ADDENDUM NO. 9 TO THE REMEDIAL INVESTIGATION WORK PLAN

Supplemental Sampling, Baseline Ecological Risk Assessment Smurfit-Stone/Frenchtown Mill, Missoula County, Montana

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ACRONYMS AND ABBREVIATIONS

AOC	Administrative Settlement Agreement and Order on Consent
BERA	baseline ecological risk assessment
BHHRA	baseline human health risk assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	chain-of-custody
COPC	chemical of potential concern
CSM	conceptual site model
CVAAS	cold vapor atomic absorption spectrometry
DOC	dissolved organic carbon
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
FSP	field sampling plan
HASP	health and safety plan
HRGC/HRMS	high-resolution gas chromatography with high-resolution mass spectrometry
Integral	Integral Consulting Inc.
MDEQ	Montana Department of Environmental Quality
MDL	method detection limit
MRL	method reporting limit
MTNHP	Montana Natural Heritage Program
NAWQC	National Ambient Water Quality Criteria
OU	Operable Unit
PCB	polychlorinated biphenyl
PDSR	Preliminary Data Summary Report
PRP	potentially responsible party
QAPP	quality assurance project plan
QA/QC	quality assurance and quality control
RI/FS	remedial investigation and feasibility study

RIWP	Smurfit-Stone/Frenchtown Mill Remedial Investigation Work Plan
SFHA	Special Flood Hazard Area
Site	former Smurfit-Stone Frenchtown Mill
SLERA	screening level ecological risk assessment
SOP	standard operating procedure
SVOC	semivolatile organic compound
TDS	total dissolved solids
TEF	toxicity equivalency factor
TEQ	toxicity equivalent
$TEQ_{DF,F}$	toxicity equivalent calculated using dioxins and furans and toxicity equivalency factors for fish
$TEQ_{DF,M}$	toxicity equivalent calculated using dioxins and furans and toxicity equivalency factors for mammals
TOC	total organic carbon
TRV	toxicity reference value

1 INTRODUCTION

This document, Addendum No. 9 to the Smurfit-Stone/Frenchtown Mill Remedial Investigation Work Plan (RIWP; NewFields 2015a), is the work plan to conduct sampling of surface water, sediments, sediment porewater, and biological tissue on the former Smurfit-Stone Frenchtown Mill (the Site) and in the Clark Fork River. Resulting data will be used to inform the ecological and human health risk assessments, to further describe the nature and extent of contamination, and to refine the conceptual site model (CSM) of the transport and fate of chemicals related to the Site.

This addendum was prepared in accordance with the Administrative Settlement Agreement and Order on Consent (AOC) for Remedial Investigation/Feasibility Study (RI/FS) between the potentially responsible parties (PRPs; M2Green Redevelopment LLC, WestRock CP, LLC, and International Paper Company) and the U.S. Environmental Protection Agency (EPA), filed November 12, 2015.

1.1 SITE DESCRIPTION

The Site is located within the northwestern portion of the Missoula Valley, in Montana, approximately 11 miles northwest of Missoula and about 3 miles southeast of Frenchtown (Figures 1-1 and 1-2). The geographical coordinates of the industrial center of the Site are latitude 46°57′51.71″ North and longitude -114°12′00.02″ West.

The Site is located adjacent to the Clark Fork River, which flows north along the Site's western boundary (Figure 1-2). The Site project area (including all three Operable Units [OUs]) encompasses about 3,150 acres. Although the risk assessment is complete for OU1, the site investigation, including risk assessments, is ongoing in OU2 and OU3. Future development on all three OUs is currently restricted to industrial/commercial activities, under a restrictive covenant placed on the property.

Former mill operations spanned 1,910 acres in OU2 and OU3. A detailed description of the former uses of subareas within OU2 and OU3 is provided in the RIWP (NewFields 2015a). Part of the land in OU3 resides within the Special Flood Hazard Area (SFHA), the Federal Emergency Management Agency jurisdictional 100-year floodplain. For the purposes of the human health risk assessment, OU3 is considered to consist of two areas, each with different potential future uses. The OU3 upland area includes lands within OU3 that reside outside the SFHA, where future development is less constrained. The OU3 floodplain area includes lands that reside within the SFHA, where certain constraints on development exist.

1.2 ECOSYSTEMS AND HABITATS

The Site is currently occupied by a variety of habitats and wildlife. In its current condition, the Site consists of former operational area of OU2 that provides limited habitat value, and OU3 which is partially in the upland, and partially in the floodplain. Habitats in OU2 and OU3 include upland and floodplain meadows, ponds, and wetlands, some of which occur in areas formerly used for treatment of wastewaters generated by the mill. OU3 includes riparian forest adjacent to the Clark Fork River.

A description of the ecosystems potentially at risk is a necessary component of the qualitative evaluation of complete exposure pathways in the preparation of an ecological risk assessment (ERA; USEPA 1997). The ecosystems potentially at risk at OU2 and OU3 are discussed below.

1.2.1 OU2 Industrial Area

The core industrial footprint of the former operational area (OU2) occupies about 260 acres. In OU2, there are a few buildings and other facilities and structures currently not in use, paved roads and parking areas, the wood chip staging area, and locations where recovery boilers, lime kilns, and other equipment were once located but have been decommissioned. Most of the OU2 area does not currently provide good wildlife habitat because the soil has been disturbed by the industrial processes that occurred during mill operations, or the ground is paved. The plant community consists of hearty weeds and shrubs, other forbs, and grasses. Wildlife that may use OU2 in its current state are those adapted to developed or disturbed areas (e.g., pigeons, swallows, crows, and small mammals). There is one area formerly used as a borrow pit on OU2, and now fed by groundwater, that may be considered surface water habitat in OU2. Another aquatic habitat on OU2 is the non-contact cooling water ditch that runs along the western border of OU2, flowing in a northerly direction along a roadway, eventually draining into a side channel of the Clark Fork River at the northern end of OU3 (Figure 1-2).

1.2.2 OU3 Uplands and Floodplain

OU3 consists of about 1,650 acres that include multiple habitat types: upland meadows; several ponds in areas formerly used for treated water holding ponds and infiltration basins; and both forested and shrubby riparian areas adjacent to two creeks, the Clark Fork River, and riverside channels.

The upland meadows are occupied by both native forbs and shrubs and invasive weeds. Birds recently observed in this area include a variety of common passerines (e.g., sparrows, wrens, magpies) and small falcons, as well as northern harriers, red-tailed hawks, and eagles perched in nearby snags or on poles or fences. Coyotes, elk, and deer have been observed in open areas of OU3 (elk have also been observed in OU1), and parts of OU3 are currently used for cattle grazing. Numerous Columbia squirrels were observed in OU3 during a Site visit in June 2017.

In the ERA for OU1 (USEPA 2017a) and the screening level ecological risk assessment (SLERA) for OU2 and OU3 (USEPA 2017b), EPA identified federal and state species of concern potentially present at the Site (Table 1-1) based on a search of the Montana Natural Heritage Program (MTNHP) web site's Animal Species of Concern report completed on June 12, 2018 (MTNHP 2018) and the U.S. Fish and Wildlife Service Montana Field Office and Information for Planning and Consultation (IPaC) query results. Some areas of the OU3 uplands were settling basins or landfills during mill operations. These areas occur closer to OU2, are currently covered with soil or wood chips, and are sparsely vegetated.

Ponds in OU3 are fed by groundwater and surface water runoff; they do not have a surface hydrological connection to the river, and therefore are not expected to be occupied or used by fish. Ponds containing water for most or all of the year are occupied by early successional stage wetland plant communities, including algae, and some floating and some emergent aquatic plants. Ponds are used by a variety of ducks, geese, and other waterfowl (e.g., grebes); they also seasonally attract wading birds and shorebirds, mammals, amphibians, and reptiles.

O'Keefe Creek runs along the southern edge of OU3, and is joined by Lavalle Creek just before the confluence of Lavalle with the Clark Fork River (Figure 1-2). O'Keefe Creek is a ditch for much of its length, and intersects several roads and has several railroad crossings before entering the Site boundary, where the creek also intersects an agricultural ditch. It is surrounded by emergent wetland vegetation (e.g., cattails, sedges, grasses) in some areas, and passes through culverts in several places along its length. Lavalle Creek is heavily impacted by domestic animal grazing above the confluence with O'Keefe Creek. Both creeks have very sparse riparian vegetation consisting mainly of grasses and forbs; shrubs and trees are largely absent on portions of the creeks that run through the Site. Beaver are active at the confluence of Lavalle Creek with the Clark Fork River, and signs of other aquatic mammals (e.g., river otters) have also been observed in this area. Waterfowl can be expected to use the creeks at times for foraging, but the lack of vegetative cover limits the creeks as breeding areas for birds.

Forested riparian areas adjacent to the Clark Fork River have an open understory and sparsely distributed Ponderosa pines with shrubby vegetation in some portions directly adjacent to the Clark Fork River. Large snags provide perches for eagles and osprey. Great blue herons, belted kingfisher, and a variety of passerines and waterfowl have been observed along the shoreline of the river. Larger mammals using the upland portion of the Site can also be expected to visit the riparian habitat.

1.3 PROJECT OBJECTIVES

The objective of the studies described in this addendum is to close data gaps identified by EPA and the PRPs through the screening level risk assessment process (a data gaps analysis is

presented in Section 2). Resulting data will be applicable to several aspects of the remedial investigation, including:

- Evaluation of risks to ecological receptors in terrestrial, stream, and pond environments in OU2 and OU3 on the Site and in the Clark Fork River
- Evaluation of human health risks in OU2 and OU3 for those human receptors potentially exposed to chemicals in surface water and sediments in creeks, ponds, or the river
- Description of the nature and extent of contamination in OU2 and OU3 and in the Clark Fork River
- Refinement of CSMs, and in particular evaluation of chemical transport pathways through both physical processes and bioaccumulation.

Although the proposed study will generate information to address all of these aspects, it was initiated primarily to address data gaps related to ERA. An overarching objective of the study is to complete the data collection required to address baseline ecological and human health risks at the Site.

1.4 DOCUMENT ORGANIZATION

A review and summary of prior risk assessment and site descriptive work is provided in Section 2. A description of data quality objectives of the sampling program described in this addendum is presented in Section 3. Section 4 and the appendices address field, laboratory, and data management procedures to be used in performing the study. All aspects of the program will be conducted consistent with the approved Quality Assurance Project Plan (QAPP; NewFields 2015b).

2 SUMMARY OF PREVIOUS SITE INVESTIGATIONS

The Site investigation has been underway since 2014, and has included several studies and reports relevant to planning the study described in this RIWP addendum. EPA has required and PRPs have performed several studies to describe the nature and extent of contamination, including in areas targeted by the study described in this RIWP addendum. Site investigation work was conducted in 2014 and documented in a report (NewFields 2014) and synthesized in the RIWP (NewFields 2015a). In 2015, PRPs collected data on metals, polychlorinated biphenyls (PCBs), and dioxins and furans in sediments and water of the Clark Fork River, and in Lavalle and O'Keefe creeks; the results are presented in NewFields (2016). Further investigation of chemicals in soils of OU2 and OU3 was completed in the fall of 2017 (NewFields 2017c); the results are presented in NewFields (2018a). Reports describing the finding of these studies include:

- 2014 Site Investigation Report (NewFields 2014)
- Remedial Investigation Work Plan (RIWP; NewFields 2015a)
- Preliminary Data Summary Report (PDSR; NewFields 2016)
- OU2 PCB Soils Investigation Report (NewFields 2017a)
- PCB Data Summary Memorandum (NewFields 2017b)
- Supplemental Soil Sampling Report (NewFields 2018a).

Extensive groundwater studies have also been conducted, and groundwater monitoring and evaluation are ongoing. Groundwater is not discussed further in this addendum.

EPA has also prepared several risk assessment reports:

- Human Health Risk Assessment for the Smurfit Stone Frenchtown Mill Operable Unit 1 Site Located in Missoula County Montana (USEPA 2017c)
- Ecological Risk Assessment for Operable Unit 1 of the Smurfit Stone Frenchtown Mill Site Located in Missoula County, Montana (USEPA 2017a)
- Draft Memorandum: Strategy for Selecting Chemicals of Potential Concern (COPCs) for OU2, Smurfit Stone Frenchtown Mill, Missoula County, Montana (USEPA 2017d)
- Draft Screening Level Ecological Risk Assessment for Operable Units 2 & 3 of the Smurfit Stone Frenchtown Mill Site Located in Missoula County, Montana (USEPA 2017b)
- Draft Proposed Human Health Conceptual Site Model for Operable Unit 2 (OU2), Smurfit Stone Frenchtown Mill, Missoula County Montana (USEPA 2017e)

- Draft Baseline Human Health Risk Assessment (USEPA 2018b)
- Draft Baseline Ecological Risk Assessment (BERA) Work Plan (USEPA 2018a)

EPA found no unacceptable human health or ecological risks in OU1, and no further risk assessment activity is anticipated for OU1 (USEPA 2017a,c). EPA has initiated a baseline human health risk assessment (BHHRA) and SLERAs for OU2 and OU3. In these documents, EPA has developed conceptual site exposure models depicting potential exposure pathways (exposure CSMs) for various human and ecological receptors, and prepared screening evaluations (USEPA 2017a,b,c,e). EPA has also prepared a draft BERA Work Plan (USEPA 2018a) and received input from other agencies and public stakeholders. The final BERA Work Plan is pending.

Through evaluation of the results of EPA's risk assessment documents, and NewFields (2016, 2018a) reports on chemicals in sediments, soils, and surface water, data gaps that must be addressed to perform the BERA have been identified. Sampling locations proposed in this draft addendum for the onsite ponds, and most sampling locations in the Clark Fork River, were selected by EPA; creek sampling locations and small mammal sampling locations have been discussed with EPA. By addressing these data gaps, information relevant to multiple aspects of the remedial investigation will be generated. The results of sampling described in this RIWP addendum will complement results of earlier sampling efforts to support both the risk assessment and the remedial investigation for the Site.

2.1 SURFACE WATER INVESTIGATIONS

A study of surface water quality was completed by NewFields on behalf of PRPs in 2015 (NewFields 2016). For this study, 10 surface water samples were collected downstream, adjacent to, and upstream of the Site at locations coincident with bed sediment samples. The surface water sample locations were chosen to provide additional data to evaluate surface water quality above, below, and along the Site. Two samples were collected in the Clark Fork River downstream of the Site, one sample along the Site, and five samples upstream of the Site. In addition, one background sample was collected from O'Keefe Creek and one background sample from Lavalle Creek (NewFields 2016).

All surface water samples were analyzed for dioxins and metals. Two Clark Fork River samples upstream of the Site, two Clark Fork River samples downstream, and both samples in the tributaries (total of six surface water samples) were analyzed for PCBs and semivolatile organic compounds (SVOCs).

In the Clark Fork River, the results of 2015 surface water sampling reported by NewFields (2016) show that metals and toxicity equivalent (TEQ) concentrations in surface water adjacent to the Site are comparable to or below concentrations in upstream background. This is true for

barium, manganese, and TEQ (i.e., the chemicals present above background in OU3 soils [antimony was not tested in surface water]). Mercury, PCBs, and SVOCs were not detected in any surface water samples collected in 2015 from the Clark Fork River or other surface waters (NewFields 2016), except at one location upstream of the Site where Aroclor 1221 was detected.

2.2 SUMMARY OF SURFACE WATER DATA GAPS

There are currently no data describing the surface water quality in ponds in OU2 and OU3, and no data for the surface water in the non-contact cooling water ditch.

There are only two surface water samples from O'Keefe and Lavalle creeks, including only one upstream of the Site boundary in O'Keefe Creek, and an additional one in Lavalle Creek occurring within the Site boundary.

In the Clark Fork River, surface water samples were collected upstream of the Site at eight locations, and adjacent to or downstream of the Site at three locations.

Additional information on surface water quality is needed from:

- Ponds and creeks to describe the nature and extent of contamination and to evaluate potential ecological and human exposures and risks
- Areas downstream of the Site within the Clark Fork River to further describe the conditions in the Clark Fork River, and evaluate the extent of influence of the Site on water quality of the river downstream of and adjacent to the Site, if any
- Areas upstream of the Site in both the creeks and the Clark Fork River to describe background surface water conditions.

2.3 SEDIMENT INVESTIGATIONS

A study of sediment quality was also completed by NewFields on behalf of PRPs in 2015 (NewFields 2016). Sediment samples collected in 2015 were divided into two categories: bed and flood fringe samples. Bed samples were benthic sediment samples collected below the waterline at the time of sampling, while flood fringe sediments were collected from areas where river sediment deposition has occurred in the past but may not currently be inundated. Bed sediment samples were collected from the Clark Fork River, the Bitterroot River, and two upstream tributaries (O'Keefe Creek and Lavalle Creek). Bed sediments were collected as discrete samples collected from within the top 6 in. of the sediment.

Twenty-two bed sediment samples were collected in the Clark Fork River at locations downstream, immediately adjacent, and upstream of the Site to supplement existing data and to evaluate chemical concentrations and chemical gradients, if any, in sediment. All sediment

samples were analyzed for dioxins, metals, total organic carbon (TOC), and grain size. In addition, nine bed sediment samples were analyzed for PCBs and SVOCs, including all five samples from the two creeks, two samples upstream of the site in the Clark Fork River, and two samples downstream of the site in the Clark Fork River.

Results of sediment sampling in the Clark Fork River are similar to results for surface water: PCBs and SVOCs were not detected in Clark Fork River sediments. Mercury was detected in Clark Fork River sediment, but both mercury and TEQ were present at higher concentrations in sediments upstream of the Site than adjacent to or downstream of the Site. TEQ concentrations are highest in sediments near Missoula (NewFields 2016). Moreover, TEQ concentrations in all Clark Fork River and creek sediments collected in 2015 are within the range of TEQ concentrations found in sediments in and near cities in Washington (Ecology 2009; Windward 2010, Figure 7-4, Table 7-5) and even in non-urban freshwaters elsewhere in the U.S. (USEPA 2000).

2.4 SUMMARY OF SEDIMENT DATA GAPS

There are currently no data describing the sediment quality in ponds in OU2 and OU3, and no data for sediments in the non-contact cooling water ditch.

There are only five sediment samples from O'Keefe and Lavalle creeks, including only one upstream of the Site boundary in O'Keefe Creek, and one at the uppermost end of the onsite portion of Lavalle Creek, plus an additional three in the creeks occurring within the Site boundary.

In the Clark Fork River, sediment samples were collected upstream of the Site at 11 locations, adjacent to the Site at 4 locations, and downstream of the Site at 3 locations.

Additional information on sediment quality in ponds and creeks is needed to describe the nature and extent of contamination and to evaluate potential ecological and human exposures and risks. Additional information on sediment quality in areas downstream of the Site within the Clark Fork River is needed to further describe the conditions in the Clark Fork River, and evaluate the extent of influence of the Site on sediment quality of the river downstream of and adjacent to the Site, if any. Additional data describing sediment conditions upstream of the Site in both the creeks and the river are also needed for this purpose.

Additional information on sediment quality is needed from:

- Ponds and creeks to describe the nature and extent of contamination and to evaluate potential ecological and human exposures and risks

- Areas downstream of the Site within the Clark Fork River to further describe the conditions in the Clark Fork River, and evaluate the extent of influence of the Site on sediment quality of the river downstream of and adjacent to the Site, if any
- Areas upstream of the Site in both the creeks and the Clark Fork River to describe background sediment conditions.

2.5 ECOLOGICAL RISK ASSESSMENT

The focus of this RIWP addendum is to fill data gaps that must be addressed to complete the BERA. A summary of EPA's SLERAs for OU2 and OU3 and of the framework for the BERA established by the draft BERA Work Plan are presented in this section. The overview of BERA steps performed to date is necessary context for identification of data gaps that will be addressed by this study.

Sediment and water quality data resulting from this study will also be used by EPA to update exposure assessments for human receptors potentially exposed to chemicals in sediments and water in the ponds, creeks, and river. Results will be used to prepare a final BHHRA for OU2 and OU3. The BHHRA for OU2 and OU3 is not discussed further in this RIWP addendum.

2.5.1 Screening Level Risk Assessments

EPA has completed risk screening and baseline human health and ecological risk assessments for OU1 (USEPA 2017a,c), concluding that chemicals in soils are not present at concentrations of concern to ecological receptors, and that chemicals in aquatic habitats of OU1 are not present at concentrations greater than background.

EPA has initiated the ecological risk screening process for OU2 and OU3, and development of exposure CSMs for ecological receptors in the BERA Work Plan (USEPA 2018a).

In the SLERAs for OU2 and OU3, the maximum reported concentration of 2,3,7,8-dibenzo-*p*-dioxin TEQ, calculated using dioxins and furans and toxicity equivalency factors (TEFs) for mammals ($TEQ_{DF,M}$), and the maximum concentrations of several metals exceed soil screening level concentrations established by EPA (see Appendix C of the SLERAs for screening levels). EPA's OU2 and OU3 SLERA did not include comparisons to background concentrations of metals in soils, but the draft BHHRA did include this comparison, conducted separately for OU2 and OU3.

Final chemicals of potential ecological concern to be evaluated in the baseline risk assessments will be identified by EPA using data evaluated previously by EPA, results of the supplemental soil sampling conducted in 2017, and results of the study described in this work plan.

The CSMs developed by EPA as part of the initial steps of the risk assessments define ecological receptors for OU2 and OU3. Receptors of concern were outlined in the SLERA, but representative or indicator receptors were not defined. Instead, receptors and receptor surrogates were identified in EPA's draft BERA Work Plan (USEPA 2018a). Consideration of EPA's current ecological exposure CSMs and receptors is relevant to definition of data quality objectives (DQOs) for this work plan.

2.5.2 Baseline Ecological Risk Assessment Work Plan

EPA has drafted a BERA Work Plan (USEPA 2018a), but as of the time of preparation of this addendum document (July 2018), the final BERA Work Plan is pending. In accordance with Step 4 of the eight-step process used by USEPA (1997) to conduct ERAs, the adequacy of existing Site information to support the development of the OU2 and OU3 BERA was evaluated in the draft BERA Work Plan (USEPA 2018a). The results of the SLERA for OU2 and OU3 (USEPA 2017b) were summarized in the draft BERA Work Plan; exposure media, exposure pathways, and ecological receptors that require assessment in the BERA were identified. Data gaps were assessed in the draft BERA Work Plan based on review of SLERA results and in context with the measurement endpoints (i.e., quantifiable measures of exposure and effects) described in the OU2 and OU3 SLERA.

Using the exposure CSMs and other information provided in the draft BERA Work Plan (Appendix C), Integral Consulting Inc. (Integral) has prepared a draft of a consolidated description of receptors and exposure scenarios to be addressed by the BERA (Table 2-1). This draft summary of the pending ERA also lists assessment endpoints (i.e., explicit statements of the ecological values that are to be protected) and measurement endpoints, risk questions, and risk characterization approaches (Table 2-1). This draft summary is useful in defining data gaps to be addressed by this study.

The potentially significant exposure routes and receptors identified by EPA for evaluation in the BERA include:

- Ingestion and direct contact of benthic macroinvertebrate communities with onsite sediments in ponds in OU2 and OU3, O'Keefe and Lavalle creeks, and the Clark Fork River
- Direct contact of aquatic plants, benthic organisms, and herpetiles with onsite surface water in ponds in OU2 and OU3, O'Keefe and Lavalle creeks, and the Clark Fork River
- Ingestion and direct contact of fish (through respiration) with surface water in the Clark Fork River and the onsite creeks
- Direct contact of terrestrial plants and direct contact and ingestion by soil invertebrates with OU2 and OU3 surface soil

- Ingestion of soil, food items, and surface water by terrestrial birds and mammals at OU2 and OU3:
  - Terrestrial invertivorous/insectivorous birds represented by the American robin, grey catbird, and tree swallow; mammals represented by Vagrant shrew and bat
  - Terrestrial herbivorous birds represented by the blue grouse[1]; mammals represented by white-tailed deer and Montane vole
  - Terrestrial carnivorous birds represented by the American kestrel; mammals represented by the red fox and American mink
  - Terrestrial omnivorous birds represented by the Northern flicker and Clark's nutcracker; mammals represented by the deer mouse
- Ingestion of sediment, food items, and surface water by aquatic birds and mammals at OU2 and/or OU3:
  - Aquatic omnivorous birds in OU2 and OU3 ponds represented by the mallard duck
  - Aquatic insectivorous birds in OU3 represented by the American dipper
  - Piscivorous birds in OU3 represented by the belted kingfisher; piscivorous mammals represented by the mink and river otter.

To evaluate exposures to the receptors via the exposure routes listed above and to quantitatively evaluate potential for unacceptable risk to ecological receptors at the Site, empirical Site data are required. EPA identified a range of data gaps in the draft BERA Work Plan (USEPA 2018a) to be addressed before the BERA Work Plan can be implemented. Supplemental soil sampling conducted in November of 2017 addressed soil data gaps. Additional data for the Site, including sediment, surface water, and biological tissue, are required to address the remaining data gaps.

2.5.3 Summary of Remaining BERA Data Gaps

Data gaps for surface water and sediments are listed in Sections 2.2 and 2.4, respectively. Soil data gaps relevant to risk assessment have been addressed (NewFields 2017c, 2018a). The remaining data gaps to be addressed by the study described in this RIWP addendum include:

- Measured concentrations of metals and dioxins and furans in benthic macroinvertebrate tissue of ponds and creeks
- Measured concentrations of metals and dioxins and furans in small fish tissue of the Clark Fork River

[1] The blue grouse was split into dusky and sooty grouse in 2006. The dusky grouse is east of the Cascade Range in Washington, and is the one at this site.

- Measured concentrations of metals and dioxins and furans in tissue of small mammals living in OU2 and OU3 habitats.

Further, and consistent with the draft BERA Work Plan, data gaps can be addressed in a manner suitable to support evaluation of statistical models linking concentrations of chemicals in biota with concentrations in abiotic exposure media. Such models can be applied to derive cleanup targets for soils and sediments, if unacceptable risks are the result of contamination of these media. The overall study design to address all of the data gaps identified in this section will provide the basis for such evaluations. DQOs for the sampling proposed in this work plan event are detailed in Section 3.

3 DATA QUALITY OBJECTIVES

The study described by this work plan was developed to close data gaps relevant to the BERA and the CSM. Results will also have applications to the BHHRA. The objectives of developing additional information as described by this work plan are to:

- Support evaluation of ecological risks in terrestrial, creek, and pond environments on the Site and in the Clark Fork River
- Supplement existing information on the nature and extent of contamination at the Site
- Supplement existing information for evaluation of human health risks for those human receptors potentially exposed to chemicals in surface water and sediments in creeks, ponds, or the river
- Refine the CSM by informing evaluation of chemical transport pathways and chemical fate through assessment of:
  - Porewater chemistry in ponds
  - Geographical patterns of surface water quality and of chemicals in sediment, surface water, and macroinvertebrate or fish tissue in the creeks and the Clark Fork River
  - Concentrations of chemicals in tissue relative to concentrations in abiotic exposure media.

New information and data generated in 2018 by this supplemental sampling effort will be combined with previously collected and validated data for the Site and Clark Fork River to fulfill the DQOs required to complete the risk assessments and remedial investigation.

This section outlines the scope and purpose of each type of sampling and environmental data collection described in this work plan. DQOs are presented in the cited tables. A summary of samples to be collected under this work plan is provided in Table 3-1.

3.1 SURFACE WATER

Surface water samples will be collected as grab samples in the following locations:

- Five locations in O'Keefe and Lavalle creeks, including one location in each creek that is upstream of the Site (Figure 3-1)
- Twenty locations in the Clark Fork River and one in the Bitterroot River, including seven locations upstream of the Site (Figure 3-2)
- Twelve pond areas on the Site (Figure 3-3).

Surface water samples will be collected from the upper third of the water column, and analyzed for dioxins and furans, dissolved metals, and total recoverable metals; metals analyses will include total mercury. Data for ancillary parameters will be collected for surface water to support evaluation of the bioavailability of metals, and to evaluate the extent of influence of the Site on water quality of the river downstream of and adjacent to the Site as follows:

- *In situ* measurements of water temperature, pH, dissolved oxygen, and conductivity. In ponds, pH will be measured at three depths (upper, middle, and just above the sediment-water interface). Alkalinity will be measured in the field at each pond sampling location.
- Grab samples for dissolved organic carbon (DOC), total dissolved solids (TDS); common ions (calcium, magnesium, sodium, potassium, sulfate, and chloride), alkalinity (bicarbonate, carbonate, and hydroxide), and other ions (fluoride, silicon, nitrate/nitrite, phosphate, and thiosulfate).

Resulting chemical concentration data will be used for description of the nature and extent of chemical contamination, for risk assessment, and to refine chemical transport pathways and chemical fate in the CSM.

- **Nature and extent evaluation**: Surface water sampling stations in onsite portions of O'Keefe and Lavalle creeks are concentrated toward the mouths of these creeks to improve spatial coverage of surface water data in the creeks. Surface water samples will also be collected from 12 ponds within the Site perimeter because water quality in the ponds has not been described previously. Surface water sampling within the creeks and in the Clark Fork River and Bitterroot River upstream of the Site will generate additional background data. Surface water sampling in the Clark Fork River will also provide additional data to describe conditions adjacent to and downstream of the Site. Results of water chemistry from the Site will be compared to background, as previously conducted by EPA (e.g., USEPA 2017c).
- **Human health risk assessment**: EPA will use results of the surface water sampling to further refine exposure estimates for hypothetical human receptors that may be exposed to chemicals in surface water through recreational or other activities in the creeks, ponds, and river.
- **Ecological risk assessment**: EPA will also use the results for comparison to numeric water quality criteria for the protection of aquatic life (NAWQC; MDEQ 2017; USEPA 2018a, Appendix B) for the state of Montana and potentially to selected species- or taxa-specific toxicity reference values (TRVs) expressed as concentrations in water; and to estimate the contribution of water to the cumulative exposure of each terrestrial wildlife receptor that may be exposed to chemicals through ingestion of water from the creeks, ponds, or river.

- **Conceptual site model**: Results of water quality samples will be used to evaluate whether the Site is a source of contamination to the Clark Fork River through evaluation of geographical patterns in chemical concentrations in surface waters. Results for analyses of common ions, alkalinity, and other ions will be used to prepare piper diagrams for comparison among the various waterbodies sampled, and to evaluate similarities or differences and potential connectivity between or among the various waterbodies.

Resulting data for ancillary variables measured *in situ* during sampling and from grab samples will be used to evaluate the controls on the bioavailability of those chemicals present in water on the Site at concentrations above background, which may include dioxins, furans, and metals. Published models such as the biotic ligand model (USEPA 2007a) will be used to evaluate the data and to address the potential toxicity of dissolved metals in water. Data exploration will also be performed to determine whether Site-specific bivariate or multivariate models can be used to evaluate and identify potential geochemical controls on metals bioavailability in each of the aquatic habitats sampled. Surface water DQOs are summarized in Table 3-2.

3.2 SEDIMENT

Bulk surface sediment samples from 0–6 in. depth (0–15 cm), consistent with the prior study, will be collected as discrete samples from the creeks and the river as follows:

- Ten locations in O'Keefe and Lavalle creeks, including three locations upstream of the Site and one at the Site boundary in O'Keefe Creek, with two of these in each creek (Figure 3-1)
- Twenty locations in the Clark Fork River and one in the Bitterroot River, including seven locations upstream of the Site (Figure 3-2)
- Twelve locations in onsite ponds (Figure 3-3).

Surface sediments (0–6 in.; 0–15 cm) will be collected as discrete samples from ponds using a grab sampler; and as composites within a 1-square-meter area in the creeks and the rivers, using a stainless steel trowel or spoon as in the prior study.

During sediment sampling in ponds, observations of the sediment profile will be conducted by inserting a Lexan tube or similar to a depth of 0 to 10 in. (15 to 25 cm), and photographing each to provide a qualitative description of the sediment profile (e.g., depth of the boundary between oxic and anoxic sediments; any vertical patterns in grain size distribution or coloration, etc.).

Sediment samples from creeks, the river, and the onsite ponds will be analyzed for dioxins and furans, and metals including total mercury and methylmercury. Ancillary parameters to be analyzed in all sediment samples include TOC and sediment grain size distribution. Pond

sediments will also be analyzed for acid-volatile sulfides and simultaneously extracted metals. *In situ* measurements of pH in sediments will be collected during sampling; pH will be measured within a depth interval of 0–6 in. (0–15 cm) at locations where porewater samplers are deployed (Section 3.3).

Resulting chemical concentration data will be used for risk assessment, for description of the nature and extent of chemical contamination, and to refine chemical transport pathways and chemical fate in the CSM.

- **Nature and extent evaluation**: Sediment sampling stations in portions of O'Keefe and Lavalle creeks on the Site are concentrated toward the mouths of these creeks to improve spatial coverage of sediment data in the creeks. Sediment samples will also be collected from 12 ponds within the Site perimeter because sediment chemistry in the ponds has not been described previously. Sediment sampling at two locations within each of the creeks and at six locations in the Clark Fork River upstream of the Site will generate additional background data. Sediment sampling in the Clark Fork River will also provide additional data to describe conditions adjacent to and downstream of the Site. Results of sediment chemistry from the creeks on the Site will be compared to background, as previously conducted by EPA (e.g., USEPA 2017c).
- **Human health risk assessment**: EPA will use results of the sediment sampling to further refine exposure estimates for hypothetical human receptors that may be exposed to chemicals in sediments through recreational or other activities in the creeks, ponds, and river.
- **Ecological risk assessment**: EPA will also use the results for comparison to EPA's selected sediment screening values (USEPA 2018a), and potentially to selected species- or taxa-specific TRVs expressed as concentrations in sediments; and to estimate the contribution of sediments to the cumulative exposure of each terrestrial and aquatic wildlife receptor that may be exposed to chemicals through incidental ingestion of sediments while foraging in the creeks, ponds, or river.
- **Conceptual site model**: Results of bulk sediment chemistry samples will be used to evaluate whether the Site is a source of contamination to the Clark Fork River through evaluation of geographical patterns in chemical concentrations. The visual assessment of sediment profiles will provide qualitative information on the sediment types (e.g., muddy, gravelly) and the depth of the oxygenated layer to augment evaluation of the chemistry results.

In addition to risk assessment steps to be performed by EPA, data exploration will be conducted to identify and define variables that control ecological risk-driving processes such as exposure, toxicity, and bioaccumulation. Data for ancillary variables measured *in situ* during sediment sampling or from bulk sediment composite samples will be used to evaluate the controls on the

bioavailability of those chemicals present in sediments on the Site at concentrations above background. These may include dioxins, furans, and metals. For example:

- Published information and guidance on derivation of equilibrium partitioning–based sediment benchmarks for mixtures of metals (USEPA 2005) will be consulted and applied to determine whether or not metals concentrations in pond sediments would result in unacceptable risk to benthic macroinvertebrate communities.
- Site-specific statistical modeling will also be used to evaluate whether systematic sediment-tissue bioaccumulation relationships exist or do not exist. If present, statistically significant relationships between sediment chemistry and tissue chemistry can be used to evaluate possible bioaccumulation and risk drivers when unacceptable risk is present. The absence of statistical correlations between bulk sediment chemistry and tissue chemistry may indicate the presence of conditions not attributable to hazardous substances that may limit or amplify bioaccumulation of chemicals from sediments, which can also inform long-term management of the Site.

The geochemistry of the ponds may be complex because of the unique combination of constituents (e.g., sodium ions, organic matter, sulfur compounds) that are present as a result of paper manufacture in the treated water. The data collection design will capture a gradient of pond types and conditions from those that were not used for treated water storage to ponds that were used extensively for treated water storage. The set of ponds selected for sampling is expected to capture the range of conditions that could drive ecological risks in the ponds. Data analysis and data exploration will be conducted to identify risk-driving conditions. Sediment DQOs are summarized in Table 3-3.

3.3 POREWATER IN POND SEDIMENTS

The onsite ponds represent a unique type of aquatic habitat. Ponds are fed by groundwater and surface water runoff, but do not have a direct surface hydrological contact with the Clark Fork River. Moreover, as the receiving areas for treated wastewaters, the pond sediments, as indicated by the chemistry of nearby soils, reflect an accumulation of a variety of chemical constituents as materials settled out of the water. Some of these constituents (e.g., metals) may be toxic to aquatic life, and others (e.g., sodium ions, organic carbon, sulfides) may be present at concentrations that result in mitigation of toxicity by binding to the toxic constituents. Sulfides can also be toxic to benthic infauna. In this context, the geochemistry of surface water, sediments, and sediment porewater is sufficiently complex that measurement of only bulk sediment chemistry and comparison of concentrations to screening levels or literature-derived TRVs expressed as concentrations in bulk sediment will not provide a reliable measure of risk to benthic macroinvertebrate communities.

Benthic infauna are exposed to sediment-associated metals through ingestion of sediment and detritus, respiration and, for some groups, dermal contact. For the latter two exposure routes, the concentration of a metal dissolved in the porewater is the best predictor of the toxicity of the sediment environment to infaunal organisms. Because the capacity of the sediments in each pond to bind metals or to compete with metals for binding sites on the organisms is unknown and likely spans a range across the variety of ponds on the Site, the most direct approach to understanding the potential toxicity of the pond sediments is through direct measurement of metals in sediment porewater.

Various methods are available for sampling porewater. For the purposes of understanding the potential toxicity of pond sediments to benthic invertebrates, a passive *in situ* equilibrium method will be used. This method is preferred because it provides the best representation of the exposure conditions experienced by benthic infauna. The porewater within the sediment matrix of the ponds will be sampled for dissolved metals concentrations directly using peepers. Peepers consist of a series of polyethylene peeper vials covered with a 0.45-µm semipermeable membrane. The interior of the peeper vials consists of rows of chambers that are filled with distilled, deionized, oxygen-free water. During the 4-week deployment, this water equilibrates with surrounding porewater. Upon retrieval, analysis of the water within the peeper vial provides a measure of the dissolved metals in sediment porewater and other conditions within the sediment environment.

