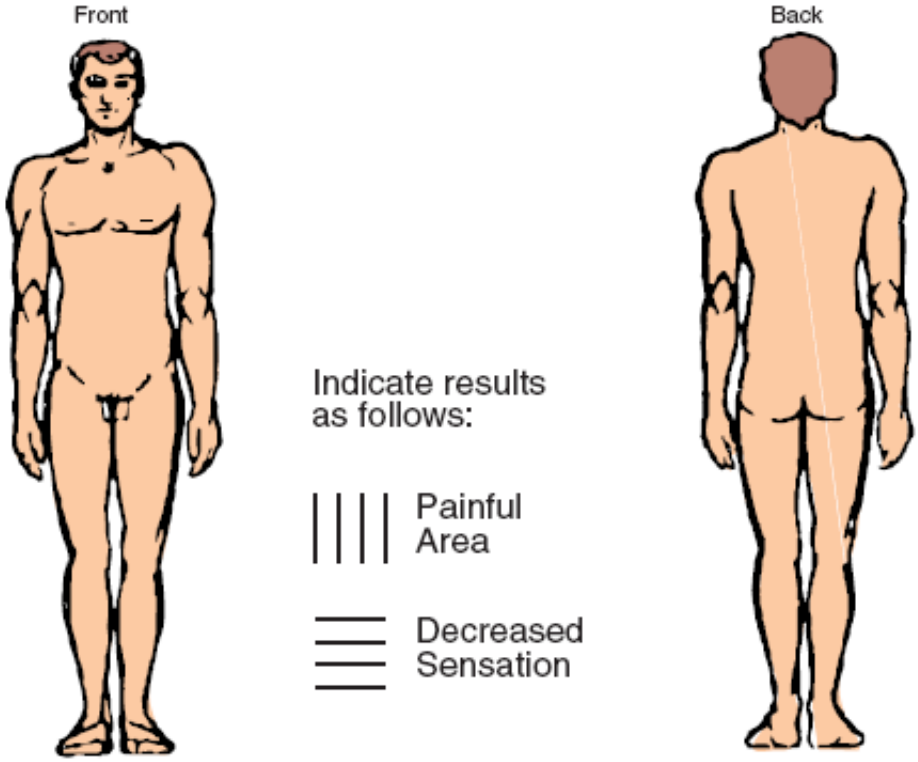
Neurological Examination* (Source: NOAA DMT Course 2009) Page 1 of 2

Note deficiencies on blue card. One person administers, one person checks off items on the list.

MENTAL STATUS/LOC	**STRENGTH**
-Alert to person, place, time	**Upper Body**
-Add a nickel, dime, quarter	-Deltoids
-Count back from 100 by 7's	-Latissimus
	-Biceps
	-Triceps
VITAL SIGNS	-Forearms
-Pulse/min	-Hands
-Blood Pressure	**Lower Body**
-Respiration/min	-Hips
-Temperature	Flexion
	Extension
COORDINATION	Abduction
-Walk	Adduction
-Heel-to-Toe	-Knees
-Romberg	Flexion
-Finger-to-Nose	Extension
-Heel-Shin Slide	-Ankles
-Rapid Movement	Flexion
	Extension
CRANIAL NERVES	
-Vision/Visual Fields	**REFLEXES**
-Eye movements/pupils (PERRLA)	-Biceps
-Facial sensation/chewing	-Triceps
-Facial expression muscles	-Knees
-Hearing	-Ankles
-Upper mouth/throat sensation (ah)	-Toes (Babinski)
-Gag and voice	
-Shoulder shrug	
-Tongue	
SKIN SENSATION	
Exam performed by:	
Date:	
Time:	