Peepers will be used as follows:

- At each pond location, peepers will be deployed in the sediments corresponding to the location at which the sediment sample is collected.
- Peepers will remain in the sediments for approximately 4 weeks to allow equilibration of chemicals dissolved in sediment porewater with the water within the peepers.
- All peepers deployed in any individual pond will be retrieved from the pond simultaneously, certain measurements will be made in the field, and the remaining peeper water will be preserved and shipped to the laboratory with minimal exposure to sunlight and oxygen.

Water within peepers will be analyzed for dissolved metals, dissolved oxygen, DOC, alkalinity, sulfide concentration, common ions, other ions, pH, and redox potential. Redox potential, pH, dissolved oxygen, alkalinity, and sulfide concentration will be measured within 2 hours of sample collection in the field.

The objective of collecting porewater samples is to determine the dissolved concentrations of metals in porewater, providing a means to understand and predict the potential toxicity of metals detected in bulk sediments to the sediment infauna, and to evaluate bioaccumulation relationships. Dissolved metal concentrations in porewater will be compared to species- or

taxa-specific TRVs of appropriate quality to characterize risks to benthic macroinvertebrate communities in pond sediments.

In addition to collection of porewater using peepers to characterize dissolved metals concentrations in pond sediment porewater, whole porewater samples will be collected from each pond using a PushPoint® sampler, at the request of EPA. PushPoint® porewater samples will be collected from each pond and analyzed for total metals, DOC, common ions and other ions. Thus both dissolved metals concentrations and whole metals concentrations in pond sediment porewater will be assessed.

Porewater will not be sampled in the other aquatic environments to be addressed by this study. Well-oxygenated, flowing water in the creeks and the river are not as likely as the ponds to be characterized by geochemistry that complicates interpretation of bulk sediment chemistry.

Porewater DQOs are summarized in Table 3-4.

3.4 BIOLOGICAL TISSUE

Sampling in 2018 will include collection of:

- Benthic macroinvertebrates from creek and pond sediments
- Small fish from cobbles on the margins of the Clark Fork River and Bitterroot River targeting the longnose dace (*Rhinichthys cataractae*)
- Small mammals from 10 upland or floodplain locations within the Site boundary.

Benthic macroinvertebrates and small mammals will be collected as a mixed-species composite to represent what their predators may be exposed to during foraging. All tissue samples will be homogenized in the laboratory, and analyzed for dioxins and furans, metals, methylmercury, lipid content, and percent moisture.

To facilitate evaluation of correlations between chemical concentrations in abiotic media and in biota:

- Benthic macroinvertebrate samples will be collected at approximately the same locations as sediment samples in all creek and pond sampling locations.
- Small fish tissue samples will be collected downstream of and as near as possible to depositional habitats sampled for sediment and water in the Clark Fork River and Bitterroot River.
- Small mammal tissue will be collected in areas where composite soil samples were collected in 2017.

Results will be used in both ERA and refinement of the CSM of chemical transport, fate, and bioaccumulation.

3.4.1 Benthic Macroinvertebrates

Benthic macroinvertebrate communities in O'Keefe and Lavalle creeks, in the onsite ponds, and in the Clark Fork River are ecological receptors (Table 2-1), and are consumed by other ecological receptors such as the American dipper, mallard duck, and stream fish. Aquatic insects are consumed by bats and tree swallows following emergence.

Benthic macroinvertebrate tissue samples will be collected as mixed-species composites at 22 sampling locations, as follows:

- One composite benthic macroinvertebrate tissue sample will be collected from each of the 12 ponds to be sampled on the Site (Figure 3-3), as close as possible to sampling locations from which sediments and porewater are collected.
  - Benthic macroinvertebrates will be collected in multiple but not more than 10 sediment grab samples at each sampling location. Depth of sediment grabs will be from 0–6 in. (0–15 cm).
  - Material captured within a grab sample (e.g., plant detritus, sediment, invertebrates) will be sieved (500 μm or similar) and contents not passing through the sieve will be packaged and transported to the laboratory.
  - Benthic macroinvertebrate tissue samples from each individual pond will be composited and weighed at the laboratory, for a total of 12 composites, one from each pond. If sufficient tissue mass is not available from an individual pond for all analytical requirements, analysis for dioxins and furans will be prioritized, followed by methylmercury, lipids, and total metals.
- One composite benthic macroinvertebrate sample will be collected from each of the 10 sampling locations within O'Keefe and Lavalle creeks (Figure 3-2) using kick nets, as close as possible to sediment sampling locations in the creeks.

All of these tissue samples will be co-located with sediment and water samples collected as described in the prior sections, and will be collected at approximately the same time (i.e., within a week). Of these 22 benthic macroinvertebrate tissue samples, four will be collected upstream of or approximately at the boundary of the Site within the creeks.

Benthic macroinvertebrate tissue chemistry results will be used for the following:

- **Ecological risk assessment:** EPA will use the results of benthic macroinvertebrate tissue chemistry to evaluate the exposure of wildlife to chemicals through ingestion of benthic macroinvertebrates. Benthic macroinvertebrate tissue data will be used to evaluate the

exposure to aquatic and terrestrial insectivorous, invertivorous, and omnivorous wildlife including robins, catbirds, tree swallows, flickers, nutcrackers, mallard ducks, dippers, shrews, bats, and deer mice. EPA will also use analytical results for metals in benthic macroinvertebrate tissue for comparison to TRVs expressed as concentrations of metals in foods of fish to evaluate risks to fish in the creeks.

- **Chemical bioaccumulation**: As described in Section 3.2, statistical evaluations (e.g., correlation and regression modeling) and other data exploration will be performed to determine whether predictive relationships between sediment or porewater and benthic macroinvertebrate tissue chemical concentrations can be defined. Where unacceptable ecological risks are possible, such relationships can be used to evaluate possible bioaccumulation and risk drivers. The absence of correlations can also be informative about mechanisms driving toxicity and risk.
- **Chemical transport:** Spatial patterns in benthic macroinvertebrate tissue samples collected in O'Keefe and Lavalle creeks will be evaluated qualitatively. For example, spatial patterns in tissue chemistry may correspond to spatial patterns in sediment chemistry, or may increase from upstream to downstream in the creeks. These types of spatial patterns, when associated with unacceptable risks, may be used to inform evaluation of remedial alternatives.

Benthic macroinvertebrate tissue DQOs are summarized in Table 3-5.

3.4.2 Small Fish

Composites of single-species small fish will be collected at 14 locations in the Clark Fork River and one location in the Bitterroot River (Figure 3-2). Longnose dace will be targeted for collection for the following reasons:

- The longnose dace provides good representation of a secondary or tertiary consumer within the aquatic food web of the Clark Fork River. It occupies cobble habitats, feeding on benthic macroinvertebrates that cling to cobbles and large wood, and likely ingesting fine particulate sediments and Aufwuchs (diatoms, fungus, bacteria) on the rocky substrate during foraging.
- The longnose dace provides good representation of this trophic level at the specific location where it is captured. One study of the longnose dace defined a limited home range for this species, with none of the individuals' home range exceeding a distance of 40 m along the length of their home stream during the season sampled (Hill and Grossman 1987).
- The size of the longnose dace is consistent with the size of fish targeted as prey for several ecological receptors (e.g., belted kingfisher, mink) to be evaluated in the BERA.

- The longnose dace is found throughout the state of Montana and in the Clark Fork River, and is likely to be present in the areas targeted for sampling.

Longnose dace will be collected at each of 14 locations on the Clark Fork River and one in the Bitterroot River (Figure 3-2), as follows:

- Six locations upstream of the Site
- Three locations adjacent to the Site and corresponding to outfalls used during mill operations
- Six locations downstream of the Site.

Longnose dace will be captured using backpack electroshocker and/or a kick seine, at locations of suitable habitat (i.e., with cobble substrate) downstream and as near as possible to depositional areas sampled for sediment and surface water. Sampling may be conducted in early evening, when the longnose dace is actively foraging and likely to be found at the surface of the cobble riverbed. Sampling effort at each location will not exceed 4 hours.

- Individual longnose dace (and any individuals of non-target species other than Salmonids between 3 and 6 in. [7.5 to 10 cm] fork length) will be captured and identified to species, and their fork length will be measured and recorded. Each individual will be assigned a unique identifier, packaged individually, preserved on ice, and shipped to the laboratory. Once all dace or other small fish from all locations have been collected, PRPs will work collaboratively with EPA to determine which individuals will be used in each composite. The goal is a single-species composite of longnose dace at each location.
- Selection of individuals for compositing will prioritize obtaining sufficient biomass of longnose dace for all chemical analyses within a specified size range (that will depend on the set of fish captured). If insufficient biomass is available for all analyses from all locations, the available tissue will be sorted to enable analysis of dioxins and furans at all locations, followed by analysis for methylmercury, lipids, and total metals. Mixed species composites may be required and would be considered acceptable. If so, sorting of specimens into composites for each location will prioritize similarity in the species mix among all locations.

Compositing will be performed by the laboratory, and tissue samples will be analyzed as described above.

Longnose dace tissue chemistry results will be used for the following:

- **Ecological risk assessment:** EPA will use the results of small fish tissue chemistry to conduct the following analyses in the BERA:

  - Assessment of exposure of wildlife (kingfisher, American mink, and river otter) to chemicals through ingestion.
  - Comparison of analytical results for metals in small fish tissue to TRVs expressed as concentrations of metals in foods of larger fish to evaluate risks to fish in the river.
  - Comparison of TEQ concentrations calculated using dioxins and furans and TEFs for fish ($TEQ_{DF,F}$) in whole fish tissue to appropriate TRVs (i.e., Steevens et al. 2005) to assess risk to fish.

- **Chemical bioaccumulation**: Statistical evaluations (e.g., correlation and regression modeling) and other data exploration may be performed to determine whether predictive relationships between sediment or surface water and fish tissue chemical concentrations can be defined. Although such relationships are less useful for evaluating potential remedies in cobbly environments, they can be used to define target levels in the controlling abiotic medium. The absence of correlations can also be informative about mechanisms driving toxicity and risk.
- **Chemical transport:** Spatial patterns in small fish tissue samples collected in the Clark Fork River will be evaluated qualitatively. For example, spatial patterns in tissue chemistry may correspond to spatial patterns in sediment chemistry, may increase from upstream to downstream in the river, or may not be apparent. A spatial pattern consisting of higher concentrations downstream of the Site than upstream, when associated with unacceptable risks, may be used to inform evaluation of remedial alternatives. The absence of a spatial pattern, or a pattern in which upstream fish tissue concentrations exceed or are equal to concentrations in fish adjacent to and/or downstream of the Site, will be interpreted to indicate that the Site is not a significant source of the constituent to the aquatic food web of the Clark Fork River.

Fish tissue DQOs are summarized in Table 3-6.

3.4.3 Small Mammals

Several ecological receptors to be addressed by the BERA (e.g., red fox, American mink, American kestrel; Table 2-1) may consume small mammals in the uplands of OU2 and OU3 and on the OU3 floodplain. Mixed-species composites of small mammals will be collected from 10 locations as follows:

- Two locations in OU1, representative of offsite background
- Two locations in OU2
- Six locations in OU3.

Locations for small mammal sampling have been selected in OU2 and OU3 to correspond to areas that are both adjacent to ponds that will be sampled and within areas in which composite surface soil samples were collected in 2017.

Sampling will be conducted using live traps that will not admit the large Columbia squirrel, which is very common on the Site. Traps will be baited with peanut butter that has been tested to characterize metals concentrations and to ensure the absence of dioxin and furan or methylmercury contamination. Traps will be placed at five locations, each at a distance of 30 m from the central sample location shown on Figure 3-3. Locations for setting traps will not include bare soils, but will be well vegetated and have good ground cover.

Traps will be set within 2 hours of dusk and will be retrieved within 3 hours of sunrise to minimize overheating of mammals in traps. Upon retrieval, individuals of targeted species captured will be euthanized prior to processing. Approximately 10–15 individual animals of mixed species will be collected for a composite sample per station. The number of traps set up each day will be adjusted to minimize the number of animals sacrificed. Trapping will occur for up to four consecutive nights per week in any one location, for two consecutive weeks, providing up to eight nights of trapping at any one location.

- Individual small mammals captured will be identified to species, their length will be measured, and both will be recorded. Each individual will be assigned a unique identifier, packaged individually, preserved on ice, and shipped to the laboratory. Once all small mammal samples from all locations have been collected, PRPs will work collaboratively with EPA to determine which individuals will be used in each composite.
- Selection of individuals for compositing will prioritize obtaining sufficient biomass of the three most abundant species across all traps for all chemical analyses within specified size ranges for each species. If insufficient biomass is available for all analyses from all locations following four nights of trapping, the available tissue will be sorted to enable analysis of dioxins and furans at all locations, followed by analysis for methylmercury, lipids, and total metals.

Small mammal tissue chemistry results will be used for the following:

- **Ecological risk assessment:** EPA will use the results of small mammal tissue chemistry in the assessment of exposure of the fox, mink, and kestrel to chemicals through ingestion.
- **Chemical bioaccumulation**: Statistical evaluations (e.g., correlation and regression modeling) and other data exploration may be performed to determine whether predictive relationships between soil and small mammal tissue chemical concentrations can be defined. If unacceptable risks are present, such statistical relationships can be

used to define target levels in the controlling abiotic medium (soil). The absence of correlations can also be informative about mechanisms driving toxicity and risk.

Small mammal tissue DQOs are summarized in Table 3-7.

4 FIELD INVESTIGATION

Field activities to perform the study described by this RIWP addendum are detailed in the appendices:

- Appendix A. Sediment, Sediment Porewater, and Surface Water Field Sampling Plan
- Appendix B. Tissue Field Sampling Plan.

This section provides a limited overview of the schedule and other field investigation logistics.

4.1 TASK ORGANIZATION AND TEAM

To execute this study, Integral and NewFields will conduct the fieldwork and data analysis. The following tasks will be performed by the two teams:

- Integral team
  - Prepare the RIWP Addendum No. 9 and the tissue field sampling plan (FSP) (Appendix B)
  - Lead field effort for collection of fish, benthic macroinvertebrate, and small mammal tissue, sediment and sediment porewater in ponds.
  - Integral Project Manager: Jennifer Sampson. Office: (206) 957-0351; Cell: (360) 286-7552
  - Integral Field Lead: Stefan Wodzicki. Cell: (360) 303-2708
- NewFields team
  - Assist Integral in preparation of RIWP Addendum No. 9 and prepare the sediment, sediment porewater, and surface water FSP (Appendix A).
  - Lead field effort for collection of water and sediment samples in creeks, water in ponds, and the Clark Fork River.
  - Coordinate with laboratories on all analytical tasks (including compositing), and perform data management and reporting.
  - NewFields Project Manager and Laboratory QA Coordinator: David Tooke. Office: (406) 218-2574; Cell: (406) 240-8360
  - NewFields Field Lead: Dan Hoffman. Office: (406) 203-9960; Cell: (406) 240-7804

The names and quality assurance (QA) responsibilities of key project personnel are detailed in the project QAPP (NewFields 2015b).

4.2 SAMPLING SCHEDULE AND LOGISTICS

This task requires scheduling of work plan preparation and approval, a reconnaissance trip to establish the final sampling locations within the Clark Fork and Bitterroot rivers and the creeks, and execution of the sampling effort.

4.2.1 Project Planning

This set of activities will be performed according to the following schedule:

- EPA will review the first draft of RIWP Addendum No. 9 between June 22 and July 6
- During the third week of July, PRPs' consultants and agency representatives will visit the Site and the Clark Fork River to establish final sampling locations for fish, sediment, and water samples. If time allows, locations on the creeks and locations for small mammal sampling will also be visited and confirmed as appropriate for sampling during the reconnaissance visit.
- PRPs will address EPA comments in a revised draft for review and comment by public stakeholders. A minimum of 2 weeks will be provided for public comment, ending July 30, 2018.
- The final RIWP Addendum No. 9 will be submitted to EPA on or before August 10, 2018.
- Fieldwork will begin following EPA approval and no later than August 20, 2018.
- Fieldwork is anticipated to be complete by September 14, 2018.

Chemical analysis, data validation, and data management require approximately 2 months to complete. Validated data are scheduled to be loaded to the project database by the end of November 2018.

4.2.2 Project Execution

The ordering of sampling will balance the objectives of sampling safety and efficiency, preventing disturbance in upstream environments from potentially affecting samples collected downstream, and prioritizing biological tissue collection to occur as early as possible to maximize the likelihood of success. Field personnel are granted flexibility to manage conditions and timing as they occur in the field. Ideally, sampling will be sequenced as follows:

- Clark Fork River and Bitterroot River
  - Fish tissue sampling will be conducted first at each location where it will be performed, and will take place at the most downstream location first, and move sequentially through all locations upstream.

  - Surface water and sediment sampling can commence after fish sampling is complete, and move through all locations upstream sequentially. Sampling effort for fish at any one location will not exceed 4 hours.
  - At locations for fish tissue sampling, only after fish tissue sampling at a location is completed, surface water grabs will be collected, followed by collection of sediment grabs. Both sediment and surface water will be collected closely upstream of fish tissue sampling locations, within depositional habitats, but will not be collected if disturbance caused by fish sampling has affected water clarity. If this occurs at the water and sediment sampling target location, then the water and sediment will be collected the following day.

- Onsite Ponds and Small Mammal Traps
  - At the same time that sampling begins in the Clark Fork and Bitterroot rivers, sampling can be initiated in the ponds. Water samples can be collected, and *in situ* measurements of water quality can be collected. Surface water sampling in the ponds should be conducted independent of and prior to any sediment or benthic macroinvertebrate tissue sampling.
  - Small mammal trapping may be initiated to correspond with days that water sampling will be performed.
  - Sediment and benthic macroinvertebrate tissue sampling in ponds will be completed together, one pond at a time, with the bulk sediment sample collected first.
  - Once the sediment grab and benthic macroinvertebrate samples have been collected from a given pond, peepers for the collection of sediment porewater samples can be deployed.
  - Peepers will be retrieved after 4 weeks equilibration time in the sediments.

- O'Keefe and Lavalle creeks
  - After all sampling is completed at station 50-CFR (Figure 3-2) and all downstream locations in the Clark Fork River, sampling in creeks can be initiated.
  - Sampling in creeks will take place from downstream to upstream, starting with water at each location, followed by collection of sediment grabs.
  - Once all water and sediment samples are collected, at all 10 creek locations, the team will return to the most downstream location, and collect benthic macroinvertebrate tissue samples. No more than 4 hours will be spent at any sampling location in the process of collection of benthic macroinvertebrate tissue.

4.3 ANALYTICAL LABORATORY TESTING

Analytical laboratory testing will be conducted consistent with the QAPP (NewFields 2015b) and consistent with prior investigations for sediment and surface water. Media sampling unique to this project includes analysis of tissue chemistry and lipids, and porewater sample handling and testing. Because these are not addressed by the QAPP for this project, the analytical methods and handling requirements for each of these are described below.

4.3.1 Biological Tissue

Tissue samples collected for this study will be homogenized at the analytical laboratory and analyzed for percent moisture, percent lipids, total metals (including mercury), methylmercury, and dioxin/furans. The proposed laboratory methods are described below and are summarized in Table 4-1. These methods are consistent with requirements provided in SW-846 (USEPA 2018c) and other established and widely accepted protocols. Analyte lists and expected method reporting limits (MRLs) and method detection limits (MDLs) are provided in Table 4-2. All tissue chemistry data will be reported on a wet-weight basis.

4.3.1.1 Percent Lipids and Moisture

A subsample of the dioxin and furan extract will be used for the determination of percent lipids. The solvent will be evaporated from the subsample, and the residual lipids will be weighed.

Percent moisture will be determined by taking approximately 1 g of tissue and freeze-drying it. The difference between the initial and final weights of the sample will be noted and the percent moisture lost will be calculated.

4.3.1.2 Metals in Tissue

Tissues analyzed for metals other than mercury will be digested with strong acid per EPA Method 3050 (USEPA 2018d) and analyzed by inductively coupled plasma/atomic emission spectrometry per EPA Method 6010C (USEPA 2018e), or by inductively coupled plasma/mass spectrometry per EPA Method 6020B (USEPA 2014).

EPA Method 7471B (USEPA 2018f) will be used for mercury analyses. Samples will be extracted with aqua regia and oxidized using potassium permanganate. Analysis will be completed by cold vapor atomic absorption spectrometry (CVAAS).

Methylmercury will be analyzed according to the laboratory's standard operating procedure (SOP) using cold vapor atomic fluorescent spectrometry.

4.3.1.3 Dioxins and Furans in Tissue

Dioxins and furans in tissue samples will be extracted and analyzed in accordance with EPA Method 8290A (USEPA 2007b). All extracts will undergo acid and silica gel cleanups. Additional cleanup procedures will be used as necessary. Samples will be analyzed by high-resolution gas chromatography with high-resolution mass spectrometry (HRGC/HRMS). Detection limits are calculated on an individual compound and sample basis and depend on the signal-to-background ratio for the specific labeled isomer.

4.3.2 Porewater

Porewater samples collected for this study will be analyzed in the laboratory for dissolved metals, DOC, and anions.

4.3.2.1 Field Parameters

Redox potential, pH, alkalinity, dissolved oxygen, and sulfide will be measured in the field within 2 hours of sample collection, as described in Appendix A.

4.3.2.2 Metals in Porewater

Porewater samples will be analyzed in the laboratory for DOC, anions, and dissolved metals. The proposed laboratory methods for metals are described below and are summarized in Table 4-3. These methods are consistent with requirements provided in SW-846 (USEPA 2018c) and other established and widely accepted protocols. Analyte lists and expected MRLs and MDLs are provided in Table 4-4. Samples analyzed for metals other than mercury will be digested with strong acid per EPA Method 6020B (USEPA 2014) and analyzed by inductively coupled plasma/mass spectrometry (USEPA 2018e).

EPA Method 245.1 (USEPA 1994) will be used for mercury analyses. Samples will be extracted with strong acid and potassium permanganate. Analysis will be completed by CVAAS.

DOC will be analyzed following Standard Methods 5310 C (APHA 2005).

Sodium bromide will be used as a tracer in the peepers to measure equilibration with the substrate. An aliquot of the porewater will be analyzed for bromide, chloride, and sulfate according to EPA Method 300.0 (USEPA 1993).

4.4 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance and quality control (QA/QC) procedures will be followed in accordance with the QAPP appended as Appendix E of the RIWP and the Comprehensive Environmental

Response, Compensation, and Liability Act (CERCLA) QAPP guidance (USEPA 2006). The QAPP was prepared by NewFields (as Appendix E of the RIWP; NewFields 2015a,b) according to CERCLA guidance specified in the AOC, and was approved by EPA.

In accordance with the QAPP, field QC samples for this investigation include equipment rinse blanks (one for every twenty [1/20] natural samples) collected using non-disposable equipment, DI blanks, trip blanks, and blind field duplicates (one for every 20 [1/20] natural samples). An equipment rinse blank will be collected by pouring deionized water over decontaminated reusable sampling equipment and collecting the rinse water in sample containers. The field QC sample will be collected in accordance with NewFields SOP-12 (Appendix A, Attachment B) and as described in Appendices A and B.

4.5 HEALTH AND SAFETY

This project will be conducted in conformance with the project health and safety plan (HASP; NewFields 2015a, Appendix F). Health and safety considerations not addressed by the project HASP include handling of small mammals and electrofishing. The health and safety procedures to be practiced during small mammal and fish tissue collections are described in HASP Addendum No. 1, included as Attachment B3 to Appendix B.

4.6 DATA MANAGEMENT, VALIDATION, AND REPORTING

Analytical and field data will be input to the EPA Scribe database. Data usability review and Tier II data validation will be conducted on all data collected during this investigation. As outlined in the QAPP (Appendix E of the RIWP), data usability and validation undertakings will be completed in conformance with guidance for conducting RI/FSs under CERCLA (USEPA 1988) and EPA requirements for QAPPs (QA/R-5).

4.6.1 Field Observations

During field operations, effective data management is essential to provide consistent, accurate, and defensible documentation of data quality. Field data will include field-collected data (e.g., water quality values), species identifying information, and descriptive and geographical information associated with sediment, surface water, and tissue sample collection. Complete and correct recording of field data during sample collection will be prioritized to ensure that the associated analytical results are usable for the intended purposes. The type of information to be collected during field investigations, and formats for data collection, are described in the appendices.

Daily field records (a combination of field logbooks, field data sheets, and chain-of-custody [COC] forms) and biological and ecological observations will make up the main documentation

for field activities. As soon after collection as possible, field logbooks and data sheets will be scanned to create an electronic record for use in creating the investigation and data reports.

If field measurements are required for a specific task (e.g., water quality measurements), then equipment calibration records including instrument type and serial number, calibration supplies used, calibration methods and calibration results, date, time, and personnel performing the calibration will be recorded in the field logbook.

Data available only in hard copy (e.g., field logbooks, field data sheets, COC forms), along with all field measurements, will be hand-entered into the database and reviewed for corrections before use. All hand-entered data will be subjected to 100 percent verification against the source document. Additional specifications for creating and handling field data records are described in the appendices.

4.6.2 Reporting

Following the receipt of sediment, surface water, tissue, and porewater sample analytical results, NewFields will prepare a data report describing the results of the investigation and any deviations from the field or analytical methods described in this FSP. All dioxin and furan congener data will be converted to TEQ concentrations as summarized in the Data Management Plan (NewFields 2018b).

Supporting documentation will be attached to the data report, including:

- Tabulated summaries of tissue, sediment, surface water, and porewater sample analytical data
- Figures depicting sample locations and concentrations of COPCs detected in sample media
- A QA/QC summary, including Tier II data validation reports completed in accordance with EPA guidance
- Appendices including field notes and field sampling forms, laboratory analytical reports, and investigation photographs.

An evaluation of the data as it relates to the risk assessment, nature and extent evaluation, and CSM-related objectives of the investigation will be completed, and if warranted, the CSM for the Site will be updated by EPA, MDEQ, and Integral.

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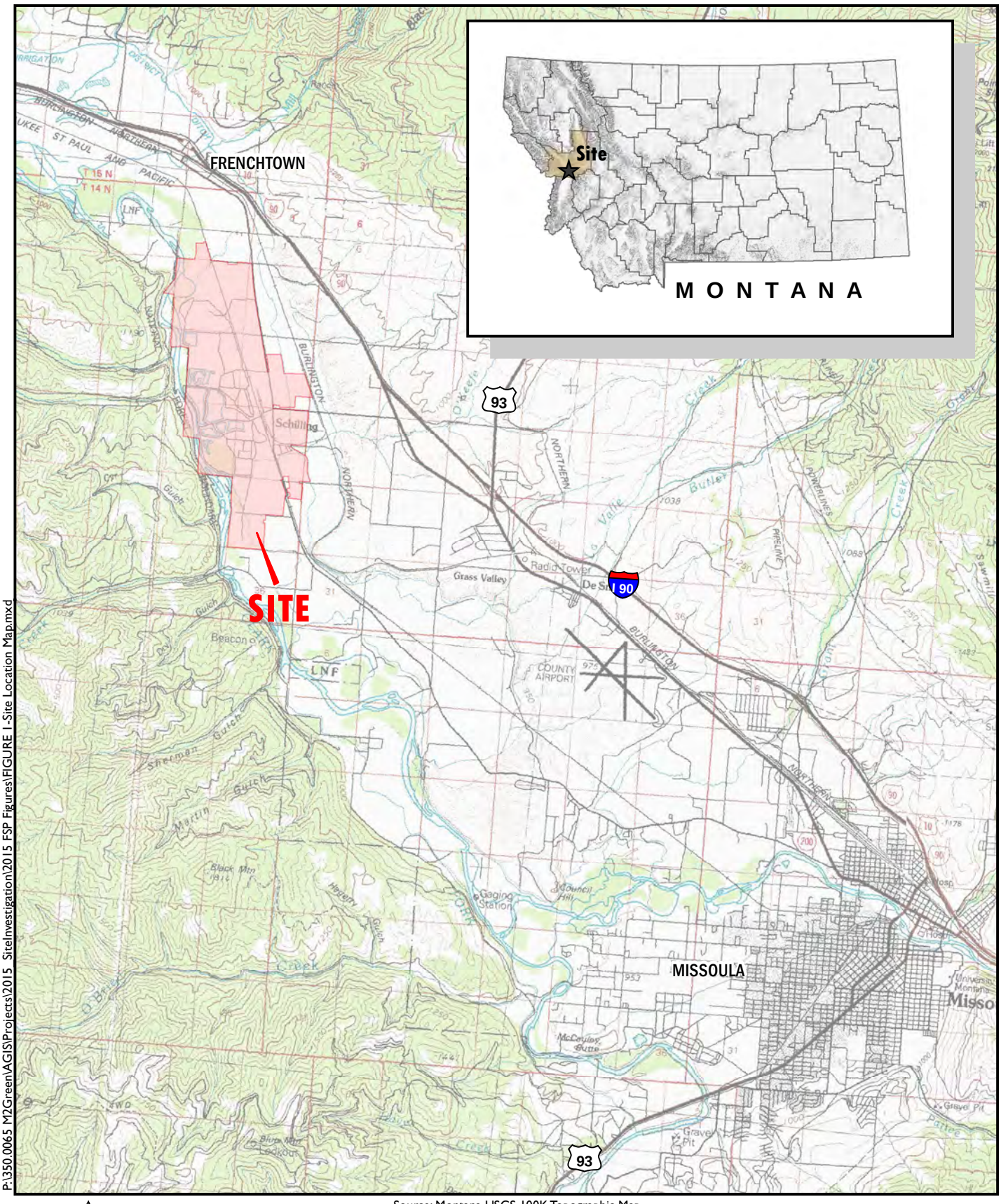
FIGURES



P:\350.0065 M2Green\AGIS\Projects\2015 SiteInvestigation\2015 FSP Figures\FIGURE 1-Site Location Map.mxd

Source: Montana USGS 100K Topographic Map

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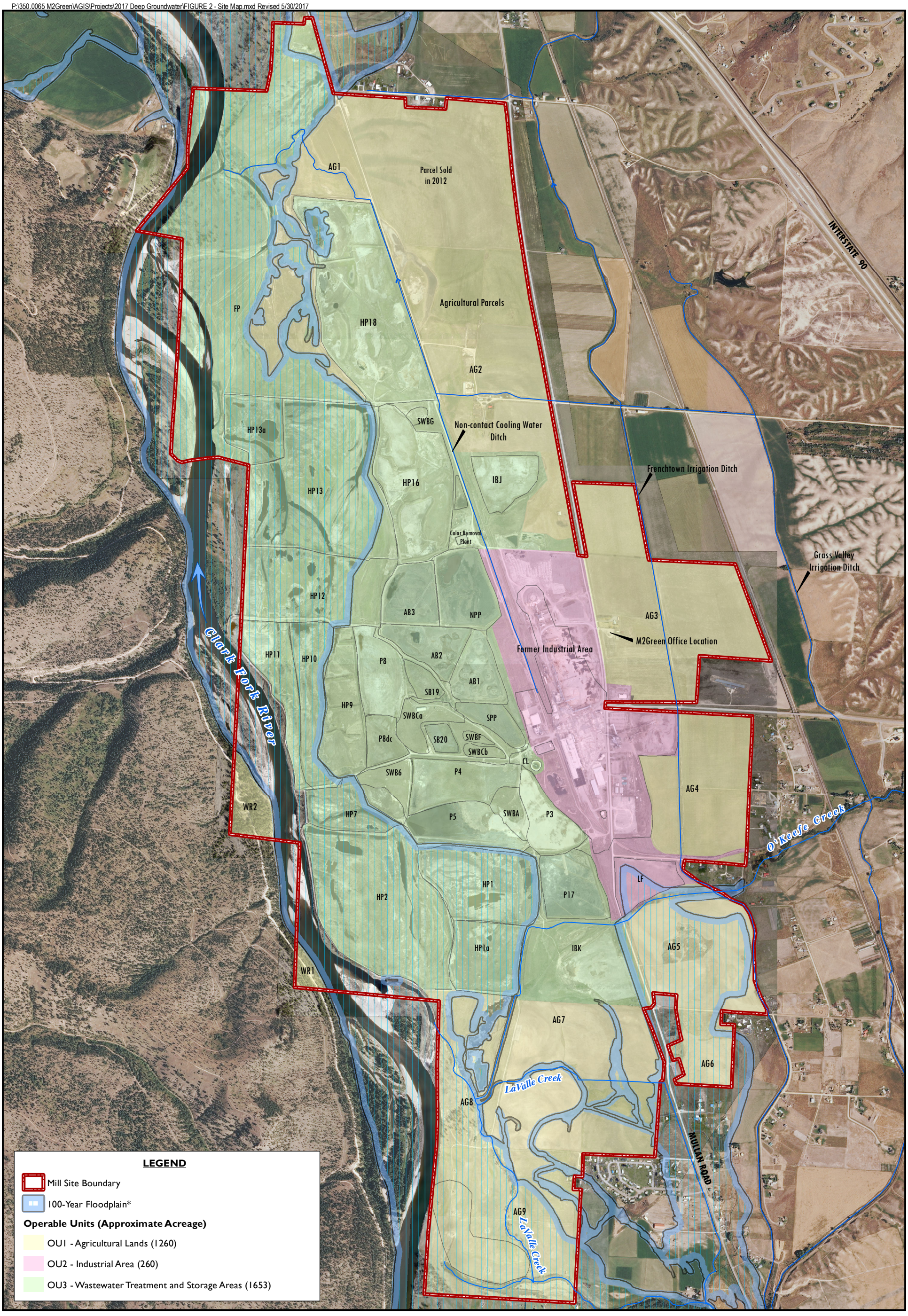
NewFields

Site Location Map
Former Frenchtown Mill Site
Missoula County, Montana
Figure 1-1

P:\350.0065 M2Green\AGIS\Projects\2017 Deep Groundwater\FIGURE 2 - Site Map.mxd Revised 5/30/2017



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Aerial Photo Source: NAIP 2011 and Newfields 2016 (Within Site Boundary)

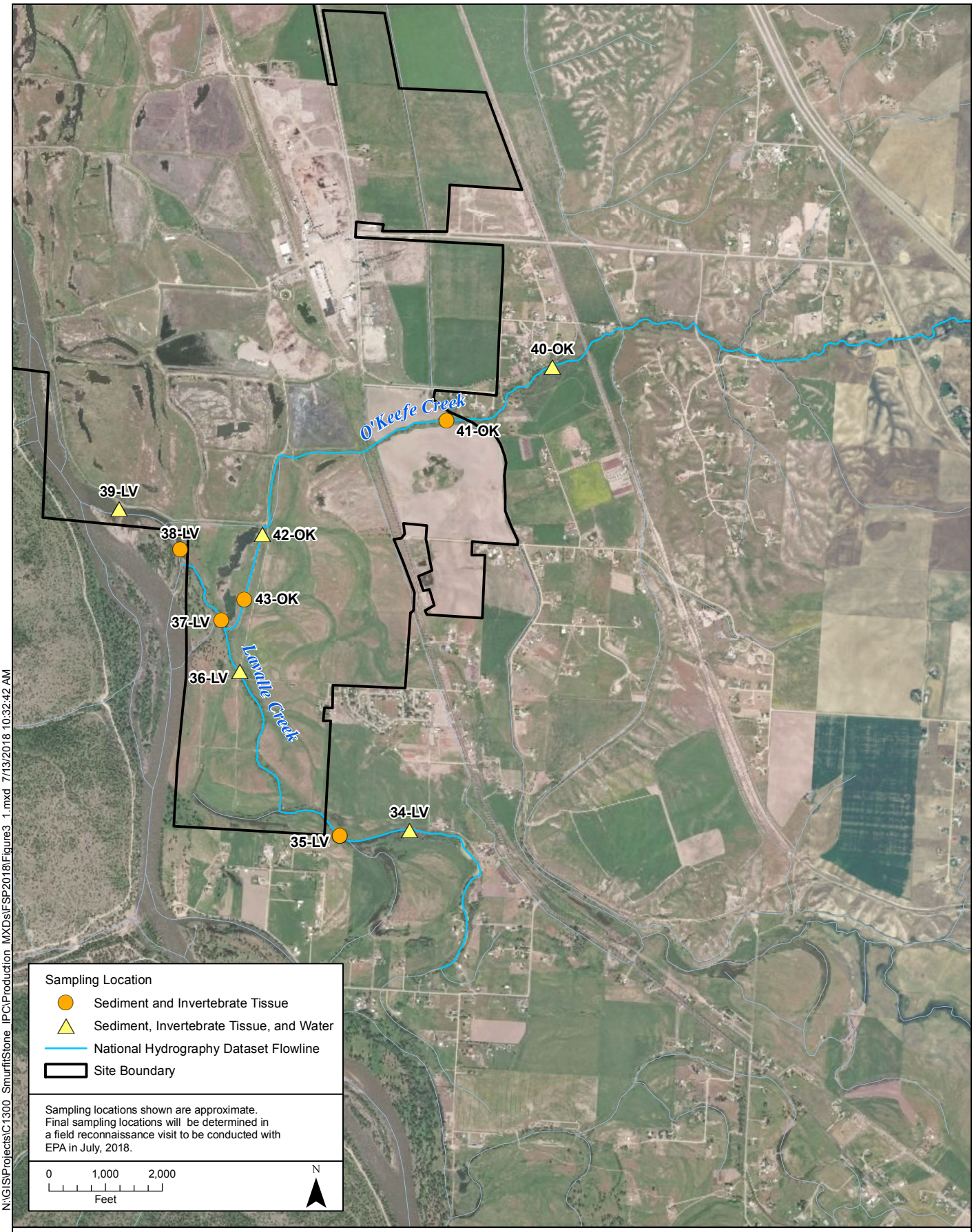
*Floodplain Source:
As defined by the Federal Emergency Management Agency (FEMA) 2013 Digital Flood Insurance Rate Map (DFIRM). (NFIP 2013)

Notes

AG - Agricultural Land
AB - Aeration Stabilization Basin
CFR - Clark Fork River
CL - Clarifier
FP - Floodplain
HP - Holding or Storage Pond
IB - Rapid Infiltration Basin
NPP - North Polishing Pond
P - Settling Pond
SB - Spoils Basin
SPP - South Polishing Pond
SWB - Solid Waste Basin
WR - West of River

NewFields

Site Map
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE 1-2



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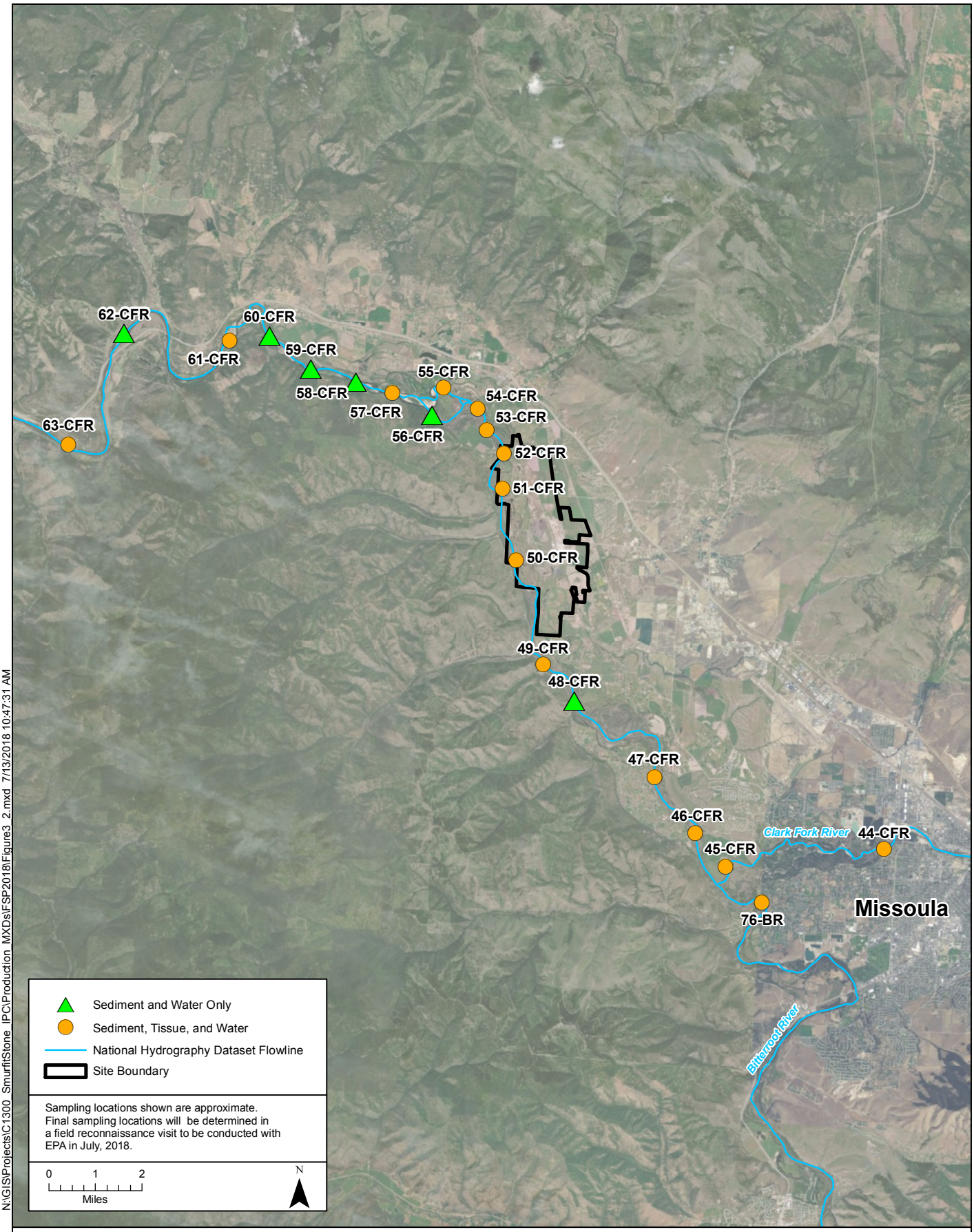
Sampling Locations for Sediment, Water and Benthic Macroinvertebrate Tissue in Lavalle and O'Keefe Creeks
Former Frenchtown Mill Site
Missoula County, Montana
Figure 3-1



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NewFields

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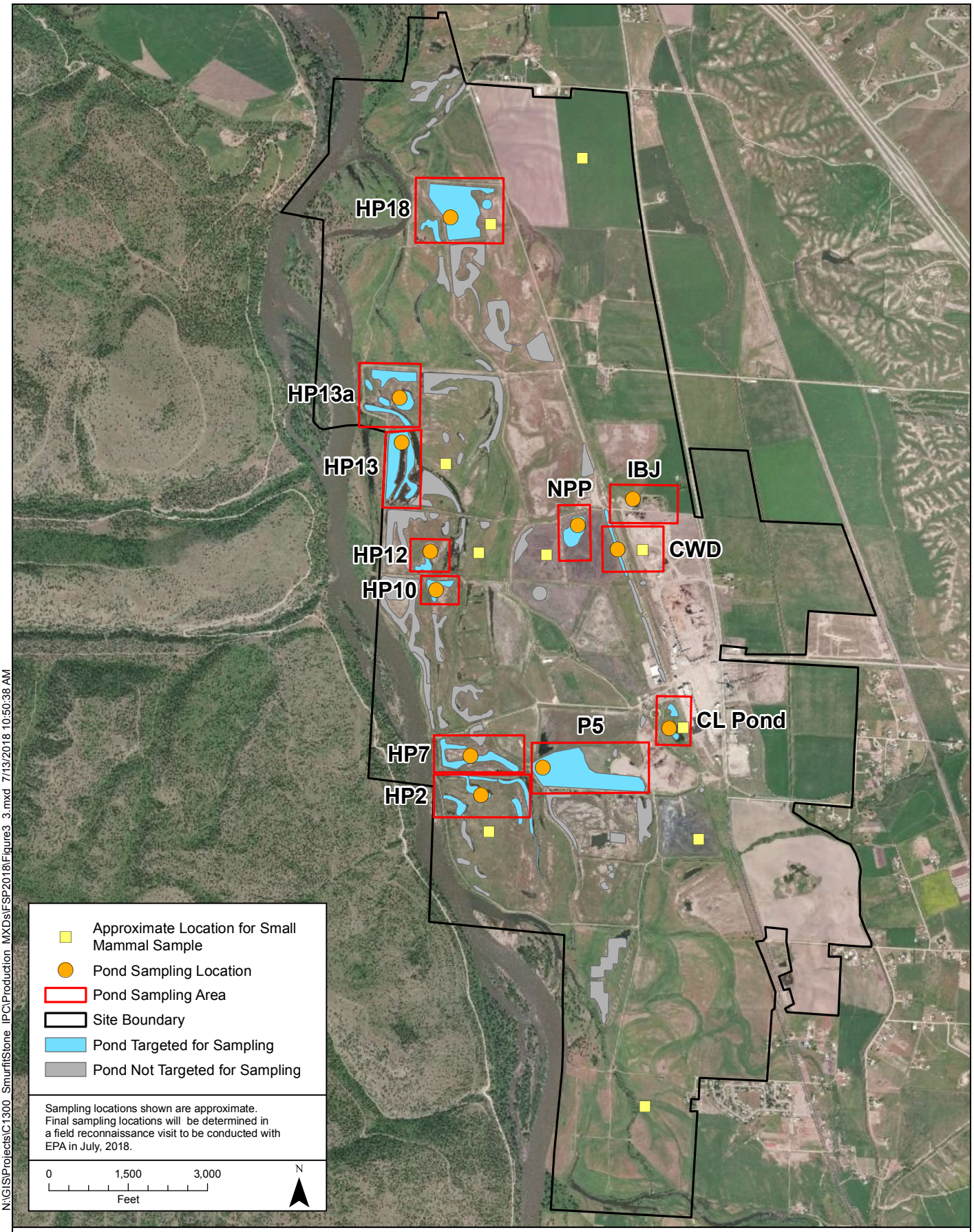
Clark Fork River and Bitterroot River Sampling Locations for
Sediment, Water, and Fish Tissue
Former Frenchtown Mill Site
Missoula County, Montana
Figure 3-2



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Pond Areas for Sampling Sediment, Water and Benthic Macorinvertebrate Tissue, and Locations for Small Mammal Sampling
Former Frenchtown Mill Site
Missoula County, Montana
Figure 3-3

TABLES

Table 1-1. Endangered, Threatened, Proposed, and Candidate Species in Missoula County, at the Vicinity of the Site

Category	Scientific Name	Common Name	State Status [source]	Federal Status [source]
Mammals	*Pekania pennanti*	Fisher	SOC [1]	No status
	Myotis thysanodes	Fringed Myotis	SOC [1]	No status
	Ursus arctos	Grizzly Bear	SOC [1]	No status
	Lasiurus cinereus	Hoary Bat	SOC [1]	No status
	Myotis lucifugus	Little Brown Myotis	SOC [1]	No status
	Erethizon dorsatum	Porcupine	PSOC [1]	No status
	Lasionycteris noctivagans	Silver-haired Bat	PSOC [1]	No status
	Corynorhinus townsendii	Townsend's Big-eared Bat	SOC [1]	No status
	Gulo gulo	Wolverine	SOC [1]	Proposed Threatened [1, 3]
	Lynx canadensis	Canada lynx	LT; but site is outside critical habitat [2]	Threatened
Birds	*Coccyzus americanus*	Yellow-billed cuckoo (western pop.)	LT [2]	Threatened [3]
	Calidris canutus rufa	Red Knot	LT [2]	Threatened [3]
Plants	*Howellia aquatilis*	Water Howellia	LT [2]	No status
	Pinus albicaulis	Whitebark Pine	C [2]	No status
Fish	*Salvelinus confluentus*	Bull Trout	LT, CH [2]	Threatened; Designated Critical Habitat [3]

Sources:

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Notes:

C = Candidate

CH = Designated Critical Habitat

LT = Listed Threatened

PSOC = Potential Species of Concern. Animals for which current, often limited, information suggests potential vulnerability or for which additional data are needed before an accurate status assessment can be made.

SOC = Species of Concern. Native Montana animals that are considered to be "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution.

Table 2-1. Summary of Ecological Receptors, Endpoints, and Risk Questions to be Evaluated in the Smurfit Stone/Frenchtown BERA

Receptor Type	Receptor Surrogate(s)	Assessment Endpoint	Measures of Exposure	Measures of Effects	Analysis Approach/Risk Question
Terrestrial and Aquatic Communities					
Benthic macroinvertebrate communities in: -O'Keefe and Lavalle Creeks -Ponds in OU2 and OU3 -Clark Fork River	NA	Benthic macroinvertebrate community structure and function	Concentration of COPECs in bulk sediment at individual sampling locations	Sediment benchmark Peer-reviewed published toxicity information (TRVs) for those individual COPECs that exceed benchmarks and background	Do COPEC concentrations exceed both benchmarks and background concentrations? Is the magnitude of the exceedance of a peer-reviewed published TRV (i.e., the HQ) greater on the site than upstream?
Aquatic communities in: -O'Keefe and Lavalle Creeks -Ponds in OU2 and OU3 -Clark Fork River	NA	Aquatic community structure and function Survival, growth, and reproduction of 95 percent of species in the aquatic community	Concentration of COPEC in surface water at each sampling location	AWQC "criterion continuous concentration" Peer-reviewed published toxicity information (TRVs) for those individual COPECs that exceed benchmarks and background	Do COPEC concentrations exceed both AWQC and background concentrations? Is the magnitude of the exceedance of a peer-reviewed published TRV (i.e., the HQ) greater on the site than upstream?
Fish in: -O'Keefe and Lavalle Creeks -Clark Fork River	Longnose dace	Sustainable fish populations Survival, growth, and reproduction of individuals of special status species (e.g., bull trout)	Whole body tissue concentrations of dioxins and furans in multiple-fish composite samples Concentrations of metals in foods of fish (invertebrates) in individual sampling locations	Critical tissue residues Concentrations in foods of fish that indicate NOAEL or LOAEL	Do measured or estimated concentrations of dioxins and furans in fish exceed CTR thresholds protective of 95 percent of fish species? Is the 95%UCL of fish prey greater than the NOAEL or LOAEL TRV?
Terrestrial plant communities in OU2 and OU3	NA	Terrestrial plant community structure and function	Concentration of COPECs in soil at each sampling location Geometric mean or 95%UCL on the mean of COPEC within an exposure unit	Soil benchmark Peer-reviewed published toxicity information (TRVs) for those individual COPECs that exceed benchmarks and background	Do COPEC concentrations in individual soil samples exceed benchmarks and peer-reviewed TRVs? Does the 95%UCL of each COPEC in soil within an exposure unit exceed the peer-reviewed TRV?

Table 2-1. Summary of Ecological Receptors, Endpoints, and Risk Questions to be Evaluated in the Smurfit Stone/Frenchtown BERA

Receptor Type	Receptor Surrogate(s)	Assessment Endpoint	Measures of Exposure	Measures of Effects	Analysis Approach/Risk Question
Terrestrial soil invertebrates communities in OU2 and OU3	NA	Terrestrial soil invertebrate community structure and function	Concentration of COPECs in soil at each sampling location Geometric mean or 95%UCL on the mean of COPEC within an exposure unit	Soil benchmark Peer-reviewed published toxicity information (TRVs) for those individual COPECs that exceed benchmarks and background	Do COPEC concentrations in individual soil samples exceed benchmarks and peer-reviewed TRVs? Does the 95%UCL of each COPEC in soil within an exposure unit exceed the peer-reviewed TRV?
Birds					
Terrestrial invertivorous/insectivorous birds in OU2 and OU3	American robin Grey catbird Tree swallow	Sustainable production of populations of terrestrial invertivorous/insectivorous birds in OU2 and OU3	Species-specific dietary dose of COPECs in prey (invertebrates/insects), soil, and surface water in OU2 and OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?
Terrestrial herbivorous birds in OU2 and OU3	Blue grouse	Sustainable production of populations of terrestrial herbivorous birds in OU2 and OU3	Species-specific dietary dose of COPECs in food (plants), soil, and surface water in OU2 and OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?
Terrestrial carnivorous birds in OU2 and OU3	American kestrel	Sustainable production of populations of carnivorous birds in OU2 and OU3	Species-specific dietary dose of COPECs in prey (small mammals), soil, and surface water in OU2 and OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?

Table 2-1. Summary of Ecological Receptors, Endpoints, and Risk Questions to be Evaluated in the Smurfit Stone/Frenchtown BERA

Receptor Type	Receptor Surrogate(s)	Assessment Endpoint	Measures of Exposure	Measures of Effects	Analysis Approach/Risk Question
Terrestrial omnivorous birds in OU2 and OU3	Northern flicker Clark's nutcracker	Sustainable production of populations of terrestrial omnivorous birds in OU2 and OU3	Species-specific dietary dose of COPECs in food (invertebrates and plants), soil, and surface water in OU2 and OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?
Aquatic omnivorous birds in OU2 and OU3 ponds	Mallard duck	Sustainable production of populations of aquatic omnivorous birds in OU2 and OU3	Species-specific dietary dose of COPECs in food (invertebrates and plants), sediment, and surface water in OU2 and OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?
Aquatic insectivorous birds in OU3	American dipper	Sustainable production of populations of aquatic insectivorous birds in OU3	Species-specific dietary dose of COPECs in prey (insects), sediment, and surface water in OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?
Piscivorous birds in OU3	Belted kingfisher	Sustainable production of populations of piscivorous birds in OU3	Species-specific dietary dose of COPECs in prey (fish), sediment, and surface water in OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?

Table 2-1. Summary of Ecological Receptors, Endpoints, and Risk Questions to be Evaluated in the Smurfit Stone/Frenchtown BERA

Receptor Type	Receptor Surrogate(s)	Assessment Endpoint	Measures of Exposure	Measures of Effects	Analysis Approach/Risk Question
Mammals					
Terrestrial invertivorous/insectivorous mammals in OU2 and/or OU3	Vagrant shrew Bat	Sustainable production of populations of terrestrial invertivorous/insectivorous mammals in OU2 and/or OU3	Species-specific dietary dose of COPECs in prey (invertebrates/insects), soil, and surface water in OU2 and/or OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?
Terrestrial herbivorous mammals in OU2 and OU3	White-tailed deer Montane vole	Sustainable production of populations of terrestrial herbivorous mammals in OU2 and OU3	Species-specific dietary dose of COPECs in food (plants), soil, and surface water in OU2 and OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?
Terrestrial carnivorous mammals in OU2 and/or OU3	Red fox American mink	Sustainable production of populations of terrestrial carnivorous mammals in OU2 and/or OU3	Species-specific dietary dose of COPECs in prey (small mammals/fish), soil/sediment, and surface water in OU2 and OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?
Terrestrial omnivorous mammals in OU2 and OU3	Deer mouse	Sustainable production of populations of terrestrial omnivorous mammals in OU2 and OU3	Species-specific dietary dose of COPECs in food (invertebrates and plants), soil, and surface water in OU2 and OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?

Table 2-1. Summary of Ecological Receptors, Endpoints, and Risk Questions to be Evaluated in the Smurfit Stone/Frenchtown BERA

Receptor Type	Receptor Surrogate(s)	Assessment Endpoint	Measures of Exposure	Measures of Effects	Analysis Approach/Risk Question
Aquatic piscivorous mammals in OU3	River otter	Sustainable production of populations of piscivorous mammals in OU3	Species-specific dietary dose of COPECs in prey (fish), sediment, and surface water in OU3; calculated (mg COPEC/kg bw-d) within each exposure unit using 95%UCL values for COPECs in each medium	TRVs for survival, growth, and/or reproduction of exposed individuals expressed as an ingested daily dose (mg COPEC/kg bw-d)	Does the estimated daily dose (based on 95%UCLs) of each COPEC within an exposure unit exceed the peer-reviewed dietary TRV? Is the potential adverse effect on the survival, growth, and reproduction of individuals severe enough to adversely affect the assessment endpoint?

Notes:
95%UCL = 95 percent upper confidence limit on the mean
AWQC = ambient water quality criteria
BERA = baseline ecological risk assessment
COPEC = chemical of potential ecological concern
CTR = critical tissue residue
HQ = hazard quotient
LOAEL = lowest-observed-adverse-effect level
NA = not applicable
NOAEL = no-observed-adverse-effect level
OU = operable unit
TRV = toxicity reference value

Table 3-1. Summary of Samples to be Collected for the Study

Area	Sediment	Sediment Porewater	Water	Aquatic Tissue	Small Mammal Tissue
Lavalle and O'Keefe Creeks	10		5	10	
Clark Fork River[a]	21		21	15	
Onsite Ponds	12	24	12	12	
Terrestrial Areas					10

Notes:

[a] One of the sample locations, at which sediment, surface water, and fish tissue will be collected, will be in the Bitterroot River.

Table 3-2. Data Quality Objectives, Surface Water in Onsite Creeks and Ponds, and in the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
1. State the Problem **Define the problem that necessitates the study, identify planning team and schedule**	In the ponds, it is necessary to characterize water quality for both the risk assessment and the evaluation of nature and extent of contamination. Surface water sampling for the remedial investigation conducted to date has included samples from the creeks and from the Clark Fork River. There are no surface water samples from the ponds on the Site. Better spatial coverage of surface water samples from the creeks is required by EPA. In the Clark Fork River, more samples from downstream are required by EPA, and more samples from upstream background are needed in both the creeks and the Clark Fork and Bitterroot rivers. Planning Team: EPA, MDEQ, PRPs Schedule: Sampling to be conducted in August and September 2018.
2. Identify the Goals of the Study **State how environmental data will be used in meeting the objectives and solving the problem, identify study questions, define alternative outcomes.**	The study resolves the problem identified in step 1 by providing a better description of water quality across all aquatic habitats on the site, and of the Clark Fork River. The goal of the study is to obtain the data needed to resolve the principal study questions listed below. The principal study questions to be addressed by the data are: 1. Are concentrations of dioxins, furans, and metals in surface waters of the creeks and river on or adjacent to the site higher than concentrations in upstream background? 2. Are concentrations of dioxins, furans, and metals on or adjacent to the site higher than Montana's surface water quality criteria for the protection of aquatic life and EPA's selected surface water screening values? 3. What would be the dose of each chemical constituent in water to individual ecological receptors that could consume surface waters on the Site? 4. What are the site-specific (hardness-based) water quality criteria for metals, and do metals concentrations in surface water exceed those values? 5. What are the biotic ligand model (BLM)-based surface water criteria for copper and other divalent metals in the ponds, and do metals concentrations exceed those values? 6. Are concentrations of dioxins, furans, and metals in Clark Fork River surface water higher in surface water samples adjacent to and downstream of the Site than upstream of the Site? Or are concentrations similar in all surface water samples?

Table 3-2. Data Quality Objectives, Surface Water in Onsite Creeks and Ponds, and in the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
	7. Are the surface waters of the creeks, river and ponds ionically similar or are they distinct? Concentrations of dioxins, furans or metals that are greater than standards, other screening values used or appropriate toxicity reference values (TRVs) may indicate risk to aquatic organisms or aquatic communities. Ingested doses to wildlife that, together with doses from ingestion of prey, soil and/or sediment that are associated with unacceptable ecological risk may indicate that chemical concentrations need to be addressed to reduce risks to wildlife to acceptable levels.
3. Identify Information Inputs **Identify data and information needed to answer study questions.**	Data and information inputs to be developed in this study that are needed to answer study questions are surface water quality data including: • Concentrations of dioxins and furans in whole water • Concentrations of metals in whole water at each sampling location • Concentrations of dissolved metals at each sampling location • Concentrations of dissolved organic carbon (DOC), common ions, other ions, alkalinity, dissolved oxygen, conductivity, pH and temperature in the creeks and river • The pH profile of the ponds, field-measured alkalinity of the ponds.
Step 4. Define the Boundaries of the Study **Specify the target population and characteristics of interest, define spatial and temporal limits and the scale of inference.**	Target population: • Surface waters on the Site, in the Clark Fork River and in upstream areas in both the Clark Fork and Bitterroot rivers • Ecological receptors that could be exposed to chemicals in water • Human receptors that could be exposed to chemicals in water Characteristics of interest: • Dioxin, furan and metal concentrations (whole water and dissolved metals) • Parameters that can affect or limit the bioavailability of metals in surface water (water hardness, BLM parameters) • Ionic composition of surface waters

Table 3-2. Data Quality Objectives, Surface Water in Onsite Creeks and Ponds, and in the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
	Temporal boundaries of the study: • Samples will be collected in August and September because they will be coupled with biological samples that must be obtained before autumn. Spatial boundaries of the study: • Surface water bodies representative of the range of aquatic habitat types on the Site and representative of the Clark Fork River
Step 5. Develop the Analytic Approach **Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings.**	Analytical approaches include those specified in tables listing analytical methods and detection limits cited in Section 4, Appendix A and the project QAPP (NewFields 2015a). Analytical approaches also include those described in EPA's draft BERA Work Plan: • Comparison of chemical concentrations to water quality standards (following calculation of hardness-based standards for metals) and other screening values or appropriate toxicity reference values. • Calculation of media-specific ingested doses of chemicals in water to those wildlife ingesting surface water on the Site Analytical approaches also include using the BLM to derive water quality standards for copper and other metals for which the BLM has applications (e.g., zinc) for those onsite pond locations at which the metals are greater than hardness-based state standards. Analytical approaches also include preparation of ternary plots for each water sample for comparison among samples to address potential connectivity among surface water bodies.
Step 6. Specify Performance or Acceptance Criteria **Specify probability limits for false rejection and false acceptance of decision errors.** **Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use.**	• Probability limits have not been established for surface water quality. Comparisons of chemical concentrations in the creeks and river surface water with concentrations in upstream stations will be made qualitatively, and statistically if warranted, with statistical significance determined at $p < 0.10$. • Performance criteria for all chemical data are as established in the approved QAPP (NewFields 2015a) and as described in Appendix A of this RIWP Addendum.

Table 3-2. Data Quality Objectives, Surface Water in Onsite Creeks and Ponds, and in the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
	• Analytical detection limits will be at or below EPA's selected screening values for surface water.
Step 7. Develop the Plan for Obtaining Data **Select the resource-effective sampling and analysis plan that meets the performance criteria.**	Plans for collecting surface water data are described in Appendix A.

Notes:

DQO = data quality objective
EPA = U.S. Environmental Protection Agency
MDEQ = Montana Department of Environmental Quality
PRP = potentially responsible party
QAPP = quality assurance project plan

Table 3-3. Data Quality Objectives, Sediments from Onsite Creeks and Ponds, and in the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
1. State the Problem **Define the problem that necessitates the study, identify planning team and schedule**	In the ponds, it is necessary to characterize sediment quality for both the risk assessment and the evaluation of nature and extent of contamination. Sediment sampling for the remedial investigation conducted to date has included samples from the creeks and from the Clark Fork River. There are no sediment samples from the ponds on the Site. Better spatial coverage of sediment samples from the creeks is required by EPA. In the Clark Fork River, more samples from downstream are required by EPA, and more samples from upstream background are needed in both the creeks and the river. Planning Team: EPA, MDEQ, PRPs Schedule: Sampling to be conducted in August and September 2018.
2. Identify the Goals of the Study **State how environmental data will be used in meeting the objectives and solving the problem, identify study questions, define alternative outcomes.**	The study resolves the problem identified in step 1 by providing a better description of sediment quality across all aquatic habitats on the site, and of the Clark Fork River. The goal of the study is to obtain the data needed to resolve the principal study questions listed below. The principal study questions to be addressed by the data are: 1. Are concentrations of dioxins, furans, metals, and methylmercury in sediments of the creeks and river higher than concentrations in upstream background? 2. Are concentrations of dioxins, furans, and metals higher than EPA's selected sediment screening values? 3. What would be the dose of each chemical constituent in sediments to individual ecological receptors that could incidentally ingest sediments on the Site while foraging? 4. Are concentrations of dioxins, furans, metals and methylmercury in Clark Fork River sediments higher in sediments adjacent to and downstream of the Site than at stations upstream of the Site? Or are concentrations similar in all sediment samples from the Clark Fork River and Bitterroot River? 5. Can sediment chemistry, including ancillary parameters such as sediment grain size, pH, and TOC be used to reliably predict concentrations of chemicals in biological tissue collected from the same locations? 6. Does the combination of organic carbon and acid-volatile sulfides potentially limit the toxicity of the divalent metals?

Table 3-3. Data Quality Objectives, Sediments from Onsite Creeks and Ponds, and in the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
	Concentrations of dioxins, furans or metals that are greater than appropriate sediment toxicity reference values (TRVs) may indicate risk to aquatic organisms or aquatic communities. Ingested doses to wildlife that, together with doses from ingestion of prey, soil and/or surface water that are associated with unacceptable ecological risk may indicate that chemical concentrations need to be addressed to reduce risks to wildlife to acceptable levels.
3. Identify Information Inputs **Identify data and information needed to answer study questions.**	Data and information inputs to be developed in this study that are needed to answer study questions are sediment quality data including: • Concentrations of dioxins and furans in bulk sediments at each sampling location • Concentrations of metals and methylmercury in bulk sediments at each sampling location • Concentrations of TOC in all sediments • In situ pH of the sediments from 0 to 6 in. depth. Chemical concentrations in biological tissue (Sections 3.4, 3.5 and 3.6) will also be used to address the questions identified in step 2.
Step 4. Define the Boundaries of the Study **Specify the target population and characteristics of interest, define spatial and temporal limits and the scale of inference.**	Target population: • Sediments from aquatic habitats on the Site, in the Clark Fork River and in upstream areas including one location in the Bitterroot River Characteristics of interest: • Dioxin, furan, metal and methylmercury concentrations in bulk sediments • Parameters that can affect or limit or enhance the bioavailability of chemicals in sediments (AVS, SEM, TOC, pH) Temporal boundaries of the study: • Samples will be collected in August and September because they will be coupled with biological samples that must be obtained before autumn.

Table 3-3. Data Quality Objectives, Sediments from Onsite Creeks and Ponds, and in the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
	Spatial boundaries of the study: • Water bodies and their sediments representative of the range of aquatic habitat types on the Site and representative of the Clark Fork River
Step 5. Develop the Analytic Approach **Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings.**	Analytical approaches include those specified in tables listing analytical methods and detection limits cited in Section 4. Analytical approaches also include those described in EPA's draft BERA Work Plan: • Comparison of chemical concentrations in sediments to EPA's sediment screening values or appropriate sediment toxicity reference values. • Calculation of media-specific ingested doses of chemicals in sediments to those wildlife incidentally ingesting sediments from water bodies on the Site or in the Clark Fork River Analytical approaches also include statistical analysis of results of bulk sediment chemistry and sediment ancillary parameters with tissue chemistry data to evaluate sediment-tissue relationships. Statistical analyses will include correlation analysis and multivariate regression, as well as exploratory and descriptive analyses.
Step 6. Specify Performance or Acceptance Criteria **Specify probability limits for false rejection and false acceptance of decision errors.** **Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use.**	• Probability limits have not been established for sediment quality data analyses. Comparisons of chemical concentrations in the creeks and river sediments with concentrations in upstream stations will be made qualitatively, and statistically if warranted, with statistical significance determined at $p < 0.10$. • Performance criteria for all chemical data are as established in the approved QAPP (NewFields 2015a) and as described in Appendix A of this RIWP Addendum. • Analytical detection limits will be at or below EPA's selected screening values for sediments.

Table 3-3. Data Quality Objectives, Sediments from Onsite Creeks and Ponds, and in the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
Step 7. Develop the Plan for Obtaining Data **Select the resource-effective sampling and analysis plan that meets the performance criteria.**	Plans for collecting data for sediments are described in Appendix A.

Notes:

DQO = data quality objective
EPA = U.S. Environmental Protection Agency
MDEQ = Montana Department of Environmental Quality
PRP = potentially responsible party
QAPP = quality assurance project plan

Table 3-4. Data Quality Objectives, Sediment Porewater from Onsite Ponds

Steps of the DQO Process (USEPA 2006)	Data Type
1. State the Problem **Define the problem that necessitates the study, identify planning team and schedule**	It is necessary to characterize the potential toxicity of sediments in the onsite ponds to benthic macroinvertebrate communities that live in or could live the ponds. It is also necessary to determine whether any potential toxicity is related to the presence of hazardous substances. Because the ponds are physically unique due to their isolation from other surface water bodies, and because of their role in the former mill operations, their sediments likely have complex geochemistry. As a result, bulk sediment chemistry data will be inadequate for estimating risk to benthic macroinvertebrates. A more direct measure of the exposure of benthic infauna to dissolved metals in porewater, and other stressors (e.g., low pH) in sediment porewater, is needed to address risks to benthic macroinvertebrate communities in the onsite ponds. Planning Team: EPA, MDEQ, PRPs Schedule: Sampling to be conducted in August and September 2018.
2. Identify the Goals of the Study **State how environmental data will be used in meeting the objectives and solving the problem, identify study questions, define alternative outcomes.**	The study resolves the problem identified in step 1 by providing a direct empirical measurement of the bioavailable metals in sediment porewater, and by generating information on geochemical drivers (dissolved oxygen, pH, sulfides, alkalinity, redox potential) to better understand specific conditions that could create conditions that are toxic or that increase or decrease the bioavailability of metals in the sediment environment. The principal study questions to be addressed by the data are: 1. Are concentrations of dissolved metals in the sediment porewater of onsite ponds potentially toxic to benthic infauna? 2. Are concentrations of total metals in sediment porewater of onsite ponds above or below relevant risk thresholds protective of benthic macroinvertebrates? 3. What geochemical conditions and geochemical drivers could mitigate or enhance the bioavailability of metals in porewater to benthic infauna? 4. What are the biotic ligand model (BLM)-based criteria for copper and other divalent metals that occur in sediment porewater of the ponds, and do porewater metals concentrations exceed those values? 5. What are the geochemical drivers of conditions in sediment porewater that could enhance or mitigate toxicity and risk to benthic macroinvertebrate communities?

Table 3-4. Data Quality Objectives, Sediment Porewater from Onsite Ponds

Steps of the DQO Process (USEPA 2006)	Data Type
3. Identify Information Inputs **Identify data and information needed to answer study questions.**	Data and information inputs to be developed in this study that are needed to answer study questions are surface water quality data including: • Concentrations of dissolved and total metals in sediment porewater • Results of analyses for BLM parameters in porewater • Results of field tests for oxidation/reduction potential, pH, dissolved oxygen, alkalinity, and sulfide concentrations Porewater dissolved metals are a measure of the bioavailable fraction of metals in porewater and provide a direct measure of exposure. Sulfide and oxidation/reduction potential analyses are being conducted on sediment pore water to assess the overall redox conditions of the sediment. For several metals, including arsenic, chromium, selenium, copper, and vanadium, redox controls the speciation, mobility, bioavailability, and toxicity of metals in the porewater environment. These analyses are particularly useful if benthic macroinvertebrates are sparse or absent in pond sediments precluding the direct measurement of metals in the biota. In addition, sulfide itself can cause toxicity to some benthos, so that it may be a useful indicator in potential toxicity that may not be caused by hazardous substances.
Step 4. Define the Boundaries of the Study **Specify the target population and characteristics of interest, define spatial and temporal limits and the scale of inference.**	Target population: • Dissolved and total metals in sediment porewaters in onsite ponds • Benthic macroinvertebrate communities in onsite ponds • Consumers of benthic macroinvertebrates originating in onsite ponds Characteristics of interest: • Dissolved metals concentrations • Parameters that can affect or limit the bioavailability of metals in water (BLM parameters, sulfides, redox potential, pH) Temporal boundaries of the study: • Samples will be collected in August and September because they will be coupled with biological samples that must be obtained before autumn.

Table 3-4. Data Quality Objectives, Sediment Porewater from Onsite Ponds

Steps of the DQO Process (USEPA 2006)	Data Type
	Spatial boundaries of the study: • Onsite ponds representative of the likely range of geochemical conditions on the Site
Step 5. Develop the Analytic Approach **Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings.**	Analytical approaches include those specified in tables listing analytical methods and detection limits cited in Section 4. Analytical approaches also include: • Comparison of chemical concentrations in porewater to appropriate toxicity reference values for benthic macroinvertebrates. • Comparison of total metals concentrations in porewater to relevant risk thresholds protective of benthic macroinvertebrates. • Using the BLM to derive water quality standards for copper and other metals for which the BLM has applications (e.g., zinc) for onsite pond sediment porewater. • Statistical regression modeling or other data exploration to address whether dissolved metals in sediment porewater are a reliable predictor of benthic macroinvertebrate tissue chemistry. Data exploration and statistical modeling will include data for invertebrate tissue in the ponds and the other geochemical conditions that may control metals bioavailability, toxicity, and risk.
Step 6. Specify Performance or Acceptance Criteria **Specify probability limits for false rejection and false acceptance of decision errors.** **Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use.**	• Probability limits have not been established for sediment porewater water quality. Comparisons of the onsite population with an offsite population is not planned. • Performance criteria for all chemical data are as established in the approved QAPP (NewFields 2015a) and as described in Appendix A of this RIWP Addendum. • Analytical detection limits will be at or below EPA's selected screening values for surface water.

Table 3-4. Data Quality Objectives, Sediment Porewater from Onsite Ponds

Steps of the DQO Process (USEPA 2006)	Data Type
Step 7. Develop the Plan for Obtaining Data **Select the resource-effective sampling and analysis plan that meets the performance criteria.**	Plans for collecting data on sediment porewater chemistry are provided in Appendix A.

Notes:

DQO = data quality objective
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
MDEQ = Montana Department of Environmental Quality
PCB = polychlorinated biphenyl
PRP = potentially responsible party
QAPP = quality assurance project plan

Table 3-5. Data Quality Objectives, Benthic Macroinvertebrate Tissue from Onsite Creeks and Ponds

Steps of the DQO Process (USEPA 2006)	Data Type
1. State the Problem **Define the problem that necessitates the study, identify planning team and schedule**	In the ponds and creeks, it is necessary to characterize tissue chemistry of the potential prey of ecological receptors (American dipper, mallard duck, and stream fish) for both the risk assessment and the evaluation of chemical fate through bioaccumulation. There have been no tissue samples collected for the remedial investigation to date. Empirical information on dioxins, furans, and metals in benthic macroinvertebrate tissue from the ponds and creeks is required by EPA. Coupled with information on the chemistry and geochemistry of benthic macroinvertebrate habitats, additional information on benthic macroinvertebrate tissue chemistry is needed to determine whether abiotic–biotic chemistry correlations or relationships exist. If they do, such relationships are necessary to define remedial action levels, if unacceptable risk is present. Planning Team: EPA, MDEQ, PRPs Schedule: Sampling to be conducted in August and September 2018.
2. Identify the Goals of the Study **State how environmental data will be used in meeting the objectives and solving the problem, identify study questions, define alternative outcomes.**	The study resolves the problem identified in step 1 by providing empirical data on the tissue chemistry of aquatic benthic macroinvertebrates on the Site. The goal of the study is to obtain the data needed to resolve the principal study questions listed below. The principal study questions to be addressed by the data are: 1. Are concentrations of dioxins, furans, and metals in benthic macroinvertebrates of the creeks on the Site higher than concentrations in upstream background? 2. What would be the dose of each chemical constituent in benthic macroinvertebrate tissue to individual ecological receptors that could consume these biota on the Site? 3. Are concentrations of metals in benthic macroinvertebrate tissue present at concentrations that exceed appropriate toxicity reference values for fish, expressed as metal concentration in food? 4. Are concentrations of dioxins, furans, and metals in benthic macroinvertebrate tissue from onsite ponds and creeks statistically significantly correlated with concentrations of the same chemicals in sediment, surface water, or (in ponds only) sediment porewater? 5. Can tissue chemistry be reliably predicted using numerical models that account for both chemical concentrations in abiotic media and other ancillary variables in the aquatic environments of the Site? If so, what are those models?