Neurological Exam. page 2/2

Location



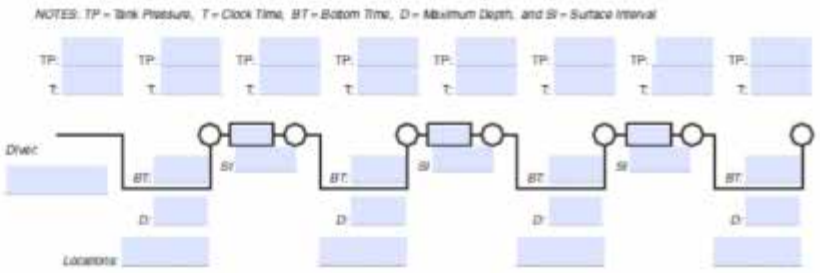
Comments:

History:

Chief complaint:
S - (Signs and symptoms of current episode)
O - Onset (when problem began and what caused it)
P - Provocation or palliation (what makes it feel better or worse)
Q - Quality (what is the pain like, i.e. crushing, dull, sharp, other)
R - Region/radiation (where is the pain, does it move anywhere)
S - Severity (rated on a scale of 1 to 10)
T - Timing of pain (constant, intermittent, duration)
A - Allergies (Rx, foods, insect stings, other substances and what reaction occurred)
M - Medications (Rx, Ole, herbs, vitamins)
P - Pertinent past history (recent illnesses, injuries, surgeries)
L - Last oral intake (including food, liquids, alcohol, drugs)
E - Events leading to the injury or illness

Dive Profile:

Comments:	
Time **Oxygen** Administration **Started**	Time **Oxygen** Administration **Ended**
Further Description of the Accident:	



Dive History:

Date/time of occurence:	Location:
Breathing gas:	Equipment Used:
Unusual events prior to dive:	

If repetitive dives, list all in last 24 hours (list most recent first):

Date	Number of dive	Depth	Bottom time	Surface interval	Breathing gas

Review of Systems: (Circle and describe, add other symptoms if present, include negatives)

a. General- Recent weight change, fever/chills, fatigue, feeling of ill health:
b. HEENT - Headaches, visual/hearing changes, ringing in ears, bleeding, sore throat, hoarseness:
c. Cardiac - Chest pain, palpitations, shortness of breath, orthopnea, edema, history of stroke, hypertension, claudication (angina of the extremities), phlebitis):
d. Pulmonary - Cough, sputum, hemoptysis:
e. Gastrointestinal- Difficulty eating, abdominal pain, nausea/vomiting, ulcers, vomiting blood, jaundice, diarrhea, liver disease:
f. Genitourinary - Dysuria, nocturia, frequency, hematuria, urgency, discharge, incontinence:
g. GYN - Discharge, menstrual history, pregnant?
h. Endocrine - Polyuria, appetite, excess thirst, heat or cold intolerance:
I. Musculoskeletal- Joint pain, stiffness, swelling, weakness:
j. Neurological- Dizziness, loss of consciousness, syncope, numbness, seizure, paresthesias:
k. Skin - Itching, rashes, lumps, bruising:
Comments or additional information:

Vital:	Time:	Time	Time	Comments:
LOR				
HR				
RR				
BP				
Skin-CMT				

Name (print) Signature Title

Appendix 1

Source: Julie Campbell USFWS, Spokane office: 2012 survey used as guidance not a template for 9/2016 EPA

B.2.2 Snorkeling Surveys

Snorkeling surveys will be conducted in three different areas of the site, including the higher surface-density sample sites from 2012, the upper reach of the UCRS, and the major tributaries, as described above. The 2012 shoreline survey sites with the highest mussel surface-densities will be snorkeled during reservoir drawdown, combined with shoreline surveys. Surveyors will attempt to locate the targeted assemblages during the shoreline surveys using GPS coordinates recorded in 2012. If the location is determined to be under water, but shallow enough for snorkeling or wading, the site will be surveyed by snorkeling following a shoreline survey. If an assemblage is located, surveyors will first attempt to estimate the size of the assemblage in the water by wading and snorkeling away from the water's edge until 1) no more mussels are located or 2) the water becomes too deep, the visibility poor or the bank drops sharply. Transect searches will then be conducted as follows:

A. GPS coordinates and start/stop times will be recorded at the starting point and ending point of the transect;
B. Transect length will attempt to estimate the distance of the 2012 survey, however transects may need to be shorter depending on visibility, etc. (conditions will likely make searches more difficult in the water). Dominant substrate types will be recorded (Table 3). Surveyors will also note the presence of slag, if observed, and attempt to estimate the percentage of slag in fine materials;
C. Transect width will be a surveyor's arm's-length, from fingertip to fingertip. Surveyors will be positioned at arm's length from each other conducting parallel transect searches. Transect length and total area will be recorded;
D. Surveyors will swim (or wade) slowly above the substrate using both visual and tactile (hand grubbing, or probing the substrate up to 1 inch in depth) methods to identify mussels at the surface;
E. Surveyors will have PVC pipe "sleeves" positioned on one arm, on which they will record transect data. Data will include mussel counts by species/clade, and by size category within each species/clade. Size ranges of < 25 mm, 25-75 mm, 76- 125 mm and > 125 mm will be measured and marked on the PVC for identifying the correct size category of mussels under water;
F. A target number of 10 mussels from each species/clade (representing all size categories observed) will be gently removed from the substrate and collected in mesh bags and brought to the surface;
G. Surveyors will bring the mussels to shore, where they will be stored in a bucket of water dipped from the site. They will be quickly identified, measured and photographed, and representative individuals will be sampled for genetic analysis according to the methods described in Section B.2.4 below;
H. When field measurements are recorded mussels will be returned to the water and carefully placed back in substrate from which they were collected;
I. All information on the data forms/cards will be verified and the team will proceed to the next sample site.

Sampling sites in the upper reach of the UCRS and in major tributaries will be surveyed during late summer following the same procedures, however target transect lengths will be set at 100 meters.

B.2.3 Diving Surveys

Diver surveys will be conducted in deep water areas pre-selected as described above. Two divers will be deployed from a dive boat at each site to conduct searches along transects, and collecting live mussels for field measurements. The length of time to conduct the survey, size of the survey area, and dominant substrate type will also be recorded. Specific procedures are as follows:

A. Divers will search transects that run parallel to the main channel or shoreline, using both visual and tactile methods to search for mussels;
B. Divers will be trained in basic mussel identification, and will have laminated photo cards of each species likely to be observed.
C. GPS coordinates and start/stop times will be recorded from the boat at the point that divers descend, and again at the point where they emerge; Dominant substrate types will be recorded (Table 3). Surveyors will also note the presence of slag, if observed, and attempt to estimate the percentage of slag in fine materials;
D. Transects will be 100 meters in length (or less, depending on current or underwater features that may obstruct searches). Transect width will be a diver's arm's-length, from fingertip to fingertip; transect length and total area will be recorded;
E. Divers will be positioned at arm's length from each other, moving slowly to search the substrate; alternatively, one diver may search the substrate while the second diver records video of the survey and search area (however the searches will take longer);
F. Divers will have PVC pipe "sleeves" positioned on one arm, on which they will record transect data. Data will include mussel counts by species/clade, and by size category within each species/clade. Size ranges of < 25 mm, 25-75 mm, 76- 125 mm and > 125 mm will be measured and marked on the PVC for identifying the correct size category of mussels under water;

G. A target number of 10 mussels from each species/clade (representing all size categories observed) will be gently removed from the substrate and collected in mesh bags and brought to the surface;
H. Divers will transfer the mussels to the boat, where they will be stored in a bucket of water dipped from the site. They will be quickly identified, measured and photographed, and representative individuals will be sampled for genetic analysis as described in Section B.2.4 below;
I. When field measurements are recorded mussels will be returned to the bottom and carefully placed back in substrate from which they were collected;
J. All information on data forms/PVC pipe will be verified and the team will proceed to the next sample site.