Table 3-5. Data Quality Objectives, Benthic Macroinvertebrate Tissue from Onsite Creeks and Ponds

Steps of the DQO Process (USEPA 2006)	Data Type
3. Identify Information Inputs **Identify data and information needed to answer study questions.**	Data and information inputs to be developed in this study that are needed to answer study questions are surface water quality data including: • Concentrations of dioxins and furans in benthic macroinvertebrate tissue • Concentrations of metals in benthic macroinvertebrate tissue • Concentrations of total and dissolved metals in water at each sampling location • Concentrations of dissolved organic carbon (DOC), calcium, magnesium, and pH and temperature in the creeks and river • Concentrations of chemicals, grain size distribution, and total organic carbon (TOC) in bulk sediments • Concentrations of dissolved metals in sediment porewater of the onsite ponds • Geochemical drivers and ancillary parameters for sediments and sediment porewater in the ponds.
Step 4. Define the Boundaries of the Study **Specify the target population and characteristics of interest, define spatial and temporal limits and the scale of inference.**	Target population: • Benthic macroinvertebrate communities in aquatic habitats on the Site and in upstream areas of the creeks • Ecological receptors that could be exposed to chemicals in benthic macroinvertebrate tissues, including fish residing in the creeks, birds, and mammals that consume aquatic invertebrates. Characteristics of interest: • Dioxin, furan, and metal concentrations, percent lipid and percent moisture • Variability in tissue concentrations with variability in abiotic media chemistry Temporal boundaries of the study: • Samples will be collected in August and September because biological samples that must be obtained before autumn. Spatial boundaries of the study: • Creeks and pond, in a set of locations that is representative of the range of aquatic habitat types on the Site that benthic macroinvertebrates could inhabit.

Table 3-5. Data Quality Objectives, Benthic Macroinvertebrate Tissue from Onsite Creeks and Ponds

Steps of the DQO Process (USEPA 2006)	Data Type
Step 5. Develop the Analytic Approach **Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings.**	Analytical approaches include those specified in tables listing analytical methods and detection limits cited in Section 4. Analytical approaches include those described in EPA's draft BERA Work Plan: • Calculation of media-specific ingested doses of chemicals in water to those wildlife ingesting benthic macroinvertebrate tissue on the Site • Comparison of metals in benthic macroinvertebrate tissues to metals concentrations in the foods of fish that are known to cause adverse effects in fish (i.e., TRVs expressed as metals concentrations in the foods of fish) Analytical approaches also include data exploration using statistical and other numerical modeling methods to determine whether predictive relationships between sediment or porewater and benthic macroinvertebrate tissue chemical concentrations can be defined. Where unacceptable ecological risks are possible, such relationships can be used to estimate remedial action levels. The absence of correlations can also be informative about mechanisms driving toxicity and risk.
Step 6. Specify Performance or Acceptance Criteria **Specify probability limits for false rejection and false acceptance of decision errors.** **Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use.**	• Probability limits have not been established for benthic macroinvertebrate tissue chemistry. Comparisons of chemical concentrations in the tissue from the creeks with concentrations in upstream stations will be made qualitatively. • Performance criteria for all chemical data are as established in the approved QAPP (NewFields 2015a) and as described in Appendix B of this RIWP Addendum. • Analytical detection limits will be at the levels provided for by EPA's standard methods for analysis of tissue chemistry.

Table 3-5. Data Quality Objectives, Benthic Macroinvertebrate Tissue from Onsite Creeks and Ponds

Steps of the DQO Process (USEPA 2006)	Data Type
Step 7. Develop the Plan for Obtaining Data **Select the resource-effective sampling and analysis plan that meets the performance criteria.**	Plans for collecting benthic macroinvertebrate tissues are described in Appendix B.

Notes:

DQO = data quality objective
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
MDEQ = Montana Department of Environmental Quality
PRP = potentially responsible party
QAPP = quality assurance project plan

Table 3-6. Data Quality Objectives, Fish Tissue from the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
1. State the Problem **Define the problem that necessitates the study, identify planning team and schedule**	In the Clark Fork River, it is necessary to characterize tissue chemistry of small fish, which are the potential prey of ecological receptors (belted kingfisher, river otter, and larger fish) for the risk assessment. There have been no small benthic fish tissue samples collected in the Clark Fork River for the remedial investigation to date. In addition, empirical information on dioxins, furans, and metals in a species of benthic fish in the Clark Fork River at locations upstream of, adjacent to, and downstream of the Site is required by EPA. Coupled with information on the chemistry of surface water and sediments from locations in close proximity to locations for fish tissue samples, additional information on small benthic fish tissue chemistry is needed to determine whether the Site could be a source of chemicals to the aquatic food web of the Clark Fork River. The selected small fish targeted by this study is a conservative representation of local conditions including chemical contamination because it is a benthic fish with a limited home range. Planning Team: EPA, MDEQ, PRPs Schedule: Sampling to be conducted in August and September 2018.
2. Identify the Goals of the Study **State how environmental data will be used in meeting the objectives and solving the problem, identify study questions, define alternative outcomes.**	The study resolves the problem identified in step 1 by providing empirical data on the tissue chemistry of benthic fish in the Clark Fork River. The goal of the study is to obtain the data needed to resolve the principal study questions listed below. The principal study questions to be addressed by the data are: 1. What would be the dose of each chemical constituent in small fish tissue to individual ecological receptors that could consume these biota at locations adjacent to or downstream of the Site? 2. Are concentrations of dioxins, furans, and metals in small benthic fish in the Clark Fork River adjacent to and downstream of the Site higher than concentrations in upstream background locations within the Clark Fork and Bitterroot rivers, between the Site and Missoula? 3. Are concentrations of metals in small fish tissue present at concentrations that exceed appropriate toxicity reference values (TRVs) for fish, expressed as metal concentration in foods of fish? 4. Can concentrations of dioxins, furans, or metals in small fish tissue be predicted from concentrations of these chemicals in abiotic media (sediment and surface water?

Table 3-6. Data Quality Objectives, Fish Tissue from the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
3. Identify Information Inputs **Identify data and information needed to answer study questions.**	Data and information inputs to be developed in this study that are needed to answer study questions are fish tissue chemistry data including: • Concentrations of dioxins, furans, and metals in composites of a single species of small benthic fish from the Clark Fork River and the Bitterroot River • Lipid content and percent moisture in fish tissue analyzed • Concentrations of dioxins, furans, and metals in abiotic media to which the fish could have been exposed • Ancillary parameters in the sediments collected at locations adjacent to fish tissue collection locations, including sediment grain size distribution and total organic carbon in bulk sediments
Step 4. Define the Boundaries of the Study **Specify the target population and characteristics of interest, define spatial and temporal limits and the scale of inference.**	Target population: • Longnose dace, a small benthic fish found in the Clark Fork River, of sizes ranging from 60 to 90 mm. • Ecological receptors that could be exposed to chemicals in fish of the Clark Fork River, including larger fish, birds, and mammals that consume small fish. Characteristics of interest: • Dioxin, furan, and metal concentrations, percent lipid and percent moisture • Variability in tissue concentrations with variability in abiotic media chemistry • Spatial patterns in fish tissue chemistry relative to the Site. Temporal boundaries of the study: • Samples will be collected in August and September because biological samples must be obtained before autumn. Spatial boundaries of the study: • The Clark Fork and Bitterroot rivers, from Missoula to about 3 miles downstream of the Site (Figure 3-3), in a set of locations representative of the range of potential exposures of river fish to chemicals associated with the site, if any.

Table 3-6. Data Quality Objectives, Fish Tissue from the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
Step 5. Develop the Analytic Approach **Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings.**	Analytical approaches include those described in EPA's draft BERA Work Plan: • Calculation of media-specific ingested doses of chemicals in water to those wildlife ingesting small fish from the Clark Fork River • Comparison of metals in small fish to metals concentrations in the foods of fish that are known to cause adverse effects in fish (i.e., TRVs expressed as metals concentrations in the foods of fish) Analytical approaches also include data exploration using statistical and other numerical modeling methods to determine whether predictive relationships between sediment or surface water and longnose dace tissue chemical concentrations can be defined. Where unacceptable ecological risks are possible, such relationships can be used to estimate remedial action levels. The absence of correlations can also be informative about mechanisms driving toxicity and risk. Analysis approaches will include comparison of chemical concentrations in fish tissue from upstream of the Site with those of fish captured adjacent to and downstream of the Site.
Step 6. Specify Performance or Acceptance Criteria **Specify probability limits for false rejection and false acceptance of decision errors.** **Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use.**	• Probability limits have not been established for fish tissue chemistry. Comparisons of chemical concentrations in fish of the Clark Fork River adjacent to and downstream of the Site with fish tissue concentrations in upstream stations will be made qualitatively, and statistically if warranted, with statistical significance determined at $p < 0.10$. • Performance criteria for all chemical data are as established in the approved QAPP (NewFields 2015a) and as described in Appendix B of this RIWP Addendum. • Analytical detection limits will be at the levels provided for by EPA's standard methods for analysis of tissue chemistry.

Table 3-6. Data Quality Objectives, Fish Tissue from the Clark Fork River

Steps of the DQO Process (USEPA 2006)	Data Type
Step 7. Develop the Plan for Obtaining Data **Select the resource-effective sampling and analysis plan that meets the performance criteria.**	Plans for collection of fish tissue samples are described in Appendix B.

Notes:

DQO = data quality objective
EPA = U.S. Environmental Protection Agency
MDEQ = Montana Department of Environmental Quality
PCB = polychlorinated biphenyl
PRP = potentially responsible party
QAPP = quality assurance project plan

Table 3-7. Data Quality Objectives, Small Mammal Tissue from the Upland Habitats of the Site

Steps of the DQO Process (USEPA 2006)	Data Type
1. State the Problem **Define the problem that necessitates the study, identify planning team and schedule**	In the uplands of OU2 and OU3 and floodplain of OU3, it is necessary to characterize tissue chemistry of the potential prey of ecological receptors (red fox, American kestrel) for both the risk assessment and the evaluation of chemical fate through bioaccumulation. There have been no tissue samples collected for the remedial investigation to date. Empirical information on dioxins, furans, and metals in small mammal tissue from the floodplain and uplands of OU3 and from the OU2 upland terrestrial habitats is needed for the BERA. Coupled with information on soil chemistry collected in prior studies, additional information on small mammal tissue chemistry is needed to determine whether abiotic–biotic chemistry correlations or relationships exist. If they do, such relationships are necessary to define remedial action levels, if unacceptable risk is present. The absence of correlations can also be informative about mechanisms driving toxicity and risk. Planning Team: EPA, MDEQ, PRPs Schedule: Sampling to be conducted in August and September 2018.
2. Identify the Goals of the Study **State how environmental data will be used in meeting the objectives and solving the problem, identify study questions, define alternative outcomes.**	The study resolves the problem identified in step 1 by providing an empirical data on the tissue chemistry of small mammals on the Site. The goal of the study is to obtain the data needed to resolve the principal study questions listed below. The principal study questions to be addressed by the data are: 1. Are concentrations of dioxins, furans, and metals in small mammals in OU2 and OU3 on the Site higher than concentrations in small mammal tissues from OU1? 2. What would be the dose of each chemical constituent in small mammal tissue to individual ecological receptors that could consume small mammals on the Site? 3. Are concentrations of dioxins, furans, and metals in small mammal tissues statistically significantly correlated with concentrations of the same chemicals in surface soils?

Table 3-7. Data Quality Objectives, Small Mammal Tissue from the Upland Habitats of the Site

Steps of the DQO Process (USEPA 2006)	Data Type
3. Identify Information Inputs **Identify data and information needed to answer study questions.**	Data and information inputs to be developed in this study that are needed to answer study questions are small mammal tissue chemistry data including: • Concentrations of dioxins, furans, and metals in small mammal tissue • Lipid content and percent moisture in small mammal tissues • Concentrations of chemicals, grain size distribution, and total organic carbon in soils
Step 4. Define the Boundaries of the Study **Specify the target population and characteristics of interest, define spatial and temporal limits and the scale of inference.**	Target population: • Small mammals in floodplain and upland terrestrial habitats in all three OUs of on the Site • Mammals with a maximum body length of 100 mm • Ecological receptors that could be exposed to chemicals in small mammal tissues, including mammals and birds that prey on small mammals, such as the red fox and American kestrel. Characteristics of interest: • Dioxin, furan, and metal concentrations, percent lipid and percent moisture in small mammal tissue • Variability in tissue concentrations with variability in abiotic media chemistry Temporal boundaries of the study: • Samples will be collected in August and September because biological samples must be obtained before autumn. Spatial boundaries of the study: • Locations in the OU1, OU2, and OU3 uplands and in OU3 floodplain that are representative of the spatial distribution of mammals that could inhabit the site and their predators that could forage there.

Table 3-7. Data Quality Objectives, Small Mammal Tissue from the Upland Habitats of the Site

Steps of the DQO Process (USEPA 2006)	Data Type
Step 5. Develop the Analytic Approach **Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings.**	Analytical approaches include those described in EPA's draft BERA Work Plan: • Calculation of media-specific ingested doses of chemicals in tissue to those wildlife ingesting small mammals on the Site • Data exploration using statistical and other numerical modeling methods to determine whether predictive relationships between soil and small mammal tissue chemical concentrations can be defined.
Step 6. Specify Performance or Acceptance Criteria **Specify probability limits for false rejection and false acceptance of decision errors.** **Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use.**	• Probability limits have not been established for small mammal tissue chemistry. Comparisons of chemical concentrations in the tissue from OU2 and OU3 with each other or with concentrations in OU1 stations will be made qualitatively. • Performance criteria for all chemical data are as established in the approved QAPP (NewFields 2015a) and as described in Appendix B of this RIWP Addendum. • Analytical detection limits will be at the levels provided for by EPA's standard methods for analysis of tissue chemistry.
Step 7. Develop the Plan for Obtaining Data **Select the resource-effective sampling and analysis plan that meets the performance criteria.**	Plans for collecting small mammal tissues are described in Appendix B.

Notes:

BERA = baseline ecological risk assessment
DQO = data quality objective
EPA = U.S. Environmental Protection Agency
MDEQ = Montana Department of Environmental Quality
OU = operable unit
PRP = potentially responsible party
QAPP = quality assurance project plan

Table 4-1. Laboratory Methods for Tissue Samples

		Sample Preparation		Quantitative Analysis	
Parameter	Laboratory	Protocol	Procedure	Protocol	Procedure
Sample Preparation					
Sample homogenization	TBD	--	--	--	--
Conventionals					
Percent moisture	Pace Analytical	ASTM D2974-87	Oven dry	ASTM D2974-87	Gravimetric
Lipids	Frontier Analytical	Lab SOP	Solvent extraction	Lab SOP	Gravimetric
Inorganics					
TAL metals	Pace Analytical	EPA 3050B	Acid digestion	EPA 6020A/7471M	ICP-MS/CVAA
Methylmercury	Pace Analytical	EPA 1630	KOH/MeOH extraction	EPA 1630	CVAFS
Organics					
Dioxins/furans	Frontier Analytical	EPA 8290A	Soxhlet extraction Silica gel column cleanup Additional cleanup as needed	EPA 8290A	HRGC/HRMS

Notes:
-- = not available
CVAA = cold vapor atomic absorption
CVAFS = cold vapor atomic fluorescence spectrometry
EPA = U.S. Environmental Protection Agency
HRGC = high-resolution gas chromatography
HRMS = high-resolution mass spectrometry
ICP-MS = inductively coupled-mass spectrometry
SOP = standard operating procedure
TAL = target analyte list
TBD = to be determined

Table 4-2. Analytes, Method Reporting Limits, and Method Detection Limits for Tissue Samples

Analyte	CAS Number	Method Detection Limit [a]	Method Reporting Limit
Conventionals			
Percent moisture (percent)	--	NA	0.01
Lipids (percent)	--	NA	0.1
Inorganics			
TAL Metals (mg/kg-wet weight)			
Aluminum	7429-90-5	5.7439	25
Antimony	7440-36-0	0.0124	0.10
Arsenic	7440-38-2	0.0302	0.10
Barium	7440-39-3	0.0455	0.15
Beryllium	7440-41-7	0.0331	0.11
Cadmium	7440-43-9	0.01	0.10
Calcium	7440-70-2	25.399	84.66
Chromium	7440-47-3	0.0885	0.29
Cobalt	7440-48-4	0.0082	0.10
Copper	7440-50-8	0.1235	0.41
Iron	7439-89-6	3.6745	25.00
Lead	7439-92-1	0.0126	0.10
Magnesium	7439-95-4	44.8431	149.48
Manganese	7439-96-5	0.0676	0.23
Mercury	7439-97-6	0.00494	0.0165
Nickel	7440-02-0	0.0411	0.14
Potassium	7440-09-7	360.7422	1202.47
Selenium	7782-49-2	0.0507	0.17
Silver	7440-22-4	0.0179	0.06
Sodium	7440-23-5	60.8339	202.78
Thallium	7440-28-0	0.013	1.00
Zinc	7440-66-6	1.7246	5.75
Methylmercury (ng/g-wet weight)	22967-92-6	1.06	3.1
Organics			
Dioxins/Furans (ng/kg-wet weight)			
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin	1746-01-6	0.0390	0.500
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin	40321-76-4	0.180	2.50
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin	39227-28-6	0.150	2.50
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin	57653-85-7	0.260	2.50
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin	19408-74-3	0.170	2.50
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin	35822-46-9	0.220	2.50
Octachlorodibenzo-*p*-dioxin	3268-87-9	0.460	5.00
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	0.110	0.500
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	0.250	2.50
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	0.150	2.50
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	0.240	2.50
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	0.180	2.50

Table 4-2. Analytes, Method Reporting Limits, and Method Detection Limits for Tissue Samples

Analyte	CAS Number	Method Detection Limit [a]	Method Reporting Limit
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	0.150	2.50
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	0.250	2.50
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	0.300	2.50
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	0.280	2.50
Octachlorodibenzofuran	39001-02-0	0.340	5.00
Total tetrachlorinated dioxins	41903-57-5	0.0390	0.500
Total pentachlorinated dioxins	36088-22-9	0.180	2.50
Total hexachlorinated dioxins	34465-46-8	0.260	2.50
Total heptachlorinated dioxins	37871-00-4	0.220	2.50
Total tetrachlorinated furans	30402-14-3	0.110	0.500
Total pentachlorinated furans	30402-15-4	0.250	2.50
Total hexachlorinated furans	55684-94-1	0.250	2.50
Total heptachlorinated furans	38998-75-3	0.300	2.50
2,3,7,8-TCDD TEQ	NA	NA	NA

Notes:
NA = not applicable
TEQ = toxicity equivalent

[a] Method detction limits and reporting limits are periodically updated by laboratories. The limits in effect at the time of analysis will be used.

Table 4-3. Laboratory Methods for Porewater Samples

		Sample Preparation		Quantitative Analysis	
Parameter	Laboratory	Protocol	Procedure	Protocol	Procedure
Conventionals					
DOC	Pace Analytical	NA	NA	SM 5310 C	Persulfate oxidation
Bromide, chloride, sulfate	Pace Analytical	NA	NA	EPA 300.0	Anion Chromatography
Metals					
TAL Metals (other than mercury)	Pace Analytical	EPA 6020B	Acid digestion	EPA 6020B	ICP-MS
Mercury	Pace Analytical	EPA 245.1	Potassium permanganate - potassium persulfate oxidation	EPA 245.1	CVAA

Notes:
CVAA = cold vapor atomic absorption
DOC = dissolved organic carbon
EPA = U.S. Environmental Protection Agency
ICP-MS = inductively coupled plasma-mass spectrometry
TAL = Target Analyte List
NA = not applicable

Table 4-4. Analytes, Method Reporting Limits, and Method Detection Limits for Porewater Samples

Analyte	CAS Number	Method Detection Limit [a]	Method Reporting Limit
Conventionals (mg/L)			
Dissolved organic carbon	7440-44-0	0.2	1
Bromide	24959-67-9	0.0262	0.05
Chloride	16887-00-6	0.1211	1.00
Sulfate	14808-79-8	0.1161	1.00
Metals (µg/L)			
Aluminum	7429-90-5	2.27	10
Antimony	7440-36-0	0.117	0.5
Arsenic	7440-38-2	0.211	0.5
Barium	7440-39-3	0.142	0.3
Beryllium	7440-41-7	0.0635	0.2
Cadmium	7440-43-9	0.0279	0.08
Calcium	7440-70-2	11.4	40
Chromium	7440-47-3	0.128	0.5
Cobalt	7440-48-4	0.151	0.50
Copper	7440-50-8	0.203	1
Iron	7439-89-6	6.75	50
Lead	7439-92-1	0.028	0.1
Magnesium	7439-95-4	3.00	10
Manganese	7439-96-5	0.0985	0.5
Mercury	7439-97-6	0.0540	0.2
Nickel	7440-02-0	0.124	0.5
Potassium	7440-09-7	12.5	50
Selenium	7782-49-2	0.167	0.5
Silver	7440-22-4	0.169	0.5
Sodium	7440-23-5	14.0	50
Thallium	7440-28-0	0.028	0.1
Zinc	7440-66-6	0.818	5

Notes:

CAS = Chemical Abstracts Service

NA = not applicable

[a] Method detection limits and reporting limits are periodically updated by laboratories. The limits in effect at the time of analysis will be used.

APPENDIX A

SEDIMENT, SEDIMENT POREWATER, AND SURFACE WATER FIELD SAMPLING PLAN

Appendix A

Sediment, Sediment Porewater, and Surface Water Field Sampling Plan
Smurfit-Stone/Frenchtown Mill Site
Missoula County, Montana

Prepared for:
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NewFields

July 2018

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AOC	Administrative Order on Consent
AVS-SEM	Acid Volatile Sulfides-Simultaneously Extracted Metals
BERA	Baseline Ecological Risk Assessment
BMI	Benthic Macroinvertebrates
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Clark Fork River
Creeks	Lavalle and O'Keefe Creeks
dioxins	Dioxins/furans
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
EPA	U.S. Environmental Protection Agency
Frontier	Frontier Analytical, El Dorado Hills, California
FSP	Field Sampling Plan
GPS	Global Positioning Sensor
HASP	Health and Safety Plan
JSAs	Job Safety Analysis
M2Green	M2Green Redevelopment
MPDES	Montana Pollutant Discharge Elimination System
NewFields	NewFields Companies, LLC
NPL	National Priority Listing
OUs	Operable Units
ORP	Oxidation-Reduction Potential
Pace	Pace Analytical Services, Inc.
PRPs	Potentially Responsible Parties
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RI Work Plan	Remedial Investigation Work Plan
SC	Specific Conductivity
SOPs	Standard Operating Procedures
TEQ	Toxicity Equivalent Quotient
TOC	Total Organic Carbon
WWTS	Wastewater Treatment System

1.0 INTRODUCTION

NewFields Companies, LLC (NewFields) has prepared this Field Sampling Plan (FSP) as Appendix A to Addendum Number 9 to the Remedial Investigation Work Plan (NewFields 2015) (RI Work Plan) for continued environmental investigation of the former Frenchtown Mill Site, hereafter referred to as the "Site" (**Figure A-1**). This document is a description of the work to be performed; a discussion of the investigation background and data quality objectives can be found in the main text of this Work Plan.

Addendum 9 includes the collection of tissue, sediment, pore water and surface water to supplement the existing data set and inform the baseline ecological risk assessment (BERA), the nature and extent evaluation and the conceptual site model for the Site. This FSP provides the information and methods needed to collect the sediment, pore water, and surface water samples. Tissue sampling is addressed in Appendix B of this RIWP addendum. NewFields prepared this FSP on behalf of three potentially responsible parties (PRPs) including M2Green Redevelopment (M2Green), WestRock, and International Paper Company.

The FSP was developed in accordance with guidance issued by the U.S Environmental Protection Agency (EPA), including: guidance for conducting site inspections under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (EPA, 1992); and interim final guidance for conducting remedial investigations and feasibility studies under CERCLA (EPA, 1988).

Field investigations are proposed within the areas outlined on **Figure A-2**. The investigations will focus on three primary components: 1) Lavalle and O'Keefe Creeks, 2) upstream, downstream and in a site-adjacent portion of the CFR, and 3) the on-site ponds.

Work to be completed under this FSP expands upon previous work conducted by:

- NewFields collected additional samples in 2014 on behalf of M2Green (NewFields 2014). This site investigation was focused on the ancillary parcels and wastewater treatment system lands present on the Site, and

- NewFields led the remedial investigation sampling in November/December 2015. This work was completed in accordance with the EPA-approved RI Work Plan (NewFields 2015) on behalf of the PRPs. Results are summarized in the preliminary data summary report (NewFields 2016). Portions of the remedial investigation included the collection of samples from the areas targeted in this FSP. Samples collected from these areas are discussed in more detail in the accompanying work plan.

1.1 SITE DESCRIPTION

A detailed background discussion of Site location, geography, geology, hydrogeology and current environmental conditions is included in the body of the RI Work Plan. The following provides a summary of the site setting.

The Site is located approximately 11 miles northwest of Missoula, Montana and about 3 miles southeast of Frenchtown, Montana (**Figure A-1**). The Site is located adjacent to the Clark Fork River, which flows west through the valley and then north along the Site's western boundary (**Figure A-2**). It is a 3,150 acre property that was operated as a pulp and paper mill for 53 years. Based on historical and current usage, the Site has been divided into three operable units (OU) (**Figure A-2**). Water features in OU2, OU3 and the Clark Fork River will be sampled for sediment, surface water and sediment porewater (at select locations) in 2018.

OU2 represents the core industrial footprint of the Site and includes the former mill, old corrugated container plant (recycling plant), a wood chip staging area, the hog fuel area, and various equipment storage areas, and covers approximately 260 acres. There are a few aquatic features in OU2: one area formerly used as a borrow pit on OU2, and now fed by groundwater (CL Pond). The other is the non-contact cooling water ditch (CWD) that runs along the western border of OU2, flowing in a northerly direction along a roadway (**Figure A-2**).

OU3 includes a 1,100 acre WWTS system located within a 1,650 acre portion of the Site property. The WWTS system consisted of a clarifier and settling ponds (primary treatment), sludge dewatering plant, aeration basins (secondary treatment), polishing ponds, a color removal plant (tertiary treatment) and a series of unlined holding ponds used to store water prior to discharging. During operations, some of the ponds were used to dispose pond spoils from dredging activities. A few other basins in the upland portion of OU3 were used to dispose of general refuse.

The Site is underlain by alluvial materials comprised of poorly sorted, unconsolidated, silt, sands and gravels. Near-surface or "shallow" groundwater generally occurs in the upper 15 to 40 feet of the alluvial material. Where groundwater intersects the surface in former water treatment basins, ponds have formed and are an attractant to wildlife.

The site is intersected by O'Keefe Creek, which enters OU1 from the east and traverses the southern boundary of OU3 before draining into Lavalle Creek (**Figure A-2**). Lavalle Creek enters the site from the south, and joins the Clark Fork River near the south end of the Site boundary.

1.2 Data Gaps Addressed by This Study

The study described in this FSP will be conducted to address data gaps identified by EPA in preparation of the Baseline Ecological Risk Assessment (BERA) Work Plan, and by the PRPs in planning the study.

- **Surface water quality**. Additional information on surface water quality in ponds and creeks is needed to describe the nature and extent of contamination and to evaluate potential ecological and human exposures and risks. Additional information on water quality on the site and within the Clark Fork River is needed to further describe the conditions in the Clark Fork River, and evaluate the extent of influence of the Site on water quality of the river downstream of and adjacent to the Site, if any. Additional data describing surface water conditions upstream of the site in both the creeks and the river are also needed for this purpose.

- **Sediment quality**. Additional information on sediment quality in ponds and creeks is needed to describe the nature and extent of contamination and to evaluate potential ecological and human exposures and risks. Additional information on sediment quality in areas downstream of the site within the Clark Fork River is needed to further describe the conditions in the Clark Fork River, and evaluate the extent of influence of the Site on sediment quality of the river downstream of and adjacent to the Site, if any. Additional data describing sediment conditions upstream of the site in both the creeks and the river are also needed for this purpose.

- **Porewater in sediments of on-Site ponds**. In addition to bulk sediment chemistry data, additional information is needed on the concentrations of dissolved metals and total metals in pore water of pond sediments. Pond sediments have not been sampled previously, but in some cases, nearby soils have relatively high concentrations of metals. The ponds represent geochemically unique environments, and risk to benthic macroinvertebrates is not likely to be a simple function of bulk sediment concentrations of metals because of numerous potentially mitigating factors in the sediments of the ponds. To understand risks to benthic macroinvertebrates in the on-Site ponds, dissolved metal concentrations in and additional water quality characteristics of porewater are needed.

1.3 Document Organization

This document is divided into the following sections:

- **Section 2.0** presents the presents the details relating to the field investigation and includes the target sampling locations, analyte list for each location, and appropriate sampling methodologies referenced as standard operating procedures (SOPs).
- **Section 3.0** presents the quality assurance/quality control components of data collection;
- **Section 4.0** describes data management, validation, evaluation, and reporting;
- **Section 5.0** includes reference citations for this FSP.

Figures and tables for this FSP are located after **Section 5.0**. Two attachments are included with the FSP. Standard operating procedures (SOPs) for field activities are provided in **Attachment A**. Relevant field sampling forms and chain of custody forms are presented in **Attachment B**.

2.0 FIELD INVESTIGATION

This section describes the field investigation and is organized into 5 subsections, as follows:

- **Section 2.1** describes the steps necessary to prepare for the site investigation.
- **Section 2.2** describes the investigations to be conducted in Lavalle and O'Keefe Creeks, a site-adjacent portion of the CFR, and the on-site ponds.
- **Section 2.3** details sampling methods for sediments, surface water, and pore water collection.
- **Section 2.4** presents field documentation and sample handling procedures.
- **Section 2.5** describes procedures for decontamination and disposal of investigation-derived waste.

Samples from 43 locations will be collected as described by this FSP, spanning the three investigation areas described in **Figure A-3** as well as offsite locations in O'Keefe and Lavalle Creeks and in the Clark Fork River. Although the objectives for sampling these areas differ slightly, the sampling methods as detailed in **Section 2.3** apply equally, resulting in a consistent approach to sample collection and handling across the investigation.

2.1 PREPARATION FOR SITE INVESTIGATION

2.1.1 Schedule

Preliminary site reconnaissance is scheduled for mid-July, 2018. The purpose of the reconnaissance visit is to finalize sampling locations for sediments, water and fish tissue in the Clark Fork River, and to finalize on-Site ponds to be sampled. Sampling will be conducted following approval of this work plan by EPA, and is currently scheduled for August and September 2018. NewFields estimates that sampling will require roughly 4 weeks (Section 4.2 of the work plan). Approximately 1 week prior to initiating field work, NewFields will conduct meetings and/or teleconferences with Integral, the agencies, necessary subcontractors, laboratories to discuss the field schedule, sample locations, ingress/egress, decontamination needs, and health and safety requirements.

2.1.2 Safety

All field work will be conducted in conformance with the site-specific Health and Safety Plan (HASP) (Appendix F of the RI Work Plan). NewFields has designated a qualified Site Health and Safety Officer, as indicated in the HASP. Daily field staff meetings (e.g., tailgate safety meetings) will be held on-site to review job safety analyses (JSAs) at the beginning of each work day. Any work activities not addressed in the HASP will be addressed with a task-specific JSA. SOP-14 provides a breakdown of the expected safety protocols for this investigation.

2.1.3 Site Reconnaissance and Site Access

A preliminary site reconnaissance will be completed in with agency personnel to finalize sampling locations, determine site access and sample sequencing. The selected sample site locations will be recorded with a GPS. Locations shown in tables and figures are preliminary and may be changed depending on the outcome of site reconnaissance. Access agreements will be obtained in accordance with the requirements in the Administrative Order on Consent (AOC). Portions of the investigation that may require access agreements include the off-site locations in Lavalle and O'Keefe Creeks and select locations in the CFR.

2.2 Sampling Equipment

Field equipment and supplies include sampling equipment, including a vessel, utensils, decontamination supplies, sample containers, coolers, shipping containers, log books and forms, personal protection equipment, and personal gear. Protective wear (e.g., powder-free nitrile gloves) is required to minimize the possibility of cross-contamination between sampling locations. Additional information on protective wear required for this project is provided in the project HASP (NewFields 2015).

Sample jars, laboratory-grade distilled water, coolers, and packaging material for the samples will be supplied by the analytical laboratory. All samples will be clearly labeled at the time of sampling. Labels will include the task name, sample number, sampler's initials, analyses to be performed, and sample date and time. Sample numbering and identification procedures are described in detail in **Section 2.5.1** and SOP-3. Additional details on the required sampling equipment are provided in SOPs.

This field program requires use of several field instruments for measurement and recording of in situ surface water and sediment conditions (SOP-5, SOP-6, SOP-7, and SOP-8). Each instrument will be accompanied by its corresponding manufacturer's user manual during field work. Calibration of each instrument will be performed as described in its instrument manual, calibration records will be maintained in the field log book.

2.2.1 Sampling Vessel

Sediment and surface water sample collection will require the use of a boat for many of the locations. In ponds, some sampling locations can be reached by wading via access by truck or van. Other locations will required a small vessel. The vessel for pond sampling will be obtained and operated by a qualified person and will be capable of deploying and operating a Petite Ponar or similar grab sampler (or similar equipment) for sediment sample collection. The sampling vessel will also be able to deploy a water sampler to collect water samples.

The sampling vessel used on the Clark Fork River will have enough space to accommodate a minimum of four people—two sampling team members, the vessel's operator, and either an additional team member or EPA oversight individual (if required). The vessel must also be able to hold the following gear: sediment and water collection equipment, sample coolers, documentation supplies, and other ancillary equipment.

The vessels used for sampling will have navigational lights, ropes, and anchors. The vessel operator will be thoroughly familiar with the area of the river to be navigated.

As needed, weather and river gage height will be monitored using the following web sites:

- National Weather Service https://forecast.weather.gov/
- U.S. Geological Service for USGS 12353000 Clark Fork below Missoula MT https://waterdata.usgs.gov/

2.3 Sediment, Surface Water, and Pore Water Sampling

Samples from each of the three areas (CFR, O'Keefe and Lavalle Creek, and On-Site Ponds) will be collected as part of this investigation (**Figure A-3**). Selected locations will be verified during preliminary site reconnaissance and samples will be collected using guidance from the EPA (EPA, 1995). Specific sampling methods are presented in the SOPs in **Attachment A**.

All samples will be apportioned into the appropriate sample containers for laboratory analysis per **Table A-1**, and handled according to specifications therein. Target analytes for the Site are listed in **Tables A-2** through **A-4**.

Sampling will also involve the measurement of specified parameters in the field including pH, dissolved oxygen, specific conductivity, temperature, and oxidation reduction potential to be measured in situ, and alkalinity of pond water to be measured in the field using a test kit. All field parameter measurements will be recorded on individual sampling forms, either handwritten or electronic. If hand written forms are used, all data from the forms will be recorded as described in SOP-1 and SOPs 5 through 8. After sampling, data will be validated, transcribed into tables, and entered in to the SCRIBE database. All hand-entered data (100%) is validated for accuracy in transcription to the electronic database.

Field parameters may also be logged electronically using a cloud-based management system that allows for data capture using a proprietary web-based system and a digital tablet device. If field data are collected using a mobile data collection application such as fulcrum software (https://www.fulcrumapp.com/), data are saved to the mobile field tablet and backed up on a cloud-based system. Upon return to the office, data will be copied to Excel tables on the Missoula server, hand validated via checklist, and uploaded to the SCRIBE database.

The remainder of this section describes the sampling to be conducted in each area.

2.3.1 Lavalle and O'Keefe Creek Sampling

Sediment and surface water samples will be collected from Lavalle and O'Keefe Creeks (Creeks) by hand while wading. A total of ten locations will be targeted for sediment collection (**Figure A-4**). Seven of these locations are within the Site, though 41-OK is close to the boundary. The remaining three (one in O'Keefe

and two in Lavalle) are upstream of the Site (**Figure A-4**). The three upstream locations may require access agreements as noted in **Section 2.1.3**.

Sediment samples will be collected at all ten Creek sampling locations (**Figure A-4, Table A-2**). All sediment samples will be subaqueous, and will be collected from the streambed below the water line at the time of sampling. Sediment samples will be collected in accordance with SOP-11 (**Attachment A**). Creek sediment samples will be analyzed for dioxin/furan congeners, metals, methylmercury, total organic carbon (TOC), and grain size distribution (**Table A-2**). Target methods, reporting limits, and screening levels for sediments are presented in **Table A-5**.

Surface water samples will be collected from five of the ten Creek locations (**Figure A-4**, **Table A-3**). All samples will be collected in accordance with SOP-10 (**Attachment A**). In situ measurements will be made for:

- pH – SOP-6,
- dissolved oxygen (DO) – SOP-7
- specific conductivity (SC)– SOP-5, and
- water temperature.

Water samples will be collected using the containers and consistent with the handling requirements in **Table A-1**, and submitted to the laboratory for the parameters listed in **Table A-3**. Surface water samples from the creek locations will be analyzed for dioxin/furan congeners, total and dissolved metals, dissolved organic carbon (DOC), total organic carbon (TOC), and ancillary parameters. Ancillary parameters includes common anions[1], total dissolved solids (TDS), alkalinity[2], nitrate/nitrite, phosphate, conductivity, and pH. Target methods, reporting limits, and screening levels for water samples are presented in **Table A-6**.

It is possible that the target upstream locations in **Figure A-4** may be dry during the sampling period. If so, sampling will be conducted from the nearest location with standing water.

Sediment and surface water chemistry samples will be co-located with BMI tissue collection at each of the ten target locations. Tissue sample collection is described in the Tissue FSP, **Appendix B** to the work plan. The collocated sediment and water samples in the creeks will be collected before collection of BMI tissue samples, because BMI collections will disturb both sediments and water.

2.3.2 Clark Fork River Sampling

A total of 21 sediment and surface water samples will be collected from the Clark Fork and Bitterroot Rivers (**Figure A-5**) either by wading in shallow water depths or from a sampling vessel. Seven of the locations are upstream of the Site, three of the locations are adjacent, and the remaining eleven locations are downstream of the Site boundary.

[1] Common anions are: bromide, chloride, fluoride, and sulfate
[2] Speciated alkalinity includes: bicarbonate, carbonate, hydroxide.

Fine grain sediments from depositional areas of the river will be targeted for sample collection. Sampling locations for sediment and water in the Clark Fork will be finalized during the reconnaissance visit in July, 2018. All sediment samples will be analyzed for dioxin/furan congeners, metals, methylmercury, TOC, and sediment grain size distribution (**Table A-2**). Sediment sampling will be conducted in accordance with SOP-11. Target methods, reporting limits, and screening levels for sediment and water samples are presented in **Table A-5** and **A-6**, respectively.

Surface water samples will be collected from all 21 locations in the CFR and Bitterroot. Surface water samples will be collected using the containers and consistent with the handling requirements in **Table A-1**, and submitted to the laboratory for dioxin/furan congeners, total and dissolved metals, dissolved organic carbon (DOC), total organic carbon (TOC), and ancillary parameters. Ancillary parameters includes common anions, total dissolved solids (TDS), alkalinity, nitrate/nitrite, phosphate, conductivity, and pH (**Table A-3**). Surface water will be collected in accordance with SOP-10. Target methods, reporting limits, and screening levels for water samples are presented in **Table A-6**. In situ measurements will be made for:

- pH – SOP-6,
- dissolved oxygen (DO) – SOP-7
- specific conductivity (SC)– SOP-5, and
- water temperature.

Efforts will be made to obtain subaqueous sediment and surface water samples as close to the target locations as possible, but access or low water levels may necessitate adjusting the location in the field. It may be necessary to collect sediment from a small area surrounding the target location in order to obtain a suitable volume for analysis. The actual location of the final sample will be recorded using a GPS, and noted in the field log book.

2.3.3 On-Site Pond Sampling

Twelve on-Site pond locations have been targeted for collection of collocated surface water, sediment, pore water, and BMI tissue. The BMI tissue sample collection and collection of ten small mammal composite samples in the vicinity of the ponds are described in Appendix B.

Surface water, sediment and pore water will be collected from 12 on-site ponds. Pond sampling locations are shown in **Figure A-6**. At each sampling location, NewFields will collect subaqueous sediment samples (SOP-SD-04 in **Attachment A**), surface water samples (SOP-10), and pore water samples (Porewater Sampling Method and SOP-16). Pond samples will be collected by wading if water depths allow it or from a sampling vessel.

Sediment samples will be collected and analyzed for dioxin/furan congeners, metals, methylmercury, TOC, sediment grain size distribution, and acid volatile sulfides-simultaneously extracted metals (AVS-SEM; **Table A-2**). Field measurements will be made in situ to characterize the pH of sediments within the upper 0 – 6 inches at each sampling location. This pH measurement will be made by pushing the data sonde 4-6 inches into the sediment bed.

Provided the substrate is suitable for core penetration, observations of the sediment profile in the ponds will be conducted by wading to access a water depth of 3 to 4 feet and inserting a Lexan tube or similar to a depth of 15 to 25 cm, and photographing each to provide a qualitative description of the sediment profile.

Surface water samples will be collected from all 12 on-site pond locations. Samples will be collected using the containers and consistent with the handling requirements in **Table A-1**, and submitted to the laboratory for dioxin/furan congeners, total and dissolved metals, dissolved organic carbon (DOC), total organic carbon (TOC), and ancillary parameters. Ancillary parameters includes common anions, total dissolved solids (TDS), alkalinity, nitrate/nitrite, phosphate, conductivity, and pH. The surface water checklist is presented in **Table A-3**. In situ measurements will be made for:

- pH at three depths (upper, middle, and sediment-water interface) – SOP-6,
- dissolved oxygen (DO) – SOP-7
- specific conductivity (SC)– SOP-5, and
- water temperature.

Alkalinity of water in ponds will be measured in the field using a field test kit.

Porewater samples will be collected via peepers according to the porewater sampling method (**Attachment A**). Porewater samples will also be collected using PushPoint® samplers as described in SOP-16 (Attachment A). Porewater samples will be collected and submitted to the laboratory for analysis of metals, DOC, hardness, and common anions. Bromide is included as an anion in the peepers as it is a trace used to confirm peeper equilibrium. Target analytes for porewater analysis are provided in **Table A-4**. Target methods, reporting limits, and screening levels for sediment and water samples are presented in **Tables A-5** and **A-6**, respectively. A subset of the peepers will be analyzed in the field for:

- pH (SOP-6)
- oxidation reduction potential (ORP) – SOP-8,
- alkalinity
- sulfide
- dissolved oxygen (DO) – SOP-7
- specific conductivity (SC) – SOP-5, and
- water temperature.

All field porewater analysis will be conducted within 2 hours of sample collection.

Samples will be divided into appropriate sample containers for laboratory analysis in accordance with requirements listed in **Table A-1**. All sample locations will be recorded in the field using a resource-grade GPS and documented on field sampling forms in accordance with SOP-1 (**Attachment A**). NewFields will coordinate with the EPA about modifying locations if standing water is not present at any of the target sampling locations at the time of field sampling.

2.4 Sampling Methods

This section provides details regarding sampling methods and references applicable SOPs to be followed for field measurements, surface water collection, pore water collection, sediment sample collection, handling, and custody. These methods and procedures will apply to all field sampling efforts conducted as part of this investigation. SOPs referenced below are contained in **Attachment A**.

2.4.1 Sediments

Sediment samples will all be collected as discrete samples, homogenized in the field and transferred into appropriate sample jars for laboratory analysis per **Table A-1**. All sample locations will be recorded in the field using a resource-grade GPS and documented on field sampling forms in accordance with SOP-1.

Subaqueous samples will be collected from the upper 0-6 inches of sediments by hand using a spoon or scoop in the river and creeks in accordance with SOP-11 and in the ponds using a grab sampler deployed from a sampling vessel according to SOP SD-11. Where required, a pH profile can be measured in accordance with SOP-6. After collection at each location, all equipment will be decontaminated following SOP-2. Samples will be labeled according to SOP-3. In situ pH measurements will be recorded with the station and sample ID in the field log book.

Samples will be shipped to the appropriate laboratory once labeled and placed in ice-filled, sealed coolers (SOP-4). Samples for TOC, grain size, metals, and methylmercury analysis will be shipped to Pace in Billings, Montana. Samples for AVS-SEM will also be shipped to Pace. The sample jar for AVS-SEM should be filled as to leave no head space for potential sample oxidation. The laboratory should be instructed to not freeze this sample. Samples for dioxin/furan analysis will be shipped to Frontier in El Dorado Hills, California.

All shipments will be accompanied with chain-of-custody documentation in accordance with SOP-3. Shipping documents will specify the laboratory analyses for each sample. All samples submitted for laboratory analysis will be analyzed using standard turnaround times. Each cooler will be secured with strapping tape and will clearly display a shipping label with all appropriate laboratory information in accordance with SOP-4.

2.4.2 Surface Water

Surface water grab samples will be collected as discrete samples. If conditions permit, samples will be collected directly into the laboratory-provided container. If preservatives have already been added to the laboratory containers, or if current or water depth prevents sampling by hand, a separate container will be used for collection and water will be transferred to the laboratory container. Sample locations will be recorded in the field and documented on field sampling forms following SOP-1.

Surface water samples will be collected from the top third of the water column following procedures in SOP-10. Metals samples will be shipped to Pace in Billings, Montana. Depending on laboratory requirements, filtration of samples in the field (as opposed to the laboratory) may be necessary. If needed, filtration will be conducted in accordance with SOP-9. Samples for dioxin/furan analysis will be shipped to Frontier in El Dorado Hills, California.

In situ field measurements of all surface waters include parameters for electric or specific conductance (SOP-5), pH profile (SOP-6), temperature, and dissolved oxygen (SOP-7). Water collected from ponds will be measured for alkalinity using a field test kit.

All surface water samples will be shipped in wet ice-filled, sealed coolers with appropriate chain-of-custody documentation as described in SOP-3. Shipping documents will specify the laboratory analyses for each sample. Each cooler will be secured with strapping tape and will clearly display a shipping label with all appropriate laboratory information in accordance with SOP-4.

2.4.3 Porewater

Various methods are available for sampling porewater. For the purposes of understanding the potential toxicity of pond sediments to benthic invertebrates, a passive *in situ* equilibrium method will be used. The porewater within the sediment matrix of the ponds will be sampled directly using peepers. Peepers consist of a series of polyethylene vials covered with a 0.45-µm semipermeable membrane. The interior of the peeper vials consists of rows of chambers that are filled with distilled deionized oxygen-free water. During the four-week deployment, this water equilibrates with surrounding porewater. Upon retrieval, analysis of the water within the peeper vial provides a measure of the dissolved metals in sediment porewater and other conditions within the sediment environment.

Peepers will be used as follows:

- At each pond location, peepers will be deployed in the sediments corresponding to the location at which the sediment sample is collected. Peepers will be deployed attached to a frame. Each Frame holds two 60 mL peepers. Three frames are expected per pond.
- Peepers will remain in the sediments for approximately 4 weeks to allow equilibration of chemicals dissolved in sediment porewater with the water within the peepers.
- All peepers deployed in any individual pond will be retrieved simultaneously. Certain measurements will be made in the field, and the remaining peeper water will be preserved and shipped to the laboratory with minimal exposure to sunlight and oxygen (SOP-3 and SOP-4).

Peeper deployment and collection will follow the Porewater Sampling Method provided in **Attachment A**. In situ field measurements of porewater samples include parameters for electric or specific conductance (SOP-5), pH profile (SOP-6), temperature, dissolved oxygen (SOP-7), and ORP (SOP-8).

In addition to collection of porewater using peepers to characterize dissolved metals concentrations in pond sediment porewater, whole porewater samples will be collected using PushPoint® sampler, at the request of EPA. PushPoint® porewater samples will be collected from each pond and analyzed for total metals. Porewater for analysis of whole porewater concentrations of metals will be performed according to SOP-16 (**Attachment A**).

2.5 Field Documentation and Sample Handling

2.5.1 Sample Nomenclature

Samples will be labeled as described in SOP-3. Naming conventions for all major areas of the site are described in Table 1 of the RI Work Plan. Specific sample IDs are presented in **Tables A-2**, **A-3**, and **A-4** and also in **Figures A-4**, **A-5**, and **A-6**.

All sample IDs in the aforementioned tables and figures are sequentially numbered, beginning at sample 34 for the Creek samples and ending at 75 for the on-site pond samples. The appropriate prefix and suffix will be added as followed and as described in SOP-3

- Using location 34-LV as an example, all sample IDs are formatted as XX34-LV-YY where:
    - XX is equal to the media designation of SE for sediment, SW for surface water, and PW for pore water, and
    - YY is equal to the media sub-type area. In this investigation, all sediment samples will be subaqueous (SA). -YY is left blank for surface water and pore water samples.

2.5.2 Documentation of Field Activities

All field observations (including but not limited to, visual indications of potential contamination, sample locations, and a log of photographs) will be recorded in project-dedicated field books or appropriate field forms in accordance with SOP-1. **Attachment B** contains the field forms for this investigation.

2.5.3 Sample Shipment and Chain of Custody

Samples will be placed in ice-filled and sealed coolers for shipment to the laboratory along with all appropriate shipping forms under chain-of-custody in accordance with SOP-3. **Attachment B** contains the chain of custody form to be used for this investigation. Shipping documents will specify the laboratory analyses for each sample. All samples submitted for laboratory analysis will be analyzed using standard turnaround times. Each cooler will be secured with strapping tape and clearly display a shipping label with all appropriate laboratory information in accordance with SOP-4.

2.6 Decontamination Procedures and Disposal of Investigation-Derived Wastes

Decontamination of sampling equipment will be performed to ensure the quality of samples collected. A list of field equipment to be used during this investigation is provided in each relevant SOP. To prevent cross-contamination between sediment samples, all non-disposable sampling equipment will be decontaminated on-site between sampling locations using distilled water, Alconox detergent, and a methanol and/or nitric acid rinse in accordance with SOP-2. Decontamination procedures will be

conducted at locations identified by NewFields prior to sampling and at an appropriate distance from sampling activities. Disposable equipment intended for one-time use will not be decontaminated, but will be disposed as described in SOP-2.

Investigation derived waste will be handled according to SOP-13. Care will be taken to collect the volume of sediment needed for laboratory analysis. Any excess sediment that is collected will be placed at the target location. Any disposable equipment such as tubing will be disposed of in contractor bags and placed in the appropriate receptacle.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) procedures will be followed in accordance with the Quality Assurance Project Plan (QAPP) appended as Appendix E of the RI Work Plan and CERCLA QAPP guidance (EPA, 2006a). Field quality control samples for this investigation include; duplicates, rinsate blanks, DI blanks, and trip blanks. Field Quality control (QC) samples for this investigation will be collected in accordance with SOP-12 (**Attachment A**), the QAPP (Appendix E of the RI Work Plan), and as described below.

- Sediment - QC samples will include equipment rinse blanks (one for every twenty (1/20) natural samples collected using non-disposable equipment) and blind field replicates (one for every twenty (1/20) natural samples). An equipment rinse blank will be collected by pouring deionized water over decontaminated reusable sampling equipment and collecting the rinse water in sample containers. Use of new, disposable sampling equipment will not require a rinse blank. The blind field replicates and rinse blanks will be analyzed for the same analytes as the natural samples (**Table A-2**). Specific analytes and analytical methods are identified in **Table A-5**.
- Surface Water - QC samples will include blind field duplicates (one for every twenty (1/20) natural samples). The field replicate blanks will be analyzed for the same analytes as the natural samples (**Table A-3**) Specific analytes and analytical methods are identified in **Table A-6**.
- Porewater - QC samples will include trip blanks (one for every twenty (1/20) natural samples collected using non-disposable equipment) and blind field duplicates (one for every twenty (1/20) natural samples). The trip blank and blind field replicates will be analyzed for the same analytes as the natural samples (**Tables A-4**). Specific analytes and analytical methods are identified in **Table A-6**.

4.0 DATA EVALUATION AND REPORTING

4.1 DATA MANAGEMENT AND VALIDATION

Analytical and field data will be input to the EPA Scribe database. Data usability review, and Tier II data validation will be conducted on all data collected by NewFields during this investigation. As outlined in the QAPP (Appendix E of the RIWP), data usability and validation undertakings will be completed in conformance with guidance for conducting remedial investigations and feasibility studies under CERCLA (EPA, 1988) and EPA Requirements for QAPPs (QA/ R5) (EPA, 2006a, p. 5).

4.2 FIELD OBSERVATIONS

During field operations, effective data management is essential to provide consistent, accurate, and defensible documentation of data quality. Field data will include field collected data (e.g., water quality values measured in situ), and identifying information and descriptive and geographical information associated with sediment, surface water, and tissue sample collection. Complete and correct recording of field data during sample collection will be prioritized to ensure that the associated analytical results are usable for the intended purposes. The type of information to be collected during field investigations, and formats for data collection, are described in the appendices.

Daily field records (a combination of field log books, field data sheets, and COC forms) and navigational records will make up the main documentation for field activities. As soon after collection as possible, field log books and data sheets will be scanned to create an electronic record for use in creating the investigation report.

If field measurements are required for a specific task (e.g., water quality measurements), then equipment calibration records including instrument type and serial number, calibration supplies used, calibration methods and calibration results, date, time, and personnel performing the calibration will be recorded in the field log book.

Data available only in hard copy (e.g., field log books, field data sheets, COC forms), along with all field measurements, will be hand-entered into the database and reviewed for corrections before use. All hand-entered data will be subjected to 100 percent verification against the source document. Electronic quality assurance checks to identify anomalous values will also be conducted following data entry. Additional specifications for creating and handling field data records are described in the appendices.

4.3 REPORTING

Following the receipt of sediment, surface water, tissue and porewater sample analytical results, NewFields will prepare a data report describing the results of the investigation and any deviations from the field or analytical methods described in this FSP. All dioxin/furan congener data will be converted to Toxicity Equivalent (TEQ) concentrations as summarized in the Data Management Plan (NewFields 2018).

Supporting documentation will be attached to the data report, including:

- Tabulated summaries of sediment, surface water, and porewater sample analytical data
- Figures depicting sample locations and concentrations of analytes detected in sample media
- A QA/QC summary, including Tier II data validation reports completed in accordance with EPA guidance
- Appendices including field notes and field sampling forms; laboratory analytical reports; and investigation photographs.

An evaluation of the data as it relates to the objectives of the investigation will be completed and the CSM for the Site will be updated by Integral, in collaboration with EPA.

5.0 REFERENCES

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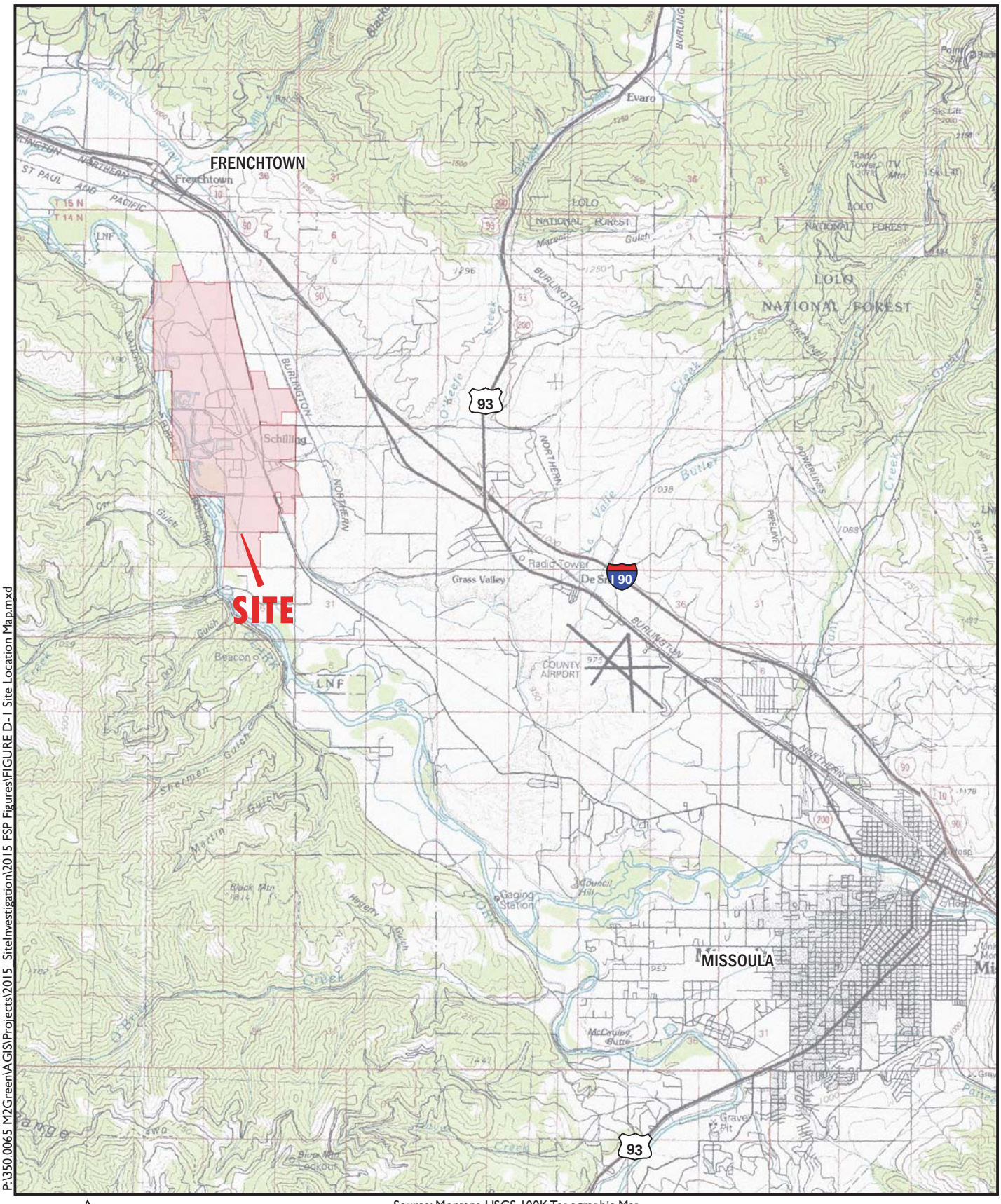
FIGURES



P:\350.0065 M2Green\AGIS\Projects\2015 SiteInvestigation\2015 FSP Figures\FIGURE D-1 Site Location Map.mxd

Source: Montana USGS 100K Topographic Map

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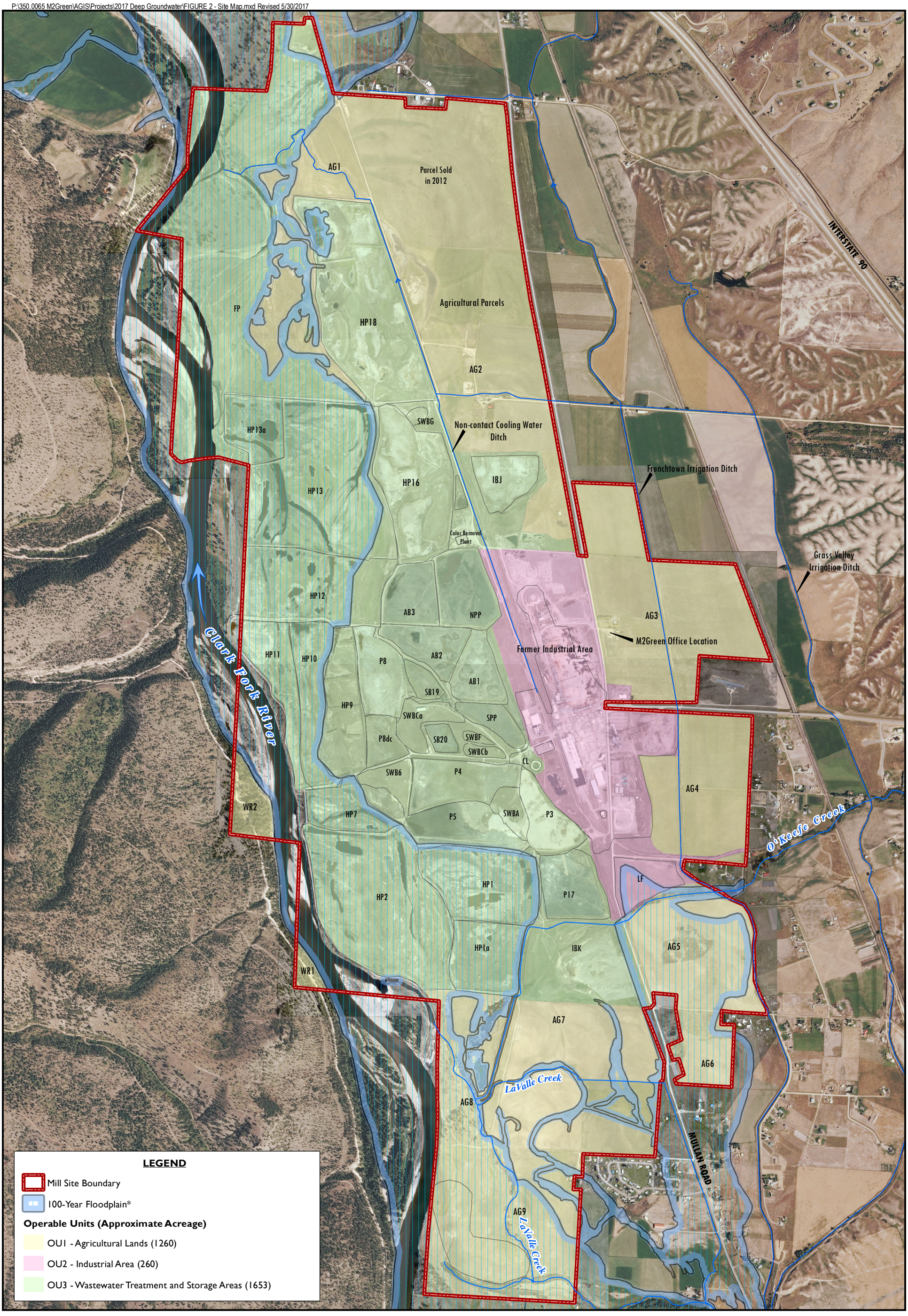
NewFields

Site Location Map
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE A-1

P:\350.0065 M2Green\AGIS\Projects\2017 Deep Groundwater\FIGURE 2 - Site Map.mxd Revised 5/30/2017



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Aerial Photo Source: NAIP 2011 and Newfields 2016 (Within Site Boundary)

*Floodplain Source:
As defined by the Federal Emergency Management Agency (FEMA) 2013 Digital Flood Insurance Rate Map (DFIRM). (NFIP 2013)

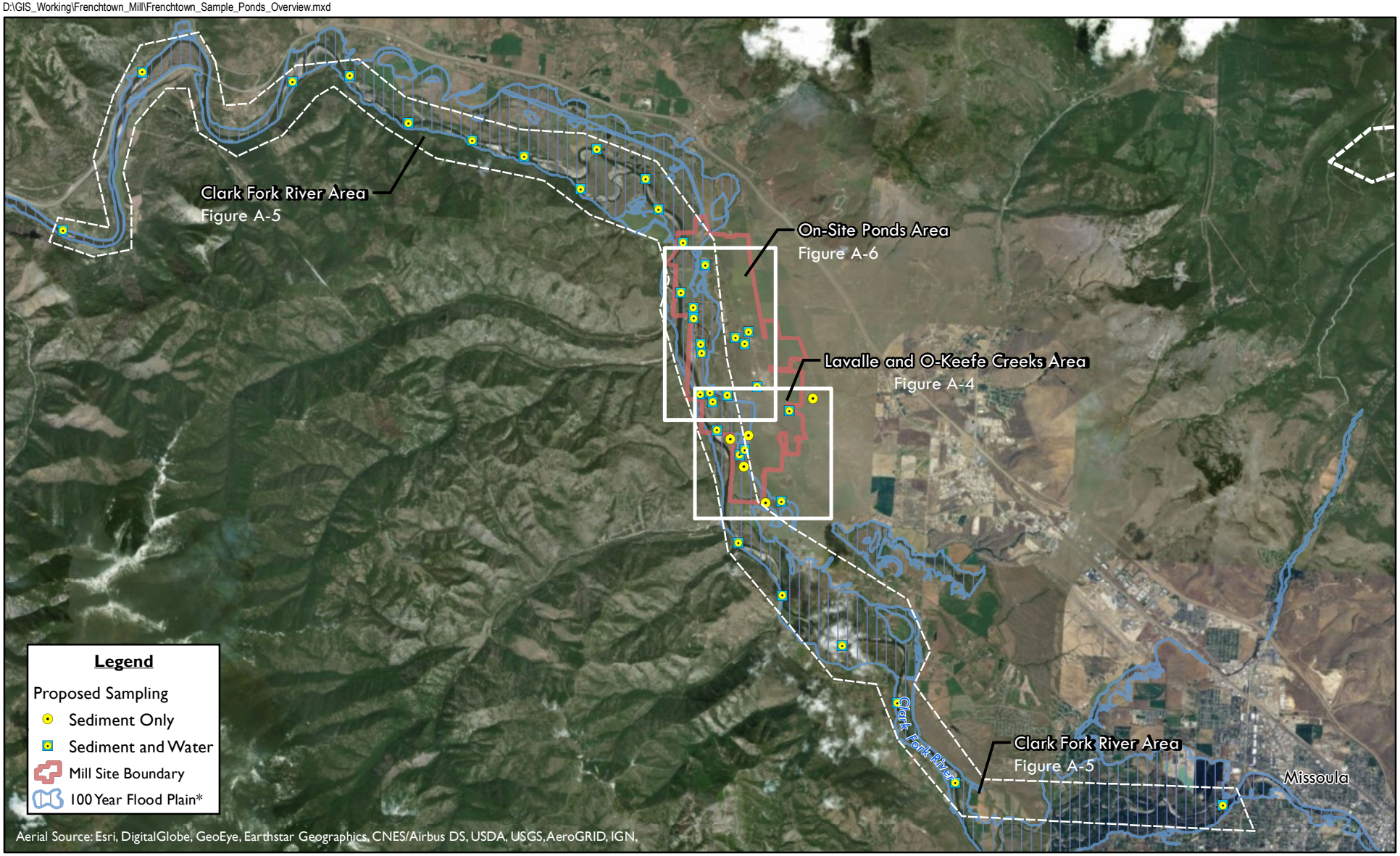
Notes

AG - Agricultural Land
AB - Aeration Stabilization Basin
CFR - Clark Fork River
CL - Clarifier
FP - Floodplain
HP - Holding or Storage Pond
IB - Rapid Infiltration Basin
NPP - North Polishing Pond
P - Settling Pond
SB - Spoils Basin
SPP - South Polishing Pond
SWB - Solid Waste Basin
WR - West of River

NewFields

Site Plan and Operable Units
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE A-2

D:\GIS_Working\Frenchtown_Mill\Frenchtown_Sample_Ponds_Overview.mxd



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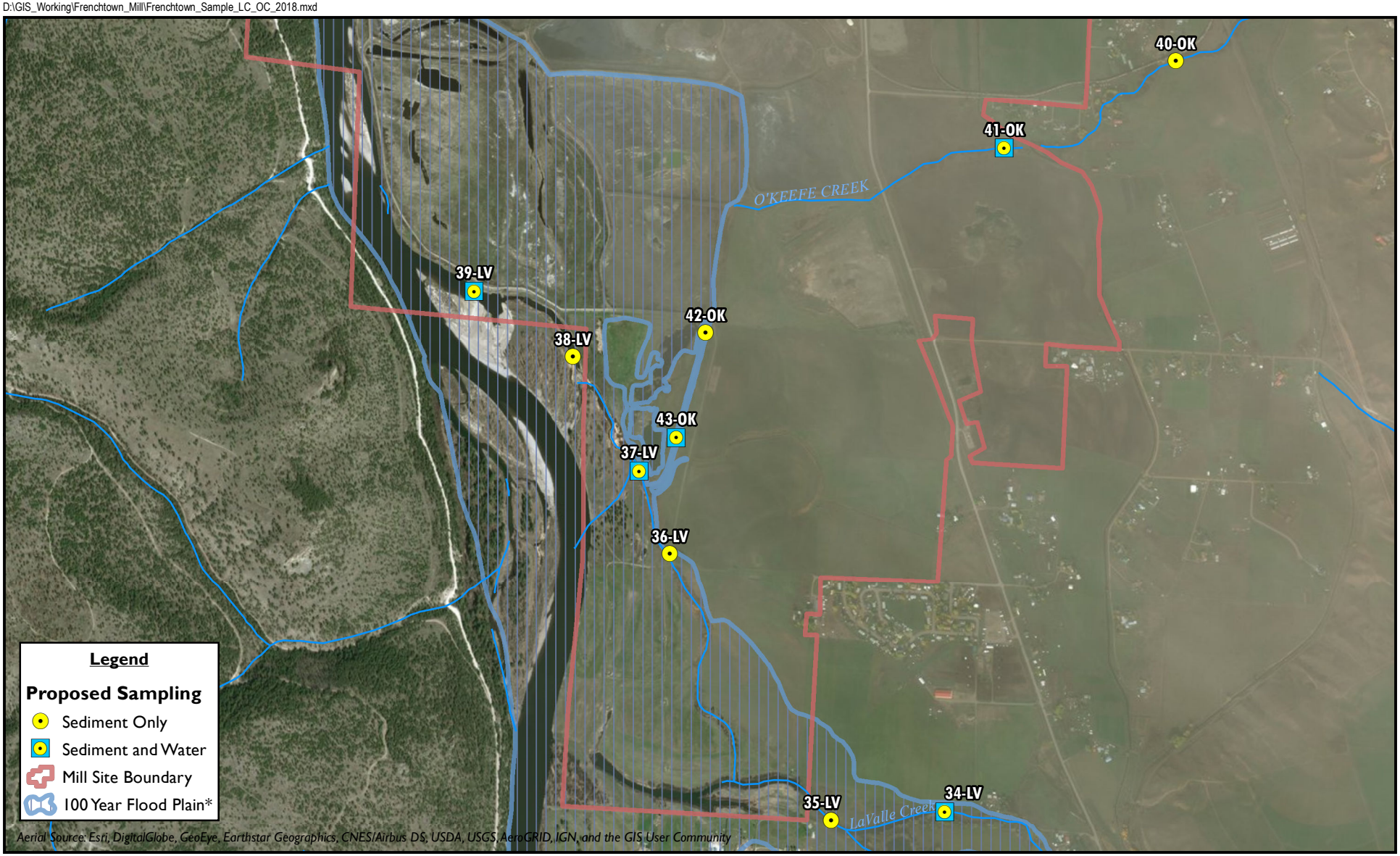
0 Feet 10,000

NewFields

*Floodplain Source:
As defined by the Federal Emergency Management Agency (FEMA) 2013 Digital Flood Insurance Rate Map (DFIRM). (NFIP 2013)

Proposed Sampling Locations Overview
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE A-3

D:\GIS_Working\Frenchtown_Mill\Frenchtown_Sample_LC_OC_2018.mxd



N

0 Feet 2,000

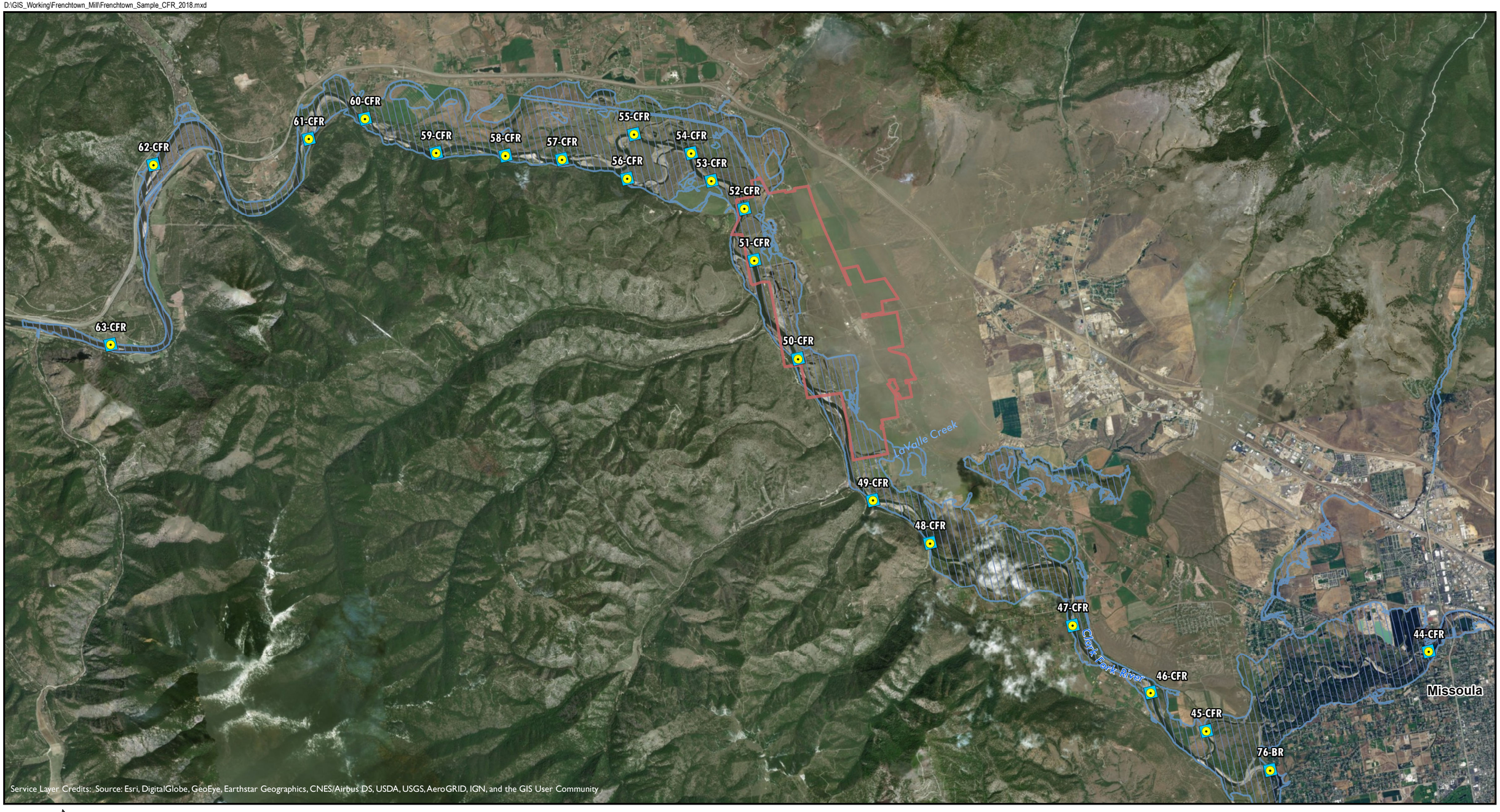
NewFields

*Floodplain Source:
As defined by the Federal Emergency Management Agency (FEMA) 2013 Digital Flood Insurance Rate Map (DFIRM). (NFIP 2013)

Notes
OK - O'Keefe Creek
LV - LaValle Creek

Proposed Sediment and Water Sample Locations in Lavalle and O'Keefe Creeks
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE A-4

D:\GIS_Working\Frenchtown_Mill\Frenchtown_Sample_CFR_2018.mxd



0 Feet 10,000

NewFields

Legend

Proposed Sampling

- Sediment and Water
- Mill Site Boundary
- 100 Year Flood Plain*

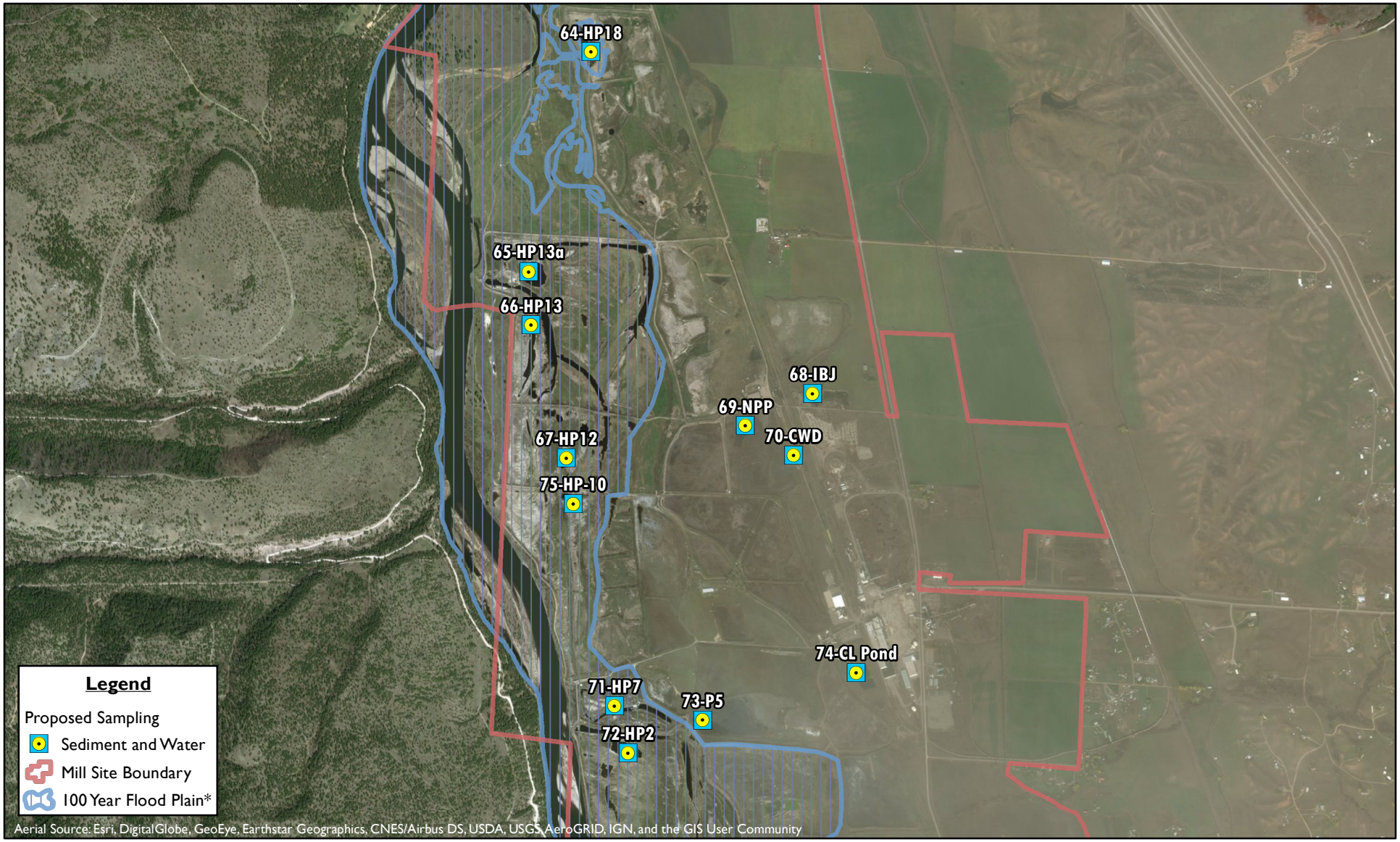
*Floodplain Source:
As defined by the Federal Emergency Management Agency (FEMA) 2013 Digital Flood Insurance Rate Map (DFIRM). (NFIP 2013)

Notes

CFR - Clark Fork River

Proposed Sediment and Water Sample Locations in the Clark Fork River
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE A-5

D:\GIS_Working\Frenchtown_Mill\Frenchtown_Sample_Ponds_2018.mxd



N

0 2,000
Feet

NewFields

*Floodplain Source:
As defined by the Federal Emergency Management Agency (FEMA) 2013 Digital Flood Insurance Rate Map (DFIRM). (NFIP 2013)

Notes
HP - Holding Pond
IBJ - Logyard Basin
NPP - North Polishing Pont
CWD - Cooling Water Ditch
P -Pond
CL - Clarifier Pond

Proposed Sediment and Water Sample Locations

in the On-Site Ponds
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE A-6

TABLES

TABLE A-1
Sample Containers, Preservatives and Holding Times by Analyte List and Matrix
Former Frenchtown Mill Site, Missoula County, Montana

Parameter	Number of Containers	Container Type	Preservative / Additive	Holding Time	Laboratory
Sediment Analysis					
Dioxins / Furans	1	4 ounce amber glass jar	Cool to 4°C	Store at <6oC, or lower, in the dark. Extract within 30 days and analyze within 45 days of extraction. Analyze withing 1 year if sample extracts stored in the dark at < -10oC.	Frontier Analytical Laboratory, El Dorado Hills, CA
Target Analyte List Metals	1	4oz glass jar	Cool to 4°C	6 months with the exception of mercury (28 days).	Pace Analytical
Methylmercury	1	4oz glass jar - no headspace	Cool to 4°C	14 days	
Total Organic Carbon	1	250mL glass jar	Cool to 4°C	28 days	
AVS-SEM	1	4oz glass jar - no headspace	Cool to 4°C	28 days	
Grain Size	1	Doubled Gallon Ziplock Bags	Cool to 4°C	6 months with the exception of mercury (28 days).	
Surface Water Analysis					
Dioxins / Furans	2	1-liter amber glass bottle	Cool to 4°C, sodium thiosulfate	Store at <6oC, or lower, in the dark. Extract within 30 days and analyze within 45 days of extraction. Analyze withing 1 year if sample extracts stored in the dark at < -10oC.	Frontier Analytical Laboratory, El Dorado Hills, CA
Target Analyte List Metals	2	250 mL HDPE bottle (1 Total/1 Dissolved if Field Filtered)	Cool to 4°C; nitric acid to pH<2	6 months with the exception of mercury (28 days).	Pace Analytical
Dissolved Organic Carbon	2	40 mL glass vial	Cool to 4°C; sulfuric acid	28 days	
Total Organic Carbon	1	250 mL amber glass	Cool to 4°C; sulfuric acid to pH<2	28 days	
Nitrate+Nitrite / Phosphorus	1	250 mL HDPE bottle	Cool to 4°C; sulfuric acid to pH<2	28 days	
Common Anions[1] / TDS / conductivity / pH / alkalinity	1	500mL HDPE bottle	Cool to 4°C	All analytes 28 days except TDS (7 days)	
Porewater Analysis					
Target Analyte List Metals	2	250 mL HDPE bottle (minimum volume 80 mL)	Cool to 4°C; nitric acid to pH<2	6 months with the exception of mercury (28 days).	Pace Analytical
Common Anions[1,2]	2	≥ 125 mL HDPE (minimum volume 25 mL)	Cool to 4°C	28 days	
Dissolved Organic Carbon	2	40 mL glass vial (minimum volume 80 mL)	Cool to 4°C; sulfuric acid	28 days	

Notes:

°C degrees celsius
HDPE high density polyethylene
< less than
[1] includes bromide, chloride, fluoride, and sulfate

2 if sufficient volume is available, analysis will also include TDS, Conductivity, pH and Alkalinity.

TDS total dissolved solids
AVS-SEM Acid Volatile Sulfides-Simultaneously Extracted Metals

TABLE A-2
Sediment Sampling Checklist
Former Frenchtown Mill, Missoula County, Montana

Sample Location	Sediment Samples[b]	Type	Analysis					
			Dioxins	Metals	meHg	TOC	AVS-SEM	Grain Size
Lavalle and O'Keefe Creeks								
SE34-LV-SA	1	NM	x	x	x	x		x
SE35-LV-SA	1	NM	x	x	x	x		x
SE36-LV-SA	1	NM	x	x	x	x		x
SE37-LV-SA	1	NM	x	x	x	x		x
SE38-LV-SA	1	NM	x	x	x	x		x
SE39-LV-SA	1	NM	x	x	x	x		x
SE40-OK-SA	1	NM	x	x	x	x		x
SE41-OK-SA	1	NM	x	x	x	x		x
SE42-OK-SA	1	NM	x	x	x	x		x
SE43-OK-SA	1	NM	x	x	x	x		x
SERB	1	QCs	x	x	x			
Dup	1	QCs	x	x	x	x		x
Total NM	10		10	10	10	10		10
Clark Fork River								
SE44-CFR	1	NM	x	x	x	x		x
SE45-CFR	1	NM	x	x	x	x		x
SE46-CFR	1	NM	x	x	x	x		x
SE47-CFR	1	NM	x	x	x	x		x
SE48-CFR	1	NM	x	x	x	x		x
SE49-CFR	1	NM	x	x	x	x		x
SE50-CFR	1	NM	x	x	x	x		x
SE51-CFR	1	NM	x	x	x	x		x
SE52-CFR	1	NM	x	x	x	x		x
SE53-CFR	1	NM	x	x	x	x		x
SE54-CFR	1	NM	x	x	x	x		x
SE55-CFR	1	NM	x	x	x	x		x
SE56-CFR	1	NM	x	x	x	x		x
SE57-CFR	1	NM	x	x	x	x		x
SE58-CFR	1	NM	x	x	x	x		x
SE59-CFR	1	NM	x	x	x	x		x
SE60-CFR	1	NM	x	x	x	x		x
SE61-CFR	1	NM	x	x	x	x		x
SE62-CFR	1	NM	x	x	x	x		x
SE63-CFR	1	NM	x	x	x	x		x
SE76-BR	1	NM	x	x	x	x		x
SERB[a]	---	QCs	x	x	x			
Dup	---	QCs	x	x	x	x		x
Total NM	20		21	21	21	21	0	21
On-Site Ponds								
SE64-HP18	1	NM	x	x	x	x	x	x
SE65-HP13a	1	NM	x	x	x	x	x	x
SE66-HP13	1	NM	x	x	x	x	x	x
SE67-HP12	1	NM	x	x	x	x	x	x
SE68-IBJ	1	NM	x	x	x	x	x	x
SE69-NPP	1	NM	x	x	x	x	x	x
SE70-CWD	1	NM	x	x	x	x	x	x
SE71-HP7	1	NM	x	x	x	x	x	x
SE72-HP2	1	NM	x	x	x	x	x	x
SE73-P5	1	NM	x	x	x	x	x	x
SE74-CL Pond	1	NM	x	x	x	x	x	x
SE75-HP10	1	NM	x	x	x	x	x	x
SERB	1	QCs	x	x	x		x	
Dup	1	QCs	x	x	x	x	x	x
Total NM	12		12	12	12	12	12	12
SERB	---	QCs	3	3	3	3	1	3
Dup	---	QCs	3	3	3	3	1	3
Grand Total NM	42	NM	43	43	43	43	12	43

Notes:

--- - not applicable or no data

CFR - Clark Fork River

BR -Bitterroot River

Dup - field duplicate (e.g., blind field replicate)

x - sample will be analyzed for the respective analyte group. Specific analytes are listed in **Table A-5**

TABLE A-2
Sediment Sampling Checklist
Former Frenchtown Mill, Missoula County, Montana

HP - Holding Pond
LV - LaValle Creek
NM - natural sample
OK - O'Keefe Creek
QC - quality control sample (s - sediment, w - water)
SA - subaqueous
SERB - sediment sample rinse blank
TOC - total organic carbon
AVS-SEM Acid Volatile Sulfides-Simultaneously Extracted Metals
meHg methyl mercury

[a] - Use of new, disposable sampling equipment will not require a rinse blank. At least one deionized (DI) water blank will be also be collected if equipment rinse blanks are collected.
[b] - all samples will be collected from 0-6 inches below surface

TABLE A-3
Surface Water Sampling Checklist
Former Frenchtown Mill, Missoula County, Montana

Sample Location	SW Samples	Type	Analysis					
			Dioxins	Metals (T)	Metals (D)	DOC	TOC	Ancillary[b]
Lavalle and O'Keefe Creeks								
SE34-LV-SA	1	NM	x	x	x	x	x	x
SE35-LV-SA	1	NM						
SE36-LV-SA	1	NM						
SE37-LV-SA	1	NM	x	x	x	x	x	x
SE38-LV-SA	1	NM						
SE39-LV-SA	1	NM	x	x	x	x	x	x
SE40-OK-SA	1	NM						
SE41-OK-SA	1	NM	x	x	x	x	x	x
SE42-OK-SA	1	NM						
SE43-OK-SA	1	NM	x	x	x	x	x	x
SWRB	1	QCw	x	x	x	x	x	x
Dup	1	QCw	x	x	x	x	x	x
Total NM	10		5	5	5	5	5	5
Clark Fork River								
SW44-CFR	1	NM	x	x	x	x	x	x
SW45-CFR	1	NM	x	x	x	x	x	x
SW46-CFR	1	NM	x	x	x	x	x	x
SW47-CFR	1	NM	x	x	x	x	x	x
SW48-CFR	1	NM	x	x	x	x	x	x
SW49-CFR	1	NM	x	x	x	x	x	x
SW50-CFR	1	NM	x	x	x	x	x	x
SW51-CFR	1	NM	x	x	x	x	x	x
SW52-CFR	1	NM	x	x	x	x	x	x
SW53-CFR	1	NM	x	x	x	x	x	x
SW54-CFR	1	NM	x	x	x	x	x	x
SW55-CFR	1	NM	x	x	x	x	x	x
SW56-CFR	1	NM	x	x	x	x	x	x
SW57-CFR	1	NM	x	x	x	x	x	x
SW58-CFR	1	NM	x	x	x	x	x	x
SW59-CFR	1	NM	x	x	x	x	x	x
SW60-CFR	1	NM	x	x	x	x	x	x
SW61-CFR	1	NM	x	x	x	x	x	x
SW62-CFR	1	NM	x	x	x	x	x	x
SW63-CFR	1	NM	x	x	x	x	x	x
SW76-BR	1	NM	x	x	x	x	x	x
SWRB[a]	---	QCw	x	x	x	x	x	x
Dup	---	QCw	x	x	x	x	x	x
On-Site Ponds								
SW64-HP18	1	NM	x	x	x	x	x	x
SW65-HP13a	1	NM	x	x	x	x	x	x
SW66-HP13	1	NM	x	x	x	x	x	x
SW67-HP12	1	NM	x	x	x	x	x	x
SW68-IBJ	1	NM	x	x	x	x	x	x
SW69-NPP	1	NM	x	x	x	x	x	x
SW70-CWD	1	NM	x	x	x	x	x	x
SW71-HP7	1	NM	x	x	x	x	x	x
SW72-HP2	1	NM	x	x	x	x	x	x
SW73-P5	1	NM	x	x	x	x	x	x
SW74-CL Pond	1	NM	x	x	x	x	x	x
SW75-HP10	1	NM	x	x	x	x	x	x
SWRB	1	QCw	x	x	x	x	x	x
Dup	1	QCw	x	x	x	x	x	x
Total NM	12		12	12	12	12	12	12
Total NM	21		21	21	21	21	21	21
SWRB	---	QCw	2	2	2	2	2	0
Dup	---	QCw	2	2	2	2	2	0
Grand Total NM	43	NM	38	38	38	38	38	38

Notes:

--- - not applicable or no data

CFR - Clark Fork River

BR -Bitterroot River

Dup - field duplicate (e.g., blind field replicate)

HP - Holding Pond

Ions - cations, anions, total dissolved solids

x - sample will be analyzed for the respective analyte group. Specific analytes are listed in **Table A-6**

a - Use of new, disposable sampling equipment will not require a rinse blank. At least one deionized (DI) water blank will be also be collected if equipment rinse blanks

TABLE A-3
Surface Water Sampling Checklist
Former Frenchtown Mill, Missoula County, Montana

LV - LaValle Creek
NM - natural sample
OK - O'Keefe Creek
QC - quality control sample (s - sediment, w - water)
SA - subaqueous
SWRB - surface water rinse blank
SW - surface water
DOC - dissolved organic carbon
Metals (T) -total metals
Metals (D) -dissolved metals

are collected.
[b] - includes common anions (Cl, Br, F, and SO_4), total dissolved solids, nitrate/nitrite, phosphate, conductivity, pH, and alkalinity

TABLE A-4

Pore Water Sampling Checklist

Former Frenchtown Mill, Missoula County, Montana

Sample Location	Peeper PW Samples	Type	Analysis		
			Metals (D)	DOC	Anions[a]
On-Site Ponds					
PW64-HP18	1	NM	x	x	x
PW65-HP13a	1	NM	x	x	x
PW66-HP13	1	NM	x	x	x
PW67-HP12	1	NM	x	x	x
PW68-IBJ	1	NM	x	x	x
PW69-NPP	1	NM	x	x	x
PW70-CWD	1	NM	x	x	x
PW71-HP7	1	NM	x	x	x
PW72-HP2	1	NM	x	x	x
PW73-P5	1	NM	x	x	x
PW74-CL Pond	1	NM	x	x	x
PW75-HP10	1	NM	x	x	x
PWRB	1	QCw	x	x	x
Dup	1	QCs	x	x	x
Total NM	12		12	12	12
Total QCw	---	QCw	1	1	1
Total QCs	---	QCs	1	1	1
Grand Total NM	12	NM	12	12	12

Sample Location	PushPoint Samples	Type	Analysis		
			Metals (T)	DOC	Anions[a]
On-Site Ponds					
PP64-HP18	1	NM	x	x	x
PP65-HP13a	1	NM	x	x	x
PP66-HP13	1	NM	x	x	x
PP67-HP12	1	NM	x	x	x
PP68-IBJ	1	NM	x	x	x
PP69-NPP	1	NM	x	x	x
PP70-CWD	1	NM	x	x	x
PP71-HP7	1	NM	x	x	x
PP72-HP2	1	NM	x	x	x
PP73-P5	1	NM	x	x	x
PP74-CL Pond	1	NM	x	x	x
PP75-HP10	1	NM	x	x	x
PPRB	1	QCw	x	x	x
Dup	1	QCs	x	x	x
Total NM	12		12	12	12
Total QCw	---	QCw	1	1	1
Total QCs	---	QCs	1	1	1
Grand Total NM	12	NM	12	12	12

Notes:

--- - not applicable or no data

Dup - field duplicate (e.g., blind field replicat

HP - Holding Pond

Ions - cations, anions, total dissolved solids

NM - natural sample

QC - quality control sample (w - water)

x - sample will be analyzed for the respective analyte group. Specific analytes are listed in **Table A-6**

TOC - total organic carbon

Metals (D) -dissolved metals

Metals (T) -total metals

PWRB - pore water

SA - subaqueous

PWRB - pore water rinse blank

TABLE A-5
Sediment Analytes, Methods, Reporting Limits and Screening Levels
Former Frenchtown Mill Site, Missoula County, Montana

Analytical Method(s)	Target Analyte	CAS	CRQL ISM02.4 / HRSM01.2[c]	Lab Method Detection Limit	Lab Reporting Limit	Units	SLERA Sediment Screening Benchmark[d]	FW Sed[a]	WADOE[b]
Target Analyte List Metals									
EPA 6020 (ICP-MS)	Aluminum	7429-90-5	---	15.8	19.1	mg/kg	25519	---	---
	Arsenic	7440-38-2	0.5	0.47	0.95	mg/kg	9.8	9.8	120
	Barium	7440-39-3	5	0.3	0.57	mg/kg	---	---	---
	Cadmium	7440-43-9	0.5	0.1	0.15	mg/kg	0.99	0.99	5.4
	Chromium	7440-47-3	1	0.72	0.95	mg/kg	43	43.4	88
	Cobalt	7440-48-4	0.5	0.93	0.95	mg/kg	---	50	---
	Copper	7440-50-8	1	1.2	1.9	mg/kg	32	31.6	1200
	Iron	7439-89-6	---	94.2	95.3	mg/kg	188400	20000	---
	Lead	7439-92-1	0.5	0.17	0.19	mg/kg	36	35.8	> 1300
	Manganese	7439-96-5	0.5	0.53	0.96	mg/kg	631	460	---
	Nickel	7440-02-0	0.5	0.58	0.95	mg/kg	23	22.7	110
	Selenium	7782-49-2	2.5	0.56	0.63	mg/kg	---	2	> 20
	Silver	7440-22-4	0.5	0.44	0.95	mg/kg	1	1	1.7
	Vanadium	7440-62-2	2.5	1	1.9	mg/kg	---	---	---
	Zinc	7440-66-6	1	5.1	9.9	mg/kg	121	121	> 4200
EPA 7470/7471 (CVAA)	Mercury	7439-97-6	0.1	0.03	0.04	mg/kg	0.18	0.18	0.8
EPA 1630	Methyl mercury	22967-92-6	---	0.00117	0.0031	mg/kg	---	---	---
Dioxins / Furans									
EPA 8290 high resolution	2,3,7,8-TCDD	1746-01-6	1	0.0184	0.16	ng/kg	0.85	0.85	---
	1,2,3,7,8-PeCDD	40321-76-4	5	0.0275	0.27	ng/kg	---	---	---
	1,2,3,6,7,8-HxCDD	57653-85-7	5	0.0335	0.44	ng/kg	---	---	---
	1,2,3,4,7,8-HxCDD	39227-28-6	5	0.0314	0.39	ng/kg	---	---	---
	1,2,3,7,8,9-HxCDD	19408-74-3	5	0.0296	0.37	ng/kg	---	---	---
	1,2,3,4,6,7,8-HpCDD	35822-46-9	5	0.0492	0.575	ng/kg	---	---	---
	OCDD	3268-87-9	10	0.14	0.93	ng/kg	---	---	---
	2,3,7,8-TCDF	51207-31-9	1	0.0211	0.16	ng/kg	---	---	---
	1,2,3,7,8-PeCDF	57117-41-6	5	0.0235	0.21	ng/kg	---	---	---
	2,3,4,7,8-PeCDF	57117-31-4	5	0.0247	0.22	ng/kg	---	---	---
	1,2,3,6,7,8-HxCDF	57117-44-9	5	0.0235	0.24	ng/kg	---	---	---
	1,2,3,7,8,9-HxCDF	72918-21-9	5	0.032	0.27	ng/kg	---	---	---
	1,2,3,4,7,8-HxCDF	70648-26-9	5	0.0251	0.24	ng/kg	---	---	---
	2,3,4,6,7,8-HxCDF	60851-34-5	5	0.0271	0.27	ng/kg	---	---	---
	1,2,3,4,6,7,8-HpCDF	67562-39-4	5	0.028	0.33	ng/kg	---	---	---
	1,2,3,4,7,8,9-HpCDF	55673-89-7	5	0.0359	0.29	ng/kg	---	---	---
	OCDF	39001-02-0	10	0.0565	0.98	ng/kg	---	---	---
WHO 2005 TEF	TEQ	---	---	---	---	ng/kg	---	---	---
Acid Volatile Sulfides - Simultaneously Extracted Metals									
EPA 821/R-91-100	Cadmium	7440-43-9	0.5		2	µg/L	---	---	---
	Copper	7440-50-8	1		10	µg/L	---	---	---
	Lead	7439-92-1	0.5		20	µg/L	---	---	---
	Nickel	7440-02-0	0.5		20	µg/L	---	---	---
	Zinc	7440-66-6	1		20	µg/L	---	---	---
	Sulfide	18495-25-8	---		200	µg/L	---	---	---
Grain Size									
ASTM D422	Grain Size Analysis	---	---		---	%	---	---	---
Organic Carbon									
EPA Method 9060	Organic Carbon, Total (TOC)	TOC	---		0.10%	---	---	---	---

Notes:

[a] - Mid Atlantic Freshwater Sediment Screening Levels

[b] - Washington State Department of Ecology Sediment Management Standards Cleanup Screening Levels

[c] Contract Laboratory Program (CLP) methods are DLM01.2 and DLM02.1

[d] Benchmarks chosen from hierarchy of sources

MacDonald et al. (2000); consensus-based threshold effect concentration (TEC) and probably effect concentration (PEC).

Ingersoll, et al. (1996); Trheshold Effect Level (TEL) and Probable Effect Level (PEL) for total extraction of sediment (BT) samples from Hyalella azteca 28-day (HA28) tests

Long and Morgan (1990); NOAA Effect Range Low (ERL) and Effect Range Median (ERM).

U.S. EPA Region 3. 2009. Ecological Risk Assessment. Freshwater Screening Benchmarks. Http://ww.epa.gove/reg3hscd/risk/eco/btag/sbv/fw/screenbench.htm

--- - not available or not applicable

Exceeds CRQL

Abbreviations:

CAS - Chemical Abstracts Service
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CVAA - Cold Vapor Atomic Absorption
CRQL - Contract Required Quantification Level
EPA - United States Environmental Protection Agency
HRSM - High Resolution Superfund Methods
ISM - Inorganic Superfund Methods
SLERA - Screening Levels Ecological Risk Assessment
ICP-MS - Inductively Coupled Plasma Mass Spectrum
mg/kg - milligrams per kilogram
pg/g - picograms per gram
TEF - Toxic Equivalency Factor
TEQ - Toxic Equivalency Quotient
WHO - World Health Organization
µg/L - micrograms per liter

TABLE A-6
Water Analytes, Methods, Reporting Limits and Screening Levels
Former Frenchtown Mill Site, Missoula County, Montana

Analytical Method(s)	Target Analyte	CAS	CRQL ISM02.4 / HRSM01.2[e]	Lab Method Detection Limit	Lab Reporting Limit	Units	Aquatic Life Standards Acute	Aquatic Life Standards Chronic	SLERA SW Toxicity Benchmarks[f]	Montana DEQ7 HHS SW[a]	Montana RBSLs[b]	Regional Screening Levels[c] Tap Water		Regional Screening Levels[c] MCL	EPA Secondary Drinking Water Standards[d]
Dioxins / Furans															
EPA 8290 High Resolution	2,3,7,8-TCDD	1746-01-6	10	0.178	0.697	pg/L	---	---	---	---	---	0.12	c*	30	---
	1,2,3,7,8-PeCDD	40321-76-4	50	0.289	1.1	pg/L	---	---	---	---	---	---		---	---
	1,2,3,6,7,8-HxCDD	57653-85-7	50	0.37	1.41	pg/L	---	---	---	---	---	13	c	---	---
	1,2,3,4,7,8-HxCDD	39227-28-6	50	0.311	1.31	pg/L	---	---	---	---	---	13	c	---	---
	1,2,3,7,8,9-HxCDD	19408-74-3	50	0.324	1.25	pg/L	---	---	---	---	---	13	c	---	---
	1,2,3,4,6,7,8-HpCDD	35822-46-9	100	0.393	1.73	pg/L	---	---	---	---	---	---		---	---
	OCDD	3268-87-9	10	1.1	4.72	pg/L	---	---	---	---	---	---		---	---
	2,3,7,8-TCDF	51207-31-9	50	0.174	0.562	pg/L	---	---	---	---	---	---		---	---
	1,2,3,7,8-PeCDF	57117-41-6	50	0.3	0.766	pg/L	---	---	---	---	---	---		---	---
	2,3,4,7,8-PeCDF	57117-31-4	50	0.311	0.812	pg/L	---	---	---	---	---	---		---	---
	1,2,3,6,7,8-HxCDF	57117-44-9	50	0.264	0.689	pg/L	---	---	---	---	---	---		---	---
	1,2,3,7,8,9-HxCDF	72918-21-9	50	0.359	0.885	pg/L	---	---	---	---	---	---		---	---
	1,2,3,4,7,8-HxCDF	70648-26-9	50	0.29	0.691	pg/L	---	---	---	---	---	---		---	---
	2,3,4,6,7,8-HxCDF	60851-34-5	50	0.318	0.743	pg/L	---	---	---	---	---	---		---	---
	1,2,3,4,6,7,8-HpCDF	67562-39-4	50	0.346	0.925	pg/L	---	---	---	---	---	---		---	---
	1,2,3,4,7,8,9-HpCDF	55673-89-7	50	0.484	1.12	pg/L	---	---	---	---	---	---		---	---
	OCDF	39001-02-0	100	0.858	1.9	pg/L	---	---	---	---	---	---		---	---
Target Analyte List Metals															
EPA 6020 (ICP-MS)	Aluminum	7429-90-5	20	2.3	10	ug/L	750	87	87	---	---	2000	n	---	50 - 200
	Antimony	7440-36-0	2	0.117	0.5	ug/L	---	---	---	5.6	---	0.78	n	6	---
	Arsenic	7440-38-2	1	0.21	0.5	ug/L	340	150	150	10	---	0.052	c*	10	---
	Barium	7440-39-3	10	0.14	0.3	ug/L	---	---	5000	1000	---	380	n	2000	---
	Beryllium	7440-41-7	1	0.0635	0.2	ug/L	---	---	---	4	---	2.5	n	4	---
	Cadmium	7440-43-9	1	0.028	0.08	ug/L	1.04	0.48	0.25	5	---	0.92	n	5	---
	Chromium	7440-47-3	2	0.13	0.5	ug/L	---	---	---	100	---	--		100	---
	Cobalt	7440-48-4	1	0.15	0.5	ug/L	---	---	23	---	---	0.6	n	---	---
	Copper	7440-50-8	2	0.2	1	ug/L	7.86	5.53	9	1300	---	80	n	1300	1000
	Iron	7439-89-6	200	6.8	50	ug/L	---	1000	1000	---	---	1400	n		300
	Lead	7439-92-1	1	0.028	0.1	ug/L	37.4	1.46	2.5	15	---	15	L	15	---
	Manganese	7439-96-5	1	0.098	0.5	ug/L	---	---	120	---	---	43	n	---	50
	Nickel	7440-02-0	1	0.12	0.5	ug/L	279.3	31.1	52	100	---	39	n	---	---
	Selenium	7782-49-2	5	0.17	0.5	ug/L	20	5	3.1	50	---	10	n	50	---
	Silver	7440-22-4	1	0.17	0.5	ug/L	1.41	---	0.3	100	---	9.4	n	---	100
	Thallium	7440-28-0	1	0.028	0.1	ug/L	---	---	12	0.24	---	0.02	n	2	---
	Vanadium	7440-62-2	5	0.27	1	ug/L	---	---	20	---	---	8.6	n	---	---
	Zinc	7440-66-6	2	0.82	5	ug/L	71.3	71.3	118	7400	---	600	n	---	5000
EPA 6010C (ICP-AES)	Calcium	7440-70-2	5000	11.4	40	ug/L	---	---	11600	---	---	---		---	---
	Magnesium	7439-95-4	5000	3	10	ug/L	---	---	---	---	---	---		---	---
	Potassium	7440-09-7	5000	12.5	50	ug/L	---	---	---	---	---	---		---	---
	Sodium	7440-23-5	5000	14	50	ug/L	---	---	680000	---	---	---		---	---
EPA 7470/7471 (CVAA)	Mercury	7439-97-6	0.2	0.022	0.2	ug/L	1.7	0.91	---	0.05	---	0.063	n	2	---
Other Water Quality Parameters															
EPA 300.0	Chloride	16887-00-6	---	0.28	1.08	mg/L	---	---	---	---	---	---		---	250
	Fluoride	7782-41-4	---	0.0262	0.05	mg/L	---	---	---	---	---	1200		4000	2
	Bromide	24959-67-9	---	0.08	0.011	mg/L	---	---	---	---	---	---		---	---
	Sulfate	18785-72-3	---	0.19	1.06	mg/L	---	---	---	---	---	---		---	250
EPA 353.2	Nitrate + Nitrite	NO3+NO2	---	0.011	0.044	mg/L	---	---	---	10	---	---		10	---
SM 2320B	Alkalinity	ALK	---	1	5	mg/L	---	---	---	---	---	---		---	250
SM 4500-P-E	Phosphorus	7723-14-0	---	0.043	0.039	mg/L	---	---	---	---	---	---		---	--
SM 2540C	Total Dissolved Solids	TDS	---	100	57	mg/L	---	---	---	---	---	---		---	500
SM 5310C	Total Organic Carbon	TOC	---	0.24	1	mg/L	---	---	---	---	---	---		---	---
	Dissolved Organic Carbon	7440-44-0	---	0.1	1	mg/L	---	---	---	---	---	---		---	---
SM2510 B	Conductivity	Cond	---	1	1	umhos/cm	---	---	---	---	---	---		---	---
SM4500-H B	pH	pH	---	0.1	0.1	s.u.	---	---	---	---	---	---		---	6.5-8.5

Notes:

[a] Montana Department of Environmental Quality, Circular-7 Numerical Water Quality Standards (MDEQ 2012)
[b] Montana Department of Environmental Quality Tier 1 Risk Based Screening Levels for Soil with an assumed depth to groundwater of 10-20 feet (September 2009)
[c] Regional Screening Levels for Chemical Contaminants at Superfund Sites (June 2015) (EPA 2015)
[d] National Secondary Drinking Water Regulations (EPA 2002)
[e] Contract Laboratory Program (CLP) methods are DLM01.2 and DLM02.1
[f] Benchmarks chosen from hierarchy of sources
National Ambient Water Quality Criteria - Chronic
Great Lakes Water Quality Initiative Tier II Secondary Chronic Value
USEPA Region 4 Screening Values- Chronic

BLUE FONT Water quality standard was adjusted to account for sample hardness. The lowest adjusted standard from the most recent surface water sampling event was selected.
Exceeds Tap Water RSL only
Exceeds SLERA Surface Water Toxicity Benchmark only
Exceeds Tap Water RSL and MT DEQ7 HHS SW
Exceeds Chronic aquatic life standard, SLERA benchmark, and Tap Water RSL

--- - not applicable or not available
°C - degrees Celsius
CAS - Chemical Abstracts Service
CVAA - Cold Vapor Atomic Absorption
DEQ7 - Montana Department of Environmental Quality Circular 7 Numerical Standards
EPA - United States Environmental Protection Agency
GW - Groundwater
CRQL - Contract Required Quantitation Limits
HHS - Human Health Standards
HRSM - High Resolution Superfund Methods
ICP-AES - Inductively Coupled Plasma Atomic Emission Spectrum
ICP-MS - Inductively Coupled Plasma Mass Spectrum
ISM - Inorganic Superfund Methods
MCL - Maximum Contaminant Level
mg/L - milligrams per liter
pg/L - picograms per liter
RBSL - Risk-Based Screening Levels
SLERA - Screening Levels Ecological Risk Assessment
SM - Standard Methods
SW - Surface water
µg/L - micrograms per liter
s.u. - Standard Units

ATTACHMENT A
Standard Operating Procedures

STANDARD OPERATING PROCEDURES TABLE OF CONTENTS	
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4	Sample Packaging and Shipping
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6	Field Measurement of pH
7	Field Measurement of Dissolved Oxygen
8	Field Measurement of Oxidation Reduction Potential ORP
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10	Surface Water Sampling
11	Subaqueous Sediment Sample Collection
SD-04	Subaqueous Sediment Sample Collection via Grab Sampler
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15	Corrective Action Procedures
	Integral Porewater Sampling Method

SOP-1

FIELD LOG BOOK AND FIELD SAMPLING FORMS

Pertinent field investigation and sampling information should be recorded on a daily field log book and appropriate sampling forms to provide a continual record of actions taken each day on the site. Each employee is responsible for completing a record of the day's activities in a log book and field forms of sufficient detail such that someone can reconstruct the field activities without relying on the memory of the field crew. Field Books will be bound, with consecutively numbered pages and all information must be recorded with permanent ink. If changes need to me made within the field book, a single strikethrough line will be used to mark out incorrect information. Initials of the employee making the corrections and the date of the correction must accompany the strikeout. At a minimum, daily entries on the field log book shall include, as appropriate:

Purpose

To provide guidance on how to document activities completed in the field by NewFields employees

Goal and Objective

To provide a record of our project work and the decisions made in the field

Equipment Needs

Field Note Book
Field Sampling Forms
Permanent Writing Utensils
Camera

- Project and client name
- Date, times and locations.
- Purpose of the field effort
- Names of field crew leader and team members present on the site, and other site visitors
- Description of site conditions and any unusual circumstances, including weather conditions
- Details of actual work performed, particularly any deviations from the field work plan or standard operating procedures
- Location of sample site, including map reference, if relevant
- Field observations including documentations of conditions and procedures used when collecting, handling or treating samples.
- Field measurements made (e.g., PID readings, pH, temperature) on appropriate forms.
- Date and time of initiation and cessation of work.

Specific details for each sample collected should be recorded using NewFields standardized field forms. These field forms contain blank queries to be filled in by field personnel. Items typically recorded on field sampling forms consist of the following:

- Sample name
- Time and date samples were collected
- Number and type (media; natural, duplicate, QA/QC) of samples collected
- Analysis requested
- Sample depth

- Sample preservative (if applicable) and volume
- Sampling method, particularly any deviations from standard operating procedures
- Additional field observations, including collection of field parameters
- Decontamination procedures (if applicable)
- Photo documentation; including a photo board in the photograph with details such as date, time and location or an accompanying photo log with descriptions, dates, and times.
- Signature of sampler

The field log book and field data sheet must be signed on a daily basis by the author of the entry. Upon completion of the field effort, the original field forms will be electronically scanned and both hard copies and electronic documents will be filed in their respective project file. Photocopies of the original field forms can be made and used as working documents.

SOP-2

EQUIPMENT DECONTAMINATION

Decontamination of field equipment is necessary to prevent cross contamination between sites to be investigated and sampling locations on a site. Decontamination should be performed on all non-dedicated and non-disposable sampling equipment that may contact potentially contaminated media.

The following should be done to decontaminate field sampling equipment:

- Set up a decontamination area, preferably upwind from your sampling area to reduce the potential for windborne contamination.
- Don disposal gloves while decontaminating equipment.
- Prior to initiating decontamination, visually inspect sampling equipment for evidence of contamination; use stiff brush to remove visible material.
- Once rough brushing is complete, decontaminate each piece of equipment following a sequential process of washing with Liquinox or an equivalent degreasing detergent; rinsing with distilled water; rinsing with 10% dilute nitric acid; and finally rinsing with distilled water three times. Best procedure is to set up wash tubs for each of the above processes.
- Rinse equipment with methanol instead of nitric acid if sampling for organic contamination.
- Decontaminated equipment that is used for sampling organics should be wrapped in aluminum foil or another inert material if not used immediately.

The following should be done for oversized equipment, such as drilling rigs and excavators:

- Determine whether rinsate generated during decontamination must be containerized. If so, establish a lined decontamination area and move equipment into this area prior to decontamination. If not, decontamination should be done far enough away from the area of sampling so that rinsate generated does not affect future anticipated samples as part of the investigation. The area should also allow for the infiltration of the rinsate into the soil.

Purpose

The purpose of this SOP is to describe general decontamination procedures for field equipment

Goal and Objective

To sufficiently clean field equipment to prevent cross contamination between sites and sample locations

Equipment Needs

5-gallon plastic tubs/buckets

Distilled water

10% Nitric Acid rinse (if metals are COC)

10% Methanol (if organic COC are present)

Liquinox Soap

Hard Bristle Brush

Garbage Bags

Disposable Gloves

Paper Towels

55-gallon drums (optional depending on need to containerize wash water)

Steam cleaning equipment/water truck

- Decontaminate tracks, auger flights, wheels and excavator buckets using a high pressure washer, preferably using hot water.

All disposable items (e.g., paper towels, latex gloves) should be deposited into a garbage bag and disposed of as Class II common refuse, unless you are investigating a site known to contain hazardous wastes. Check with the project manager before initiating investigation to confirm proper handling of disposable items. Handling and disposal procedures for the rinse and wash water will depend on the likely presence and type of contaminant in the wash water. The project Field Sampling Plan should be reviewed to determine the process for handling wash water.

If equipment rinse blank samples are to be collected as part of quality control procedures, they should be collected from decontaminated sampling equipment in accordance with the project-specific Field Sampling and documented in accordance with SOP-1.

A list of equipment for decontamination is provided above (text box). The amount of dissolved water and rinse solutions needed on site will depend on the number of samples to be collected and the sampling methods. For this reason, equipment needs should be evaluated prior to going in the field.

SOP-3

SAMPLE NOMENCLATURE, DOCUMENTATION, AND CHAIN-OF CUSTODY PROCEDURES

When completing sampling it is critical that the process used to label and transport samples to the laboratory for analysis is sufficient to demonstrate with confidence that the samples were collected from the location indicated, and that during transport to the lab no actions were taken to potentially alter the integrity of the samples. Without following strict sample labeling and chain-of-custody procedures, analytical data collected at a site has little to no value.

Purpose

To identify the specific requirements for labeling and documenting sample collection

Goal and Objective

To increase the confidence in sample locations and to submit samples to the laboratory without risk of integrity loss

SAMPLE Identifiers

Samples are labeled in such a way to allow a person unfamiliar with the site to understand where the samples were collected. Samples should be labeled sequentially beginning where previous investigations left off. The sample label would be ordered as follows:

> Sample **media type,** sequential location number - general location designation - sample **media sub-type** - composite designation (if needed).

For example, the thirtieth sediment sample (SE) collected in the CFR from subaqueous sediments (SA) would be labeled SE30-CFR-SA. Discrete samples are assumed. If the sample is a composite then the label will include a "c" at the end, ie: SE30-CFR-SA-c.

The surface water sample from the same location would be given the designation (SW) ie: SW30-CFR. The surface water sample sequential number should always match that of the sediment number if the samples are collocated. The same process is followed for pore water sample designation.

For additional reference, sample IDs are provided in the FSP location maps and analytical checklists.

SAMPLE DOCUMENTATION

In addition to the chain-of-custody forms discussed below, field person will keep a list of samples collected in the field in the field log book and on appropriate field sampling forms. Upon returning to the office, the field log book and forms will be scanned and electronic files will be put in the project file. Hard copies will be maintained in the project file and copies sent to the laboratory, or other designated parties, as needed.

Each person in the field is responsible for entering information into the field log and sampling forms. All entries on the log book and field sampling forms must be made in indelible ink.

Table SOP-3.1.

Sampling Acronym			
Media Type		**Media Sub-Type**	
AA	Ambient Air		
BH	Borehole		
DW	Domestic Well		
EB	Equipment Blank		
FB	Field Blank		
FW	Flood Way (Floodplain)		
GW	Groundwater Sample		
IW	Injection Well		
MW	Monitoring Well		
OB	Observation Well		
PA	Pond Area		
PW	Pore Water		
SB	Subsurface Soil Sample		
SE	Sediments	FF	Flood Fringe (Floodplain)
		SA	Subaqueous
SPR	Spring		
SR	Surface Runoff		
SS	Surface Soil Sample		
SUMP	Sump (Water sample)		
SW	Surface Water		
TB	Trip Blank		
TI	Tissue	BMI	Benthic Macroinvertebrate
		LD	Longnose dace
		SM	Small mammal
TP	Excavated Test Pit		
UST	Underground Storage Tank		
VE	Vapor Extraction		

CHAIN OF CUSTODY PROCEDURES

A chain-of-custody form must be generated for all samples collected in the field for laboratory analysis. Samples from more than one project should not be included on the same chain of custody; however, multiple samples from a specific project can be included on the same custody form.

Copies of the chain-of-custody form should be maintained in the project file. The sampler may use a NewFields' chain-of-custody form or a chain- of-custody form provided by the laboratory. Sample custody records must be maintained from the time of sample collection until the time of sample delivery to the analytical laboratory and should accompany the sample through analysis and final disposition. The information to be included on the chain-of-custody form will include, but is not limited to:

- Project number/site name

- Sampler's name and signature
- Date and time of sample collection
- Unique sample identification number or name
- Number of containers
- Sample media (e.g., soil, water, vapor, etc.)
- Sample preservative (if applicable)
- Requested analysis
- Comments or special instructions to the laboratory

Each sample must be assigned a unique sample identification number as described above. The information on the chain-of-custody form, including the sample identification number, must correspond to the information recorded by the sampler on the field forms and field log book and the label on the sample container.

A sample is considered under a person's control when it is in their possession. When custody of a sample is relinquished by the sampler, the sampler will sign and date the chain-of-custody form and note the time that custody was relinquished. The person receiving custody of the sample will also sign and date the form and note the time that the sample was accepted into custody. The goal is to provide a complete record of control of the samples. Should the chain be broken (signed by the relinquished but not receiver or vice versa), the integrity of the sample is lost and the resulting analytical data suspect. Samples must be shipped to the analytical laboratory following the procedures described in in SOP-4. If an overnight shipping service is used to transport the samples to the laboratory, custody of the samples must be relinquished to the shipping service. If possible, have the shipping service sign the chain-of-custody form prior to placing the chain of custody in the sample cooler. If this is not possible (i.e. form placed in the sealed cooler), a note should be included on the chain of custody that the shipping company has received the samples with the chain of custody inside the cooler.

SOP-4

SAMPLE PACKAGING AND SHIPPING

SAMPLE PACKAGING

Samples must be packaged to preclude breakage or damage to sample containers, and shipped under chain of custody, complying with shipper, U.S. EPA, and U.S. DOT regulations. When packaging samples:

- Chain of custody procedures must be strictly adhered to. This applies to sample collection, transportation, shipment and laboratory handling. The COC will provide documentation from collection to analysis.
- Use sample labels from the laboratory whenever possible. Place the sample label on the side of the sample container and use indelible ink when completing the label. Sample containers should be new and stored in an environment free from dust, dirt and fumes.
- Sample should never stand in the sun. After collection and preservation, place labeled sample bottles in a high quality cooler. Place the samples in an upright position inside the cooler and wrap the samples with cushioning material for protection during transport. The cooler should be able to withstand tough handling during shipment without sample breakage.
- Make sure the cooler has an adequate amount of "wet" or "blue" ice (inside sealed Ziploc bags) at all times containers or in them and make sure ice volume is sufficient and appropriate for the season in order to maintain a temperature of 4°C or less inside the cooler from the time the samples are placed in the cooler until they are received by the laboratory. When in doubt put in more ice. Ensure the cooler drain plug is taped shut.
- Fill out the appropriate chain-of-custody forms and place them in a Ziploc bag and tape it to the inside lid of the shipping container. If more than one cooler is used per chain of custody, put a photocopy in the other coolers and mark them as a copy. Commercial carriers are not required to sign the COC, but the tracking number and name of the carrier should be documented on the original cahin-of-custody.
- Close and thoroughly secure the cooler with packing tape.

Purpose

To ensure samples are properly packaged for shipment to the analytical laboratory

Goal and Objective

To have samples received by the analytical laboratory in good condition and within EPA temperature thresholds

Equipment Needs

Indelible ink pen

Chain-of-custody forms

Custody Seals

Sample Labels from Lab

Coolers and Ice

Field Sampling Form

Packing Tape

Bubble wrap/absorbent pads

- Place completed sample custody seals on the outside of the cooler such that the seals will be broken when the cooler is opened. Secure the custody seals on the cooler with clear strapping tape.
- Secure a shipping label with address, phone number, and return address on the outside of the cooler where it is clearly visible. Shipping samples should be coordinated and scheduled to prevent exceeding of hold times or temperature requirements of analytical tests. Check with the lab if there are questions regarding holding times. If Saturday delivery is necessary, confirm with the lab that they will be able to receive the sample delivery before it is shipped.

SHIPPING HAZARDOUS MATERIALS/WASTE

Transportation regulations for shipping of hazardous substances and dangerous goods are defined by the U.S. DOT in 49 CFR, Subchapter C, Part 171 (October 1, 1988); IATA and ICAO. These regulations are accepted by Federal Express and other ground and air carriers.

According to DOT regulations, environmental samples are classified as Other Regulated Substances (ORS). ORS are articles, samples, or materials that are suspected or known to contain contaminants and/or are capable of posing a risk to health, safety, or property when transported by ground or air. Samples, substances, or materials from sources other than material drums, leachate streams, or sludge, should be considered as ORS or environmental samples. Materials shipped under the classification of ORS must not meet any of the following definitions:

Class 1: Explosives; Class 2: Gases- compressed, liquefied, dissolved under pressure, or deeply refrigerated; Class 3 Flammable Liquids; Class 4: Substances susceptible to spontaneous combustion; Class 5: Oxidizing substances; Class 6: Poisonous (toxic and infectious); Class 7: Radioactive materials; Class 8: Corrosives.

If your samples might meet any of the above definitions, contact the project manager to obtain instructions on sample shipment.

SOP-5

FIELD MEASUREMENT OF ELECTRIC OR SPECIFIC CONDUCTANCE

Purpose

To ensure measurement of specific conductance is done consistently and correctly in the field

Goal and Objective

To obtain accurate specific conductivity measurements in the field

Equipment Needs

Specific Conductivity Meter

Calibration Standard

Measurement container

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

INSTRUMENT CALIBRATION

The conductivity meter should be inspected and calibrated prior to each sampling event following the manufacturer's recommendations. If the instrument is a multi-parameter meter, follow the instructions for measurement of electric or specific conductance from the manual.

Prior to calibrating the field meter, the expiration date on the conductivity calibration solution should be checked. If the standard has expired, it should be discarded.

During calibration the standard value and units should be recorded on the apropriate field form, in addition to the meter reading. The date, time, calibration solution used, and individual performing the calibration is recorded and maintained with the field notes for the project.

Prior to conducting field measurements, verify the meter automatically corrects for temperature variations, by consulting the manufacturers instruction manual. If the meter does not, apply the appropriate temperature correction to the field measurements.

FIELD MEASUREMENT PROCEDURE

Rinse a decontaminated glass container or plastic flow-through cell with sample water.

Fill the container or flow-through cell with sample water, with enough available space to insert the probe without undesired overflow of the container.

Rinse the conductivity or multi-parameter probe with deionized water and place it in the beaker of sample water. Immerse the probe in beaker and move it around to displace any air bubbles. Keep the probe tip off of the sides of the beaker. Record the conductivity reading. Be sure to recognize the units of the reading (i.e. microseimens/centimeter (µs/cm), micromhos/centimeter (µmhos/cm), or milliseimens/centimeter (ms/cm). Record the reading on the field sampling form and filed log book. If the reading is being taken in-situ or using a flow-through cell, record the reading at time intervals until the reading stabilizes and samples are collected.

Remove the probe from sample and decontaminate probe. Store the probe following the manufacturer's recommendations.

SOP-6

FIELD MEASUREMENT OF PH

INSTRUMENT CALIBRATION

The pH meter must be calibrated prior to each daily field event, or more frequently if required by the project/client. Follow the manufacturer's recommendations to calibrate. Inspect the probe daily for damages or defects. A three-point calibration should be completed (unless meter manual specifies otherwise), using pH standards 4.0, 7.0 and 10.0. If instrument is a multi-parameter meter, follow the instructions for measurement of pH from the manual.

Prior to calibrating the field meter, the expiration date of the calibration solutions should be checked. If the standard has expired, it should be discarded. During calibration the standard value and units should be recorded on the appropriate field form, in addition to the meter reading.

Periodically throughout the field day, place the probe in 7.0 pH buffer solution. If the measured value differs from the expected value by more than 0.1 pH units, recalibrate the meter according to the manufacturer's instructions.

Purpose

Provide guidelines for pH measurements in water samples

Goal and Objective

To obtain accurate pH measurements in the field

Equipment Needs

pH Meter

Calibration standards

Glass container or flow-through cell

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

FIELD MEASUREMENT PROCEDURE

- Rinse a decontaminated glass beaker or plastic flow-through cell sample water three times.
- Rinse the pH probe with deionized water.
- Fill the container with sample water.
- Immerse the probe in the sample and agitate it to provide thorough mixing. Continue to agitate until the reading has stabilized. Read the pH to the nearest 0.1 s.u. and record on the field sampling form. If the reading is being taken using a flow-through cell, record the readings until they stabilize prior to sample collection. If the measurement is taken in-situ, wait until the reading has stabilized then recorded it on the field form.
- Note any problems such as erratic readings. If previous readings are available, compare the current measurement to previous reading to check that the current reading is within reasonable limits.
- Rinse probe with deionized water, decontaminate as necessary and store according to the manufacturer's instructions.

SOP-7

FIELD MEASUREMENT OF DISSOLVED OXYGEN

FIELD MEASUREMENT PROCEDURE

Before each use, clean and rinse the electrode tip with distilled water. Verify that the membrane cap has been filled with DO electrolyte in accordance with manufacturers required maintenance schedule (does not apply if measurement uses and optical DO probe). Visibly check the meter for damage or defects, and cleanliness.

Calibrate the probe and meter using the fresh water-air calibration method described in the manufacturer's manual. Correct the calibration value for temperature and altitude and adjust the meter accordingly. Record all calibration measurements and units on field forms. Note: Sensor can maintain polarization when disconnected from the meter for up to three hours.

Place probe the directly into the stream or well to be measured. If not possible, place the probe into a flow-through cell (must fill flow cell from the bottom, for accurate DO) receiving a continuous stream of water from the source being measured. Does not measure DO in a container of sample water extracted from a well. Allow sufficient time for the probe to stabilize to sample temperature and dissolved oxygen concentration. Record the dissolved oxygen value on the appropriate field forms. Decontaminate probe when measurement is complete.

If the sensor will not calibrate, becomes sluggish or erratic, note the behavior in the field log book and:

- Clean tip and refill cap with DO electrolyte in accordance with manufacturer's instructions (typically care must be taken to eliminate air bubbles from inside probe, and probe tip must be scarified using manufacturer-provided sandpaper).
- Check membrane for damage, replace if necessary.
- Check meter with test plug.
- Replace battery.

Purpose

Provide guidelines for Dissolved Oxygen measurements in water samples

Goal and Objective

To obtain accurate dissolved oxygen measurements in the field

Equipment Needs

Dissolved Oxygen Meter

Distilled water

Calibration cup

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

SOP-8

FIELD MEASUREMENT OF OXIDATION REDUCTION POTENTIAL (ORP)

FIELD MEASUREMENT PROCEDURE

- Calibrate the meter in accordance with the manufacturer's instructions prior to each daily sampling event. Inspect the meter for damage, defects and cleanliness.
- Prior to calibrating the field meter, the expiration/preparation date of the calibration solution should be checked. If the standard has expired, it should be discarded. During calibration the standard value and units should be recorded on the appropriate field form, in addition to the meter reading. Make sure the calibration input is correct for the ORP solution and temperature by verifying it with the calibration solution manufacturers supplied table.
- If possible, obtain an in situ measurement of ORP in an effort to minimize agitation of the sample and limit exposure to oxygen. If not possible, use a flow-through cell that receives a constant stream of water from the well. If a flow-through cell is not available, ORP measurements can be taken of sample water placed in a glass container or beaker.
- All sampling equipment should be decontaminated it in accordance with SOP-2.
- If collecting a sample in-situ or in a flow through cell, place the ORP probe into the cell or the water.
- If using a beaker, rinse the ORP electrode with distilled water and then with sample water prior to inserting it into the sample beaker. Immerse the ORP electrode in the beaker and allow at least one minute for the probe to equilibrate with the water. Obtain a reading to the nearest ten millivolts.
- Record the reading on standardized field forms and the field book. Note any problems such as erratic or drifting readings.
- Decontaminate the probe following the SOP-2, store probe in accordance with manufactures specifications.

Purpose

Provide guidelines for Redox Potential measurements in water samples

Goal and Objective

To obtain accurate Redox Potential measurements in the field

Equipment Needs

Redox Potential Meter

Distilled water

Calibration solution with table of temperature adjustment information

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

SOP-9

FIELD SAMPLE FILTRATION

FIELD PROCEDURE

- Set up a system whereby water samples can be filtered, including a disposable filter apparatus and use of a pump (peristaltic, hand-vacuum or other suitable pump) to force water under pressure through the filter.
- To avoid the need for decontamination, use disposable tubing, filters and equipment when possible.
- When collecting a grab sample of water collect the groundwater or surface water using a decontaminated bailer or similar sampling device and place water into a decontaminated vessel that can be pressurized to force the water through a disposable 0.45 micron filter.
- If a groundwater sample is being collected using a submersible pump, the submersible pump can be used to push the water through the filter.
- Filtered effluent should be placed directly into appropriate laboratory supplied sample containers and capped. Add preservative as necessary prior to capping.
- Invert sample container several times to insure complete sample-preservative mixing.
- Place sample into cooler; package and ship accordance with SOP-4 concerning shipping.
- Decontaminate, if necessary, all equipment in accordance with the SOP concerning decontamination.

  Note: If extremely turbid sample water is obtained, you may need to pre-filter the sample using 3.0 or 5.0 micron filter paper followed by 0.45 micron filtration.

Purpose

Provide guidelines for filtering water samples in the field

Goal and Objective

To employ a method of filtering samples in the field, thus removing sediment from the sample and allowing for analysis of dissolved components in the sample

Equipment Needs

0.45 micron disposable filters

3.0 and 5.0 micron disposable filter paper (if necessary)

Disposable peristaltic tubing (if using a peristaltic pump)

Pump (peristaltic or other)

Preservatives, as required

Indelible Ink Pen

Field Sampling Form

SOP-10

SURFACE WATER SAMPLING

This SOP describes the field equipment and sampling methods for collection of surface water samples from shallow fresh-water bodies. Review project specific Field Sampling Plans (FSP) in addition to this SOP.

Purpose

To provide field sampling methodologies for surface water

Goal and Objective

To ensure surface water samples are collected consistently in the field

Equipment Needs

Decontamination equipment and fluids

Latex or Nitrile gloves

pH, conductivity, temperature meter

Coolers and ice

Sample bottles Preservatives

Indelible marker

Field sampling Form

Chain-of-custody

GRAB SAMPLING

- When river sampling, field personnel should always start downstream and work upstream to avoid contaminating unsampled areas with sediment suspended by working in the river.
- If sampling is to occur in a water body without a current (such as a pond or lake) the field team must take care to minimize the amount of sediment that is disturbed.
- Sampling can be conducted using a dip sampler for more difficult to reach or higher current areas. A dip sampler consists of a container attached to the end of a pole using an adjustable clamp.
- Sampling can be conducted by hand if conditions permit.
- When collecting a grab sample of surface water attempt to collect the sample at the interval in the stream which exhibits the largest volume of flow and/or highest velocity. More than one interval may be sampled.
- If required, field parameters should be measured in accordance with the applicable SOP (SOPs 5 through 7) prior to collecting a sample for analytical testing. Take care to collect measurements from the sample locations in the stream as the grab sample.

Note: Ensure that the sample container used for collection has not been pre-preserved. In this case, a decontaminated clean sampling container should be used to collect the sample and then transferred to the appropriate container with the preservatives.

- To collect a sample, submerge the appropriate container such that mouth of bottle is submerged below the water surface 2 to 3 inches, if possible. If sampling inorganics, allow bottle to fill partially; rinse bottle by shaking and discharge this water away from sample site. Repeat this procedure three times. Do not rinse sample bottles for organics analysis. Pour collected water into pre-labeled sampling container.
- If water is too shallow to fill directly to sample bottles use a decontaminated container to collect sample water. Transfer water from compositing container into pre-labeled sampling bottles.

- Where multiple chemical analysis are to be performed, fill sample containers in the following order: VOCs, semivolatile organics, inorganics, then water quality parameters.
- Once the sample container is filled, add preservative (if necessary), and cap.
- Wrap all glass sampling containers in a sufficient amount of bubble wrap and place all individual containers in a resealable bag. Place all containers on ice or frozen gel-packs in accordance with SOP-4.
- Fill out appropriate field form(s) documenting sample location, time, and other pertinent information prior to leaving sampling site in accordance with SOP-1. Decontaminate all field sampling equipment (SOP-2)

SAMPLING FREE PRODUCT ON SURFACE WATER

This sampling procedure to be used when sampling for free phase organic constituents floating on top of water is described below.

- Decontaminate sample container in accordance with appropriate SOP.
- Using a wide mouth jar, submerge the sample container in such a manner that leaves the mouth of the container half-way out of the water. Wait for the container to fill.
- Transfer directly into sampling bottles.
- Fill out appropriate field form(s) documenting sampling location, time, and other pertinent information prior to leaving the sampling site.

SOP-11

SUBAQUEOUS SEDIMENT SAMPLE COLLECTION

This SOP describes the field equipment and sampling methods for collection of fresh-water sediment samples in shallow water (less than eight feet deep). Methods explained in this SOP may be different from those identified in the project specific Sampling and Analysis Plan (SAP) or Field Sampling Plan (FSP) and the project specific SAP or FSP should be referenced for additions or deletions to the methods noted below.

Purpose

To describe field sampling methodology for subaqueous sediment

Goal and Objective

To ensure sediment samples are collected consistently in the field

Equipment Needs

Decontamination equipment and fluids

Latex or Nitrile gloves

GPS unit

Stainless steel ruler

Stainless steel scoop, spoon, or trowel for sampling

Extension pipe (if required)

Stainless steel mixing bowl and mixing spoons

Sample jars with Teflon-lined lids

Munsel color book or geotechnical guage (if required)

Cooler and ice

Sample jar labels

Field forms and field book

Chain-of-custody forms

SAMPLE COLLECTION

- Locate the site as described in the appropriate SAP/FSP.
- Record the sampling position using the GPS. Measure and record the water depth at time of sampling.
- Prior to sample collection and between samples, be sure to decontaminant all non-disposable sampling equipment in accordance with SOP-2.
- Prepare and label sample containers in accordance with the naming conventions outlined in the FSP and SOP-3.
- If you can wade into the surface water body, collect the sediment sample using a stainless steel scoop or spoon. Collect the sediment sample with the scoop or spoon while facing upstream. Sediment should be collected from within the upper 6 inches. A stainless steel ruler inserted into the sediment bed can be used as a guage for depth. Excess water may be removed from the scoop or spoon; however, care should be exercised to avoid the loss of fines when decanting excess water.
- In surface water bodies that are too deep to wade, but less than eight feet deep, a stainless steel spoon or scoop attached to a piece of pipe may be used from the banks if the surface water body is narrow or from a boat. In deep areas with soft substrates, grab sample collection via SOP-SD-04 is preferred.
- Repeat the above steps if more volume is required.
- Record observations of sediment characteristics in the appropriate field logbook or field form. Observations may include color, texture, biological organisms, presence of debris, presence of oily sheen or obvious contamination, or odor.
- Document sample collection and location with photographs.

- Following collection, place the sample in a stainless steel mixing bowl. Remove any large pieces of cobble, wood waste or other debris greater than 0.5 inches. When analyzing for volatile organic compounds, place the sediment in the sample jar prior to homogenizing as homogenizing may release the more volatile constituents from the sediments. Homogenize the sediment thoroughly using a stainless steel spoon, and then place a portion of the sample in each sample container. Add preservatives to the sample as needed.
- Place the sample containers in a cooler with ice in accordance with SOP-4.
- Complete all out appropriate field sampling forms and chain-of-custody forms in accordance with SOP-1 and SOP-3.

STANDARD OPERATING PROCEDURE (SOP) SD-04

SURFACE SEDIMENT SAMPLING

SCOPE AND APPLICATION

This SOP defines and standardizes the methods for collecting surface sediment samples from freshwater or marine environments. Surface sediments are defined as those from 0 to at most 10 cm below the sediment-water interface. The actual definition of surface sediments is typically program-specific and depends on the purpose of the study and the regulatory criteria (if any) to which the data will be compared.

This SOP utilizes and augments the procedures outlined in USEPA (1997) and ASTM (2003) guidelines. A goal of this SOP is to ensure that the highest quality, most representative data are collected, and that these data are comparable to data collected by different programs that follow the USEPA (1997) guidelines.

SUMMARY OF METHOD

Sediment samples for chemical and toxicity analysis are collected using a surface sediment sampling device (e.g., grab sampler) or hand implements (i.e., spoons, scoops, shovels, or trowels). If a sample meets acceptability guidelines, overlying water is carefully siphoned off the surface in a grab sampler, and the sediment is described in the field logbook. Depending upon the type of analysis to be performed, sediment samples for chemical analysis may be collected directly from an undisturbed surface (e.g., volatile organic compounds and sulfides), or may be homogenized using decontaminated, stainless-steel containers and utensils prior to being placed in sample jars. Sediment from several sampler casts or exposed sediment locations may also be composited and homogenized prior to being placed in sample jars.

SUPPLIES AND EQUIPMENT

A generalized supply and equipment list is provided below. Additional equipment may be required depending on project requirements.

- Sampling device
  - Grab sampler or box corer (see examples below in procedures for "Sediment Sample Collection")

  - Stainless-steel spoon, scoop, shovel, or trowel
- Field equipment
  - Siphoning hose
  - Stainless-steel bowls or containers
  - Stainless-steel spoons, spatulas, and/or mixer
  - Stainless-steel ruler
  - Project-specific decontamination supplies (e.g., Alconox™ detergent, 0.1 N nitric acid, methanol, hexane, distilled/deionized water)
  - Personal protective equipment for field team (e.g., rain gear, safety goggles, hard hats, nitrile gloves)
  - First aid kit
  - Cell phone
  - Camera
  - Sample containers
  - Ziploc® bags
  - Bubble wrap
  - Sample jar labels
  - Clear tape
  - Permanent markers
  - Indelible black-ink pens
  - Pencils
  - Coolers
  - Ice
- Documentation
  - Waterproof field logbook
  - Field sampling plan
  - Health and safety plan
  - Correction forms
  - Request for change forms
  - Waterproof sample description forms.

PROCEDURES

Sediment Sample Collection with a Grab Sampler

Use a sampler that obtains a quantifiable volume of sediment with minimal disturbance of the surrounding sediments to collect sediment for chemical and biological analyses. The sampler should be composed of a material such as stainless steel or aluminum, or have a noncontaminating coating such as Teflon™. Samplers capable of providing high-quality sediment samples include grab-type samplers (e.g., van Veen, Ekman, Smith-McIntyre, Young grab, Power Grab and modified-ponar grab) and box cores (Soutar, mini-Soutar, Gray-O'Hara, spade core). Some programs require a sampler that collects from a specific area (e.g., 0.1 m^2). Most sampling devices are typically a standard size; however, some non-standard sizes are available to meet the requirements of specific programs. Grab samplers, especially van Veen grab and Ekman grab, are the most commonly used samplers to collect surface sediment. Power Grab samplers are often used for programs requiring collection of sediment deeper than 10 cm (4 in.) or in areas with debris.

Depending on grab weight and water depth, use a hydraulic winch system to deploy the heavier samplers at a rate not exceeding 1 m/second. As the grab nears the bottom, decrease the descent speed to about 0.3 m/second to minimize the bow wake and disturbance of the surface sediment associated with sampler descent. Once the sampler hits the bottom, close the jaws slowly and bring the sampler to the deck of the vessel at a rate not exceeding 1 m/second to minimize any washing and disturbance of the sediment within the sampler. At the moment the sampler hits the bottom, record the time, water depth, and location of sample acquisition in the field logbook.

Retrieve and secure the sampler, and carefully siphon off any overlying water. Inspect the sample to determine acceptability using the criteria detailed in USEPA (1997), except when noted in the project-specific field sampling plan. These criteria include but are not limited to the following:

- There is minimal or no excessive water leakage from the jaws of the sampler
- There is no excessive turbidity in the water overlying the sample
- The sampler is not over-penetrated
- The sediment surface appears to be intact with minimal disturbance
- There is no anthropogenic (i.e., man-made) debris in the sampler
- The program-specified penetration depths are attained.

If the sample meets acceptability criteria, record the sample collection location using a global positioning system (GPS) and enter observations onto a sample collection form or the field logbook. Depending on programmatic goals, remove the sampling interval specified in the field sampling plan. Use a decontaminated stainless-steel ruler to measure the sample

collection depth (0 to 10 cm) within the sampler. To prevent possible cross-contamination, do not use sediments touching the margins of the sampler.

Take a photograph of the sediment in the grab sampler and in the stainless-steel bowl in the field. Verify that the station number or sample ID, time, and date are shown in the photograph.

Typically, sediment from a minimum of three separate casts of the sampler is composited at each station (see project-specific field sampling plan). Once the sample has been characterized, subsample the sediment for chemical and biological analyses using a decontaminated stainless-steel spoon.

Sediment Sample Collection with Hand Implements

Obtain a quantifiable volume of sediment with minimal disturbance of the surrounding sediments to collect sediment for chemical and biological analyses. Hand implements (e.g., spoons, scoops, shovels, or trowels) must be composed of stainless steel.

Use GPS to locate the sampling site and approach the location carefully to avoid disturbing the area of sediment to be sampled. Prior to sample collection, describe and characterize the undisturbed surface sediment in the field logbook. If necessary, expose the sediment surface by clearing an approximately 1-ft^2 area at the sampling site of any rocks greater than approximately 5 in. Remove any anthropogenic (i.e., man-made) debris and organic material on the sediment surface. Note any material removed from the sampling site in the field logbook.

Using a decontaminated, stainless-steel hand implement (i.e., spoon, scoop, shovel, or trowel), excavate the sediment to 10 cm. Place the sediment in a decontaminated stainless-steel bowl and use a decontaminated stainless-steel ruler to confirm that the correct sampling interval has been collected. If the full sample collection interval (i.e., 10 cm) has not been reached, collect additional sediment, place it in the stainless-steel bowl, and reconfirm the sampling interval. Continue this process until the full sample collection interval (0 to 10 cm) has been reached.

Take a photograph of the excavated hole from where the sediment sample was removed. Verify that the station number or sample ID, time, and date are shown in the photograph.

Sample Processing

Complete all sample collection forms, labels, custody seals, and chain-of-custody forms, and record sample information in the field logbook.

Collect samples for volatile compounds (either organics or sulfides) using a decontaminated stainless-steel spoon while sediment is still in the grab sampler or, if the sample is collected using a hand implement, in the stainless-steel bowl. Sediments for volatile analysis are not homogenized. Tightly pack the volatile organics sample jar with sediment (to eliminate obvious air pockets) and fill it so that no headspace remains in the jar. Alternatively, if there is

adequate water in the sediment, fill the container to overflowing so that a convex meniscus forms at the top, and then carefully place the cap on the jar. Once sealed, the jar should contain no air bubbles.

Place the remaining sediment in the grab sampler in a precleaned, stainless-steel bowl; sediment collected using hand implements are already in a stainless-steel bowl. Once a sufficient amount of sediment has been collected, mix the sediment using a decontaminated stainless-steel spoon until it is of uniform color and texture throughout.

If required for analysis, collect samples for grain-size tests before any large rocks are removed from the homogenized sediment. Identify any rocks that are greater than 0.5 in. in diameter. Determine their percentage contribution to the homogenized sediment volume, note it on the sediment field collection form or in the field logbook, and then discard the rocks.

Dispense the sediment into precleaned sample jars for the various chemical or biological analyses. For toxicity testing, fill sample jars to the top with sediment to minimize available headspace. This procedure will minimize any oxidation reactions within the sediment. For chemical analysis, sample containers may be frozen for storage. Leave enough headspace to allow for sediment expansion.

After dispensing the sediment, place the containers into coolers with ice and either ship them directly to the analytical laboratories or transport them to a storage facility.

REFERENCES

ASTM. 2003. *Standard Practice for Collecting Benthic Macroinvertebrates with Ekman Grab Sampler*. ASTM Standards on Disc, Volume 11.05.

USEPA. 1997. Recommended protocols for sampling marine sediment, water column, and tissue in Puget Sound. Prepared for Puget Sound Estuary Program, U.S. Environmental Protection Agency, Seattle, WA, and Puget Sound Water Quality Action Team, Olympia, WA. U.S. Environmental Protection Agency, Region 10, Seattle, WA.

SOP-12

QUALITY CONTROL SAMPLING

Quality Control (QC) samples must be submitted along with natural samples to provide supporting laboratory data to validate laboratory results. In general, field equipment and field replicate samples should be collected for every sampling event. Always check the SAP before going to the field to understand what QC samples are required for the sampling event, and at what frequency samples should be collected.

With the exception of a trip blank, QC samples will be collected in the field following sample collection procedures. Trip blanks are supplied by the laboratory and will accompany each sample cooler containing samples for analysis of volatile organic compounds. Trip blanks provide data to evaluate whether the samples were affected by organic compounds during transport to the lab.

The most common QC samples are shown in the table below.

Purpose

To outline the quality control samples to be collected in the field

Goal and Objective

To ensure quality control samples are collected along with natural samples to validate laboratory results

Equipment Needs

Field Forms and field book

Chain-of-custody

Most Common QC Samples		
SP	Split Sample	A portion of a natural sample collected for independent analysis; used in calculating laboratory precision
R	Replicate Sample	Two samples taken from the same media under similar conditions; used to evaluate precision
FB	Field Blank	Deionized water collected in sample bottle; used to detect contamination introduced during the sampling process.
ERB	Equipment Rinsate Blank	Deionized water run through or over decontaminated equipment; used to verify the effectiveness of equipment decontamination procedures
MS/MSD	Matrix Spike/ Matrix Spike Duplicate	Certified materials of known concentration; used to assess laboratory precision and accuracy
TB	Trip Blank	Inert material (deionized water or diatomaceous earth) included in sample cooler; sent by the lab, the sample is used to detect any contamination or cross-contamination during handling and transportation.

Typical QC sample collection frequencies are presented in the table below. Consult the FSP for variations based on site specific objectives. Each field crew leader will be responsible for all QC samples prepared by that crew.

QC Sample	Purpose	Collection Frequency
Field Replicate Samples	Measure analytical precision.	1 per every 20 samples
Matrix Spike/Matrix Spike Duplicate	Measure analytical accuracy.	1 per every 20 samples
Equipment rinse blanks	Evaluate effectiveness of equipment decontamination and sample handling procedures.	1 per sampling event per media
Field Blank	Assess possible cross-contamination of samples due to ambient conditions during sample collection.	1 per sampling event
Trip Blanks	Evaluate sample preservation, packing, shipping, and storage.	1 per sampling event with volatile constituents

SOP-13

MANAGEMENT OF INVESTIGATIVE-DERIVED WASTE

Prior to the field sampling event, review the Sampling and Analysis Plan to understand how wastes generated during the investigation should be handled. This standard operating procedure is applicable to non-hazardous wastes. If hazardous wastes may be generated, please consult with the project manager and the Field Sampling Plan (FSP).

SEDIMENT

Care will be taken to collect the volume of sediment needed for chemical analysis and avoid excess material. Any excess sediment that is collected will be placed back at the sampling location.

RINSEATE WATER ORIGINATING FROM DECONTAMINATION

All source water for sampling equipment decontamination purposes will be distilled water. Decontamination will be conducted in a specified area that limits the spread of decontamination water. Decontamination water will be discharged to the ground in the vicinity of the source of dirt and mud to evaporate and infiltrate.

DISPOSABLE EQUIPMENT

Any equipment not intended for reuse will be placed in contractor bags and disposed of in an appropriate waste bin.

Purpose

To outline the procedure for handling wastes generated during site investigation

Goal and Objective

To employ a method for appropriate handling investigative-derived wastes that limits contamination of the environment

Equipment Needs

Field Forms and field book

Contractor bags

SOP-14

WORKER RESPONSIBILITY TO SAFETY

This SOP establishes general guidelines for NewFields personnel to follow to complete field investigations in a safe manner. All NewFields personnel involved in field work must:

1. Review and sign the site-specific Health and Safety Plan (HASP). In addition to this SOP, there are numerous other SOPs that identify specific requirements for maintaining a safe work environment, appropriate safety communication and reporting of a safety incident. NewFields employees must become familiar with these SOPs prior to initiation of field work and follow them during field work.

2. Prevent visitor access to a site unless they have reviewed the HASP and signed site entry form in the HASP. Visitors should never be allowed access to a work zone, as defined in the HASP.

3. Take personal responsibility for maintaining a safe working environment throughout the entirety of the field work. While NewFields personnel are not responsible for the safety of other contractors on the site, NewFields personnel that witness unsafe conditions should immediately report this to the NewFields Health & Safety Officer (HSO) and Project Manager (PM). If while working on a site you feel something is being done in an unsafe manner, do not continue to participate in the activity and call the HSO and PM.

4. Maintain and wear appropriate personal protective equipment (PPE), as described in the HASP.

5. Facilitate or participate in daily health and safety meetings, preferably at the beginning of each work day. The meeting should be facilitated by the NewFields field lead. At these meetings, safety issues anticipated for the upcoming work day including potential contaminant exposure, appropriate PPE, traffic safety, and any potential on site hazards should be discussed with all workers. If drilling or excavation is planned, applicable safety issues such as utility clearance, creation of work zones, heavy equipment hazards, adequate sloping of excavations, excavation setbacks, potential shoring requirements, and means of communications in a noisy environment should be discussed. In addition, protocols to follow in the event of a hazardous incident should be discussed at daily safety meetings, including what defines and incident and where personnel should congregate in the event of an incident.

6. Report all safety incidents, in accordance with the HASP.

7. Confirm prior to the start of each work day that NewFields and drilling and excavation contractors have appropriate safety equipment and PPE on site. At a minimum, this shall include a hardhat, safety glasses, steel toed boots, gloves, first aid kit, fire extinguisher and a copy of the HASP.

SOP-15

CORRECTIVE ACTION PROCEDURES

The Corrective Action Request (CAR) system for the project's field and laboratory operations is used to document major changes made to the project's sampling plan, field and laboratory procedures, to correct data entry errors in the project's database, and to correct gross errors in the field and laboratory that occur after the project has started. A good corrective action process is an invaluable management tool that can be used to improve and provide input for project reports. The CAR file provides information about why, when, and how a change was made and provides a secure place to archive information generated during the corrective action process, which includes hardcopy and electronic files.

Note: *The CAR system does not supersede the project's Work Plan, Sampling and Analysis Plan (SAP), Health and Safety Plan (HSAP), Standard Operating Procedures (SOP), Quality Assurance Project Plan (QAPP), and/or other policies in place before final approval of the project's documents and/or the commencement of the project.*

Typical situations in which the CAR process can be used include the following:

Purpose

To provide guidance on facilitating corrective actions by NewFields employees

Goal and Objective

To correct procedures or error of field and laboratory activities after the commencement of a project; and to provide documentation and tracking mechanisms associated with the corrective action.

Document Needs

Corrective Action Form

- Developing improved procedures and making the Corresponding changes to approved standard operating procedures (SOPs), the Quality Assurance Project Plan (QAPP), and other affected documents;
- Developing new training materials to remedy specific staff performance deficiencies;
- Data entry errors in the project's database system;
- Investigating and correcting systematic data quality problems in the laboratory;
- Re-sampling of a well due to gross error;
- Re-analysis of a sample due to gross error; and,
- Correction of data in the project database system due to data entry error.

A CAR should always be used when any of the following conditions apply:

- A substantial planned effort is necessary to solve a specific operational or data quality problem;
- Significant costs (i.e., labor hours or purchased materials) are involved;
- Corrected data will have to be redelivered to the client;
- The client is aware of the problem and is expecting status updates;
- The correction is expected to take a relatively long period of time (more than about two weeks and deadlines need to be monitored by management;
- Previously approved validation or QA criteria are affected.

A CAR is optional when none of the above conditions apply and the area supervisor agrees that the corrective action can be handled within the normal scope of operations. Isolated problems that normally arise during routine operations should not generate CARs; however, a CAR would be appropriate when a procedural change is necessary to address a chronic operational problem.

PROCEDURE

Administration

CAR forms will be issued and logged by the project administrator. They will assign numbers to the CARs and distribute them as requested. The project administrator will also be responsible for updating the log sheet and for filing the CAR forms and any other information that may be included with the form.

Initiation

Any project staff member may report a problem that initiates a CAR. The CAR originator should work with the area supervisor to complete the first two sections of the CAR form.

Assignment and Approval

The supervisor for the affected area is responsible for assigning personnel, setting the completion deadline, and approving the CAR to be acted upon. The supervisor may assign one of the laboratory staff, him/herself, or other qualified project personnel to lead the CAR. CARs requiring significant additional labor hours or other costs must be approved by the Program Manager (PM).

Tracking

After the CAR has been scheduled and approved, copies of the CAR form should be distributed as indicated at the bottom of the form. The project administrator will enter the information onto the log sheet and will start a new file folder for the CAR. The PM and Quality Assurance Officer (QAO) should review each CAR regularly and provide any necessary input to the process. The CAR log will be reviewed each month by the PM or QAO as part of monthly reporting. The QAO and/or PM will follow up on CARs that are overdue for completion.

Implementation and Acceptance

The assigned staff member is responsible for carrying out the corrective action, along with the area supervisor. A CAR file should be updated whenever significant modifications to the approach, costs, or deadlines become necessary. Successful completion of each CAR should be witnessed and approved by the area supervisor, QAO, or PM.

Completion and Archiving

When the corrective actions have been completed and accepted, the approved CAR form, copies of planning materials, test data, and other significant documentation should be archived in the CAR file.

CORRECTIVE ACTION REPORT (CAR)

NEWFIELDS – MES LLC

CAR# _____

DATE:_____

PROJECT: _____

STAGE OF PROJECT: _____

PROJECT AREA: _____

DESCRIPTION OF PROBLEM (INCLUDE DATE):

ACTION REQUIRED:

CA COMPLETION DATE AND NOTES:

PROBLEM OBSERVED BY: _____ _____
Print Name Date

CA NITIATED BY: _____ _____
Print Name Date

CA APPROVED BY: _____ _____
Print Name Signature Date

CA CARRIED OUT BY: _____ _____
Print Name Date

POREWATER SAMPLING METHOD

SEDIMENT POREWATER SAMPLING WITH PEEPERS

SCOPE AND APPLICATION

This sampling method describes the procedures for collecting sediment porewater using peepers, which is a sampling method that involves *in situ* equilibrium with sediment porewater. Peepers consist of a series of polyethylene vials covered with a 0.45-µm semipermeable membrane. The interiors of the peeper vials consists of rows of chambers that are filled with deionized, oxygen-free water. During the deployment, this water equilibrates with surrounding porewater. Upon the peeper's retrieval, analysis of the water within the peeper vials provides a measure of dissolved metals and other selected constituents in sediment porewater, which can be used to evaluate potential bioavailability, bioaccumulation, and toxicity of metals in sediments.

SUMMARY OF METHOD

Peepers and peeper frames are prepared for deployment by a specialized laboratory. The laboratory cleans and packages the peepers and frames and ships them to the field team prior to deployment. The day before deployment, the field team places the peeper vials in a bucket of deionized water[1] that has been sparged with nitrogen gas to remove all oxygen from the peepers.

Peepers are deployed in sediment for 28 days to ensure the peepers come to equilibrium with surrounding porewater before retrieval. Peeper vials will contain a sodium bromide (NaBr) tracer to confirm equilibrium has been reached during the deployment. At each sampling location, six 60-mL peeper vials will be deployed, inserted within a peeper frame prior to deployment to ensure all peepers are deployed at the same depth. After retrieval, two peeper vials will be used to determine temperature, pH, dissolved oxygen, oxidation reduction potential, alkalinity, sulfide, and conductivity in the field. The remaining four peeper vials will be composited and transferred into laboratory-supplied sampling containers with preservatives for analysis of metals (including magnesium, calcium, potassium and sodium), dissolved organic carbon, and anions (sulfate, chloride and bromide (tracer)).

[1]Sodium bromide is added to the deionized water bucket to achieve a concentration equal to the concentration in the peepers.

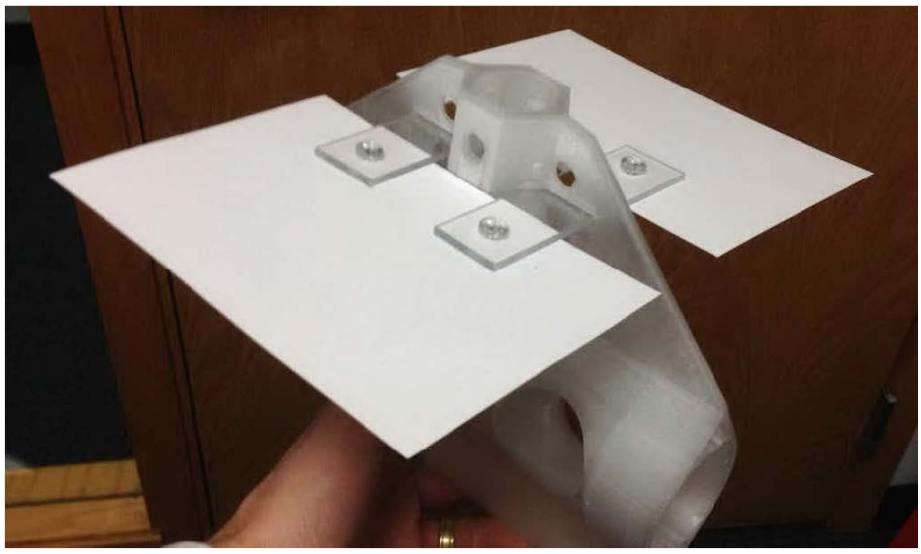
PROCEDURES

A list of equipment required for performing this method at each sampling station is provided in Tables 1–3. Field forms for deployment, retrieval and peeper processing are included as Attachment 1.

Peeper and Peeper Frame Preparation

For the Smurfit Stone Frenchtown Mill 2018 study, peepers and frames will be prepared by SiREM Laboratory in Guelph, Ontario, and shipped to the NewFields office at 700 SW Higgins Avenue, Missoula, Montana, for deployment at the site. Steps to prepare peepers for deployment are as follows:

- At 16 to 24 hours prior to deployment place the peeper vials in a 5-gallon bucket of laboratory-supplied deionized water and a concentration of NaBr equal to that used as a tracer in the peeper (to be supplied by SiREM). The use of NaBr in the field preparation process will ensure no tracer loss occurs before deployment.
- Purge the 5-gallon bucket with high-purity nitrogen gas to remove all oxygen from the peepers. Allow peepers to have between 8 to 16 hours of contact time with the deoxygenated water before deployment.
- Assemble peeper frames provided by SiREM on shore 1 day in advance of the planned deployment day. Two wing brackets slide into the slots of the frame; four screw-and-nut sets hold the wings to the wing brackets (two per wing).



Example of Assembled Peeper Frame Source: SiREM

- Prepare peeper frames for deployment by attaching two Ziploc® bags filled with approximately 50 g of clean sand to the peeper frame wings with zip ties; these sand bags will act as weights to hold the peepers in the sediment. The peeper frames will ensure all peeper vials are deployed at the same depth at each sampling location.
- Prior to deployment, perform a final nitrogen sparge in the bucket for 30 seconds to 1 minute.
- Navigate or wade to the sample location and insert the six peeper vials into the peeper frames below the water surface.
- Embed the peeper frames into the sediment. This may require digging a small trench to bury the peeper frame/peeper or removing rocks or debris, if present, and replacing the sediment to cover the peeper vials to complete the deployment.
- Complete the Peeper Field Deployment form and place a unique stake adjacent to the peeper frames, so the peepers can be located and retrieved easily.
- Leave the peepers in place for 4 weeks to allow equilibration of the water in the peeper with the surrounding porewater.

Peeper Retrieval and Processing

- Prepare a clean work station (i.e., table), ideally in a sheltered area ready for peeper processing. Do not retrieve peepers in weather that will cause the work space to become dusty.
- Navigate or wade to the sample location and retrieve peeper frame.
- Immediately after frame retrieval, remove all peeper vials from frame and place them in a sealable holding container (e.g., clean Tupperware jar) with a nitrogen headspace. Purge the container with nitrogen and continue to add nitrogen to the container as the container is closed.
- Complete the Peeper Field Retrieval form.
- Bring the sealed container to the peeper processing area.
- Prepare probes for the measurement of temperature, pH, dissolved oxygen, oxidation reduction potential, and conductivity.
- Set up for the Hach® alkalinity test (Hach 2018).
- Withdraw one peeper from the holding container, while purging the holding container with nitrogen as the lid is off.
- Rinse the peeper with deionized water to clean off sediment. Paper towels can be used to remove the majority of sediment. Make sure to flush thoroughly around the threads of the lid. There should be no trace of sediment along the peeper shaft and bottom. Flush

sediment off gloves. Use a Kimwipe and deionized water to perform a final cleaning and drying. The lid should be mostly free of sediment, such that general holding of the peeper will not lead to contaminating the shaft with residual sediment from the lid.

- Determine dissolved oxygen (NewFields SOP-7), oxidation reduction potential (NewFields SOP-8), pH (NewFields SOP-6), conductivity (NewFields SOP-5) and temperature using probes. Record measurements in the Peeper Field Parameters form.
- Conduct the Hach® alkalinity test (Hach 2018) and record alkalinity in the Peeper Field Parameters form.
- Set up for the Hach® sulfide test (Hach 2015).
- Withdraw a second peeper from the holding container.
- Rinse the peeper with deionized water to clean off sediment. Paper towels can be used to remove the majority of sediment. Make sure to flush thoroughly around the threads of the lid. There should be no trace of sediment along the peeper shaft and bottom. Flush sediment off gloves. Use a Kimwipe and deionized water to perform a final cleaning and drying. The lid should be mostly free of sediment, such that general holding of the peeper will not lead to contaminating the shaft with residual sediment from the lid.
- Determine sulfide using the Hach® test (Hach 2015). Record measurements in the Peeper Field Parameters form field sampling log.
- Composite the remaining peeper vials in a laboratory-supplied, pre-cleaned, 500-mL compositing vessel, before transferring to laboratory-supplied sampling containers for metals (80-mL minimum volume), dissolved organic carbon (2 x 40-mL vials) and anions (25-mL minimum volume) with preservatives for analysis.
- Place containers in coolers on ice (≤4 ± 2°C), ready for transport to laboratory at the end of the sampling day.

QUALITY ASSURANCE AND QUALITY CONTROL SAMPLES

The following quality control samples will be collected to assess variability within samples and to evaluate if potential sources of contamination are present:

- Duplicate samples (5 percent frequency, or 1 per maximum 20 sample locations).
- Rinsate blank (5 percent frequency, or 1 per maximum 20 sample locations). Rinsate blanks will be conducted using deionized water poured over the sampling equipment prior to deployment to avoid potential cross contamination associated with peeper preparation.

REFERENCES

Hach. 2018. Alkalinity. Phenophthalein and total alkalinity. Method 8203. DCOC316.53.01166. Hach Company.

Hach. 2015. Sulfide. USEPA Methylene Blue Method. Method 8131. DCOC316.53.01136. Hach Company.

SOP-16

PORE WATER SAMPLE COLLECTION USING PUSHPOINT®

This SOP describes the procedure for pore water sampling using PushPoint® samplers and is based on the Operators Manual and Applications Guide provided by MHE products (Version 2.01 from 2/15/2003). Pore water is collected using a PushPoint® sampler, which is length of stainless steel tubing with a small screened section near the bottom of the device and a sampling port at the top. The screened section is advanced to the desired depth, and porewater is extracted via suction.

Purpose

To describe field sampling procedures for obtaining pore water samples using PushPoint® samplers.

Goal and Objective

To ensure pore water samples are collected without interference from overlying waters.

Equipment Needs

Decontamination equipment and fluids

Latex or Nitrile gloves

GPS unit

PushPoint® sampler and guard rod

Flange for PushPoint® sampling

Tygon or Teflon® tubing matched to diameter of PushPoint® (typically 3/16")

Peristalic pump or syringe for extraction

Sample jars with Teflon-lined lids and necessary preservatives

Cooler and ice

Sample jar labels

Field forms and field book

Chain-of-custody forms

SAMPLE COLLECTION

- Locate the site as described in the appropriate SAP/FSP.
- Record the sampling position using the GPS. Measure and record the water depth at time of sampling.
- Prior to sample collection and between samples, be sure to decontaminant all non-disposable sampling equipment in accordance with SOP-2.
- Prepare and label sample containers in accordance with the naming conventions outlined in the FSP and SOP-3.
- Make sure the guard rod is inserted into the PushPoint® sampler (Figure 1). The rod provides rigidity and helps to prevent the screened section from bending during insertion into the sediment.
- Taking care not to disturb the sample area, insert the PushPoint® sampler/guard rod into the sediment bed (Figure 2). Depth of penetration is dependent upon the study objective. Refer to the SAP/FSP for specific details. Measure and record the sampling depth.
- Care should also be taken to avoid creating a space between the PushPoint® tubing and surrounding sediment. A space may allow surface water to flow down to the screened area and into the prospective sample. This can be prevented by inserting the sampler through a flange prior to penetration (Figure 3). If used, the flange should be made of a material that will not cross-contaminate the intended sample. The likelihood of creating such a space should be evaluated in the field and may be less likely with cobble substrates.
- Carefully remove the guard rod after the PushPoint® sampler has been deployed and attach the Tygon or Teflon® sample tubing. Tubing selection is dependent upon target analytes. For example,

samples for VOC and SVOC analysis must be collected using either stainless steel or Teflon® equipment. The other end of the tubing can be connected to either a syringe or peristaltic pump for pore water extraction.

- Purge the air and surface water from the PushPoint® sampler and tubing with pore water until water is clear (at least three sample volumes worth of water). If suspended solids remain in the pore water after purging it is likely that the sediments are fine enough to enter the screened section of the sampler. It may be necessary to use a mesh sleeve over the bottom of the PushPoint® prior to penetration.
- Sample collection via peristaltic pump (Figure 4):
    - A combination of a peristaltic pump and vacuum jug can be used to collect pore water with the benefit of allowing for water collection without the sample contacting the pump head tubing. The pump is used to create a vacuum in the jug which draws the sample into the container. This method does agitate the sample and cannot be used for the collection of VOCs.
    - Alternately, pore water can be drawn into the tubing connected to the PushPoint® without entering the pump head tubing. The tubing can be disconnected from the PushPoint® and the sample drained by gravity into the sample vials.
    - For samples that would note be affected by contact with the pump head tubing it is possible to collect a sample through the peristaltic pump after a sufficient volume of pore water has been purged. If this method is used, it is recommended that the pump head tubing be changed after each sample and a rinsate blank be collected with each investigation.
- Sample volume may also be collected via syringe. The pore water can be manually withdrawn using a syringe. The syringe can serve as a sample container or the volume can be transferred to another container. If required, field parameters should be measured in accordance with the applicable SOP (SOPs 5 through 8) prior to collecting a sample for analytical testing.
- Carefully decontaminate both the PushPoint® sampler and guard rod prior to reinserting the guard rod (SOP-2).
- Place the sample containers in a cooler with ice in accordance with SOP-4.
- Complete all appropriate field sampling forms and chain-of-custody forms in accordance with SOP-3.

Figures extracted from:
TechLaw, Inc. Standard Operating Procedures for Pore Water Sampling, Document No. FLD-10.00 10/17/2011.

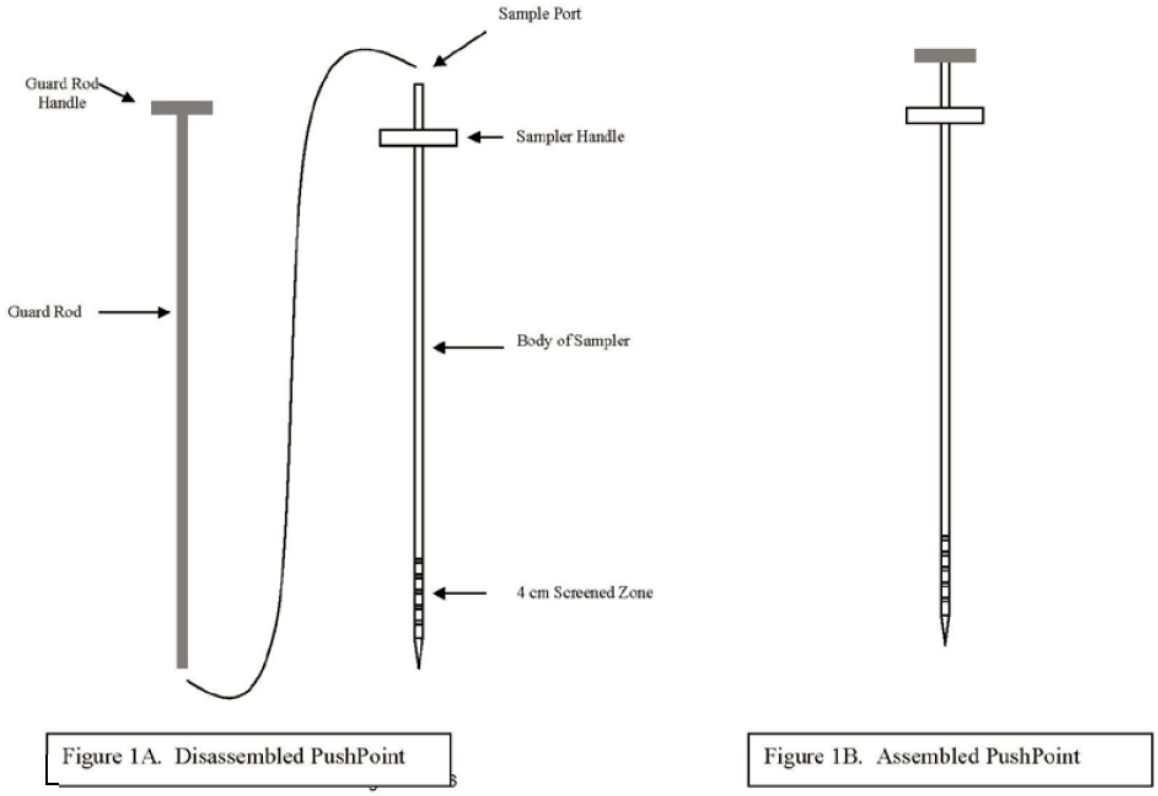


Figure 1. Pore water PushPoint® sampler and rod guard

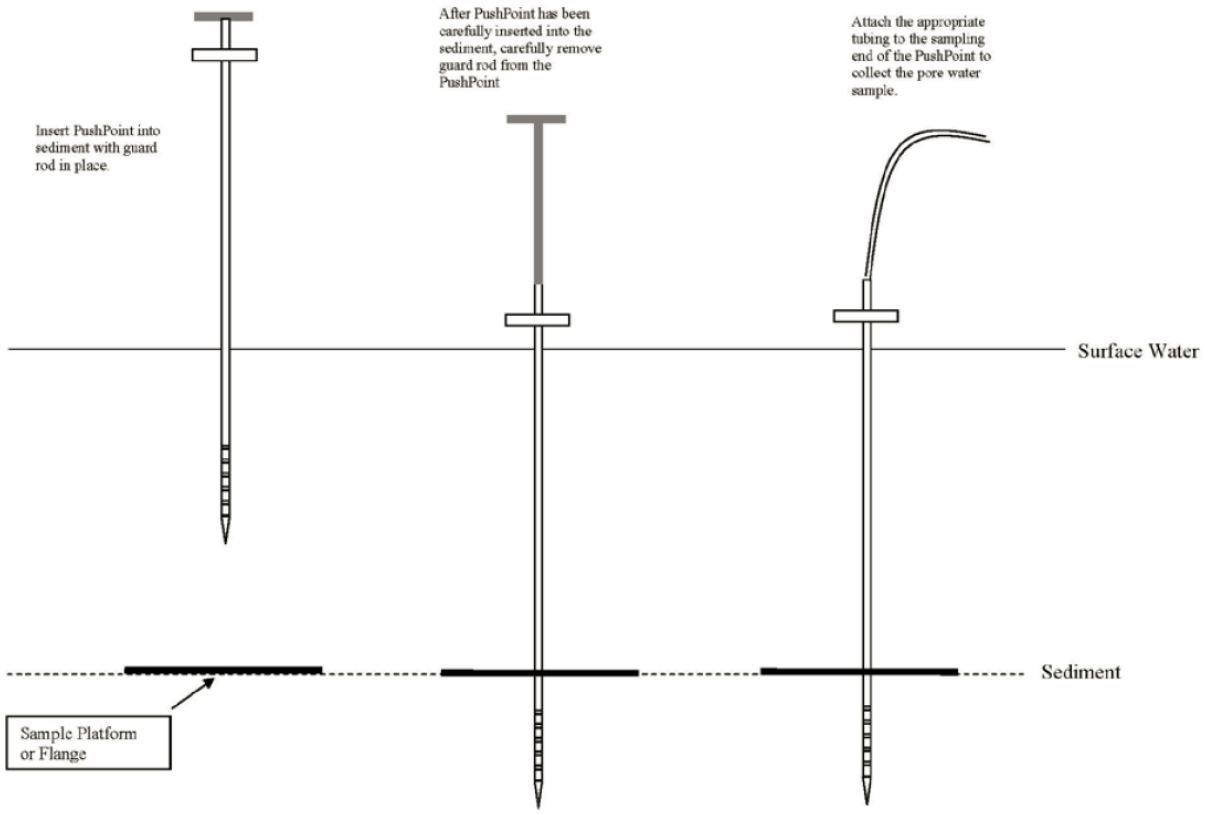


Figure 2. PushPoint® being deployed into sediment

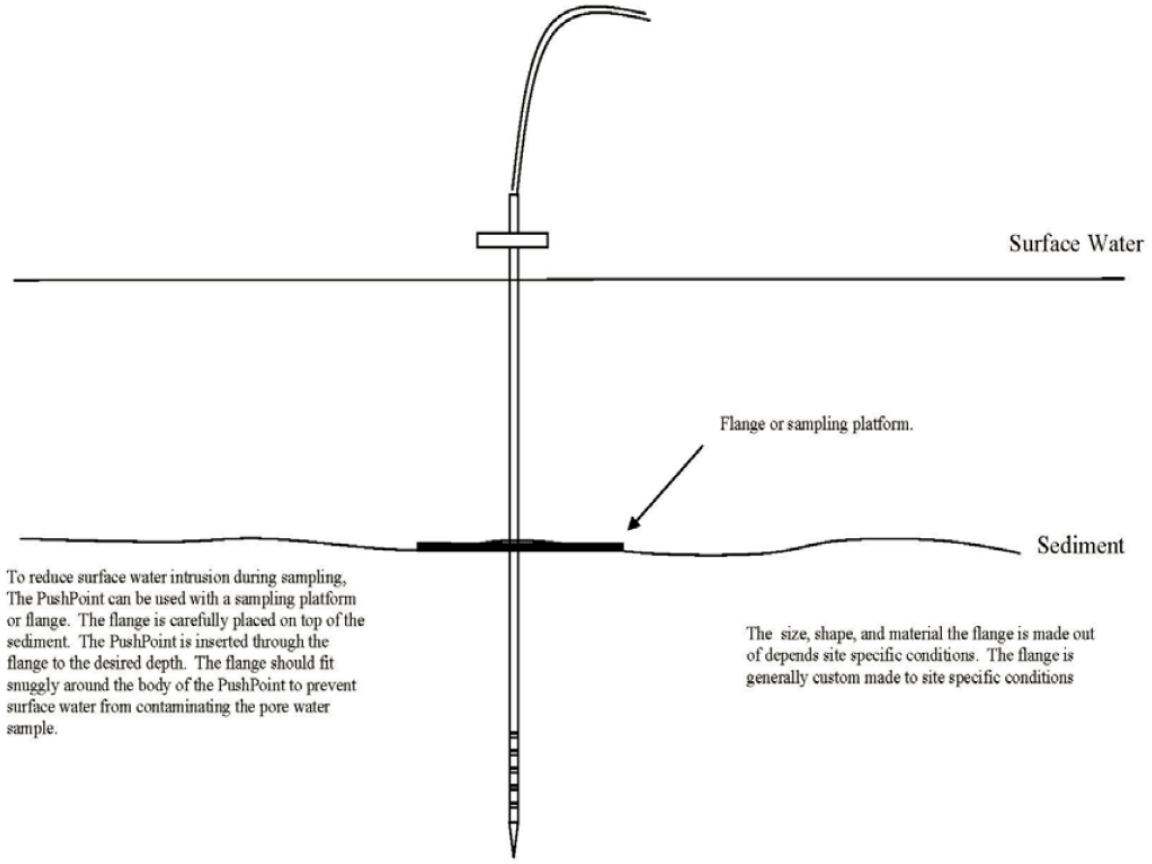


Figure 3. PushPoint® deployed with a sampling flange

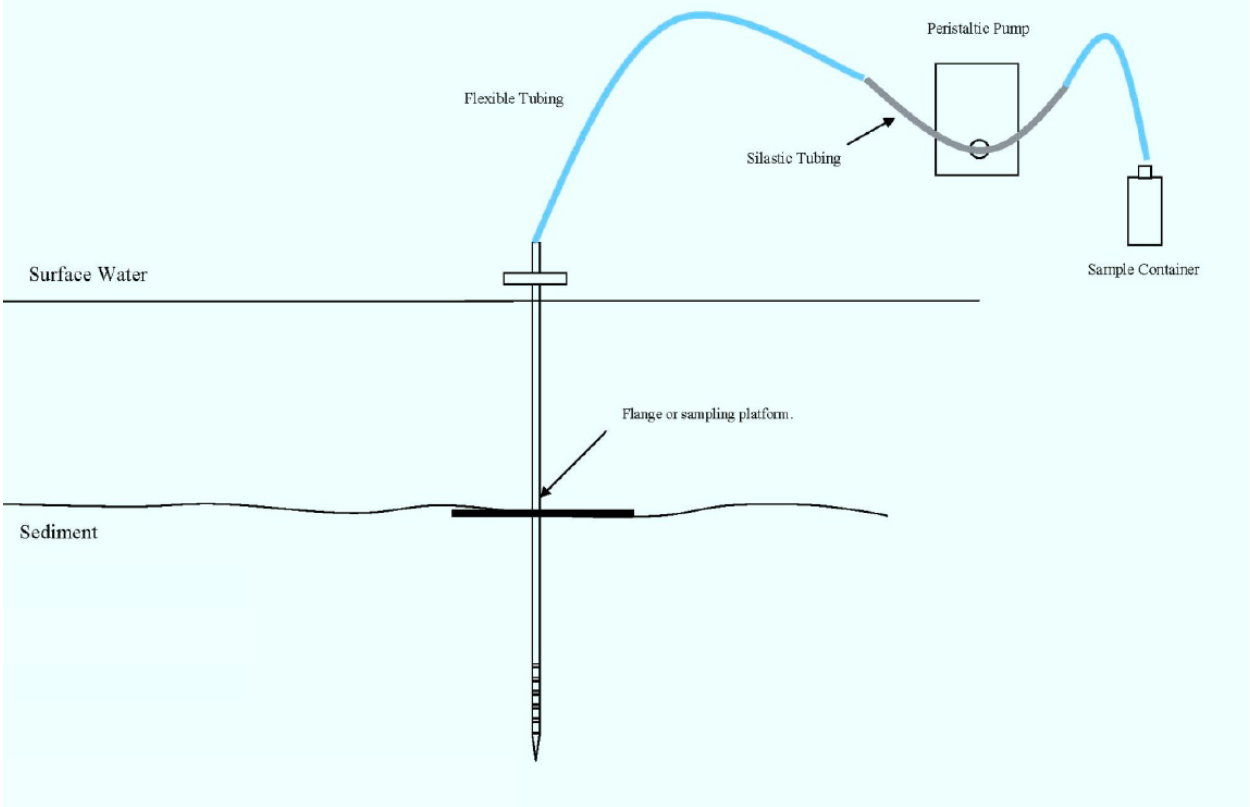


Figure 4. PushPoint® sampler using a peristaltic pump to collect pore water

ATTACHMENT B

Sample Field Forms and Chain of Custody Forms

FIELD FORMS AND COCs	
#	**TITLE**
1	Daily Field Record
2	Photo Log
3	Incident Report Form
4	Pace Analytical – Chain of Custody
5	Frontier Analytical – Chain of Custody
6	Field Investigation Form

DAILY FIELD RECORD

Page_____ of _____

NewFields
Perspective. Vision. Solutions.

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	Weather:

Personnel: Name	Company	Time in	Time Out

PERSONAL SAFETY CHECKLIST

	Steel-toed boots		Hard Hat		Traffic Vest
	Gloves		Safety Goggles		Ear Protection

TIME	DESCRIPTION OF WORK PERFORMED

DAILY FIELD RECORD

Page______ of ______

NewFields
Perspective. Vision. Solutions.

Date:________________________

TIME	DESCRIPTION OF WORK PERFORMED

PHOTOGRAPH LOG

NewFields
Perspective. Vision. Solutions.

Page______ of ______

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	

ID#	Time	Direction of View	Subject of Photograph
1			

INCIDENT REPORT
Occupational Accident, Injury, or Illness

1. *Employee Name:* _____

2. *Employee No.:* _____ 3. *Office location:* _____

4. *Job title:* _____

5. *Home address:* _____

6. *Phone number:* _____

7. *Sex:* ☐ *M* ☐ *F* 8. *Date of birth:* _____

9. *Type of incident:* ☐ *Exposure* ☐ *Physical injury*

10. *Address where incident occurred (include county):* _____

_____

11. *Date and time of incident:* _____

12. *Date incident was reported:* _____ *To whom:* _____

13. *What were you doing when injured? (Be specific identify tools, equipment, or materials you were using.)*

_____

_____

14 *How did the accident or exposure occur? (Describe events fully. Tell what happened and how it happened. Use additional sheets if needed.)*

_____

_____

15. *Object or substance that directly injured you:*

_____

16. *Describe the injury or illness (e.g., cut, strain, fracture, skin rash):*

_____

17. *Part of body affected:* _____

18. *Did you receive medical care?* ☐ *Yes* ☐ *No* *If so, when?* _____
By whom? (Name and address of physician/paramedic/hospital.)

_____

_____

If hospitalized, name and address of hospital:

_____

_____

19. *Did you lose time from work?* ☐ *Yes* ☐ *No* *If so, how much?* _____

20. *Have you returned to work?* ☐ *Yes* ☐ *No* *If so, date returned:* _____

21 *List anyone else affected by this incident.*

_____

_____

22 *List any witnesses to this incident.*

_____

_____

_____ _____

Signature *Date*

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

Section A **Required** Client Information:

Company:	
Address:	
Email To:	
Phone:	Fax:
Requested Due Date/TAT:	

Section B **Required** Project Information:

Report To:
Copy To:
Purchase Order No.:
Project Name:
Project Number:

Section C Invoice Information:

Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER

☐ UST ☐ RCRA ☐ OTHER_____

SITE LOCATION ☐ GA ☐ IL ☐ IN ☐ MI ☐ NC ☐ OH ☐ SC ☐ WI ☐ OTHER____

Filtered (Y/N)

Requested Analysis:

Section D **Required** Client Information

SAMPLE ID

One Character per box.
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Residual Chlorine (Y/N)	Pace Project No. / Lab I.D.
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			

Additional Comments:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME

SAMPLE CONDITIONS

	Y/N	Y/N	Y/N	
	Y/N	Y/N	Y/N	
	Y/N	Y/N	Y/N	
	Y/N	Y/N	Y/N	
Temp in °C	Received on Ice	Custody Sealed Cooler	Samples Intact	

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed (MM / DD / YY)

Frontier Analytical Laboratory
5172 Hillsdale Circle
El Dorado Hills, CA 95762
Tel: 916-934-0900
Fax: 916-934-0999

FAL USE ONLY

Laboratory Project No.: _____

Temperature: _____ °C

Chain of Custody

www.frontieranalytical.com

Please Print in Pen **Page_____ of_____**

CLIENT INFORMATION	**INVOICE INFORMATION** (if different from client info)	**PROJECT INFORMATION**
Company Name: _____	Company Name: _____	FAL Quote #: _____
Contact Name: _____	Contact Name: _____	P.O. #: _____
Address: _____	Address: _____	Project #: _____
Phone: _____ Fax: _____	Phone: _____ Fax: _____	Project Name: _____
Email:	Email:	TAT (business days): ☐ 15 ☐ 10 ☐ 5* ☐ 3* (√ one)
		* FAL must agree with price and RUSH TAT in writing.

REPORT INFORMATION	**REPORT DISTRIBUTION** (email only is preferred)	**ADDITIONAL INSTRUCTIONS**
Report Level: ☐ I/II ☐ III ☐ IV	☐ Hardcopy	
☐ EDD: ☐ FAL Basic ☐ Geotracker ☐ Other: _____ ☐ Custom: Contact FAL	☐ CD (.pdf including EDDs if requested)	
☐ California State Drinking Water Form	☐ Email (.pdf including EDDs if requested)	
System #: Source #:		
Sampler: Employer:		

	Sample ID	Date Collected	Time	Matrix	# of containers	EPA 1613**	EPA 8290**	DLM 02.0	EPA 8280**	Appendix IX	EPA TO-9/9A	EPA 23/23A	EPA 1668	FAL 15	Other	**CONGENERS ☐ 2,3,7,8-TCDD only ☐ 2,3,7,8-TCDD/F only ☐ PCDD/F (Cl_4-Cl_8)	**TEQ ☐ 1998 WHO ☐ 2005 WHO ☐ Other	Remarks
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		

Samples will be disposed of 90 days after sample receipt unless other arrangements have been made and agreed upon in writing.

Relinquished by: (Signature and Printed Name)	**Date**	**Time**	**Received by:** (Signature and Printed Name)	**Date**	**Time**

Client understands that all terms described in the proposals, quotations, and/or the general terms provided in the current FAL price schedules will be followed.
FAL reserves the rights to terminate its service or withhold delivery of reports, if in FAL's sole discretion the terms of the project have been broken.

White Copy – Report Yellow Copy – Laboratory Pink Copy - Originator

Field Investigation Form

Project Name:

Date:

Project Number:

Investigation Date(s):

Project Address:

Project City:

Site Contact:

Client Contact:

EPA/DEQ Manager:

Required Check Offs	**Yes**	**No**
DEQ/EPA Approved SAP		
SAP Reviewed		
Utility Locate Number		
Owner Notified		
Health & Safety Plan		
Sample Location Map		
Holding times work		

Overall Reason For Investigation

Number of Hours Approved for Sampling Effort (include all that apply)

Task	Hours	Notes
ACM/LBP Inspection		
Soils Investigation		
Groundwater Sampling		
Other		

Sampling Methods

# of Samples	Analytical Parameters	Media	Natural or QC Sample?	Method #	Containers	Preservative	Hold Time	Sample Locations

Lab Pack

Laboratory

Shipping by:

Standard Operating Procedure	SOP #

Other Instructions

Project Manager:

Site Investigator:

NewFields

APPENDIX B

TISSUE FIELD SAMPLING PLAN

APPENDIX B: TISSUE FIELD SAMPLING PLAN

Smurfit-Stone/Frenchtown Mill, Missoula County, Montana

Prepared for

M2Green Redevelopment LLC
601 East Third Street, Suite 215
Alton, IL 62002

WestRock CP LLC
3950 Shackleford Road
Duluth, GA 30096

International Paper Company
6400 Poplar Avenue
Memphis, TN 38197

Prepared by

integral consulting inc.
719 2nd Avenue
Suite 700
Seattle, WA 98104

DRAFT
July 2018

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AOC	Administrative Settlement Agreement and Order on Consent
BERA	baseline ecological risk assessment
COC	chain-of-custody
CPR	cardiopulmonary resuscitation
CWD	cooling water ditch
EPA	U.S. Environmental Protection Agency
FSP	field sampling plan
GPS	global positioning system
HASP	health and safety plan
Integral	Integral Consulting Inc.
MFWP	Montana Fish, Wildlife and Parks
MS/MSD	matrix spike/matrix spike duplicate
MTNHP	Montana Natural Heritage Program
OU	Operable Unit
PFD	personal flotation device
PPE	personal protective equipment
PRP	potentially responsible party
QA/QC	quality assurance and quality control
QAPP	quality assurance project plan
RI/FS	remedial investigation and feasibility study
RIWP	Smurfit-Stone/Frenchtown Mill Remedial Investigation Work Plan
Site	former Smurfit-Stone Frenchtown Mill
SOP	standard operating procedure

1 INTRODUCTION

This document presents the field sampling plan (FSP) for collection of biological tissue samples at the former Smurfit-Stone Frenchtown Mill (the Site) and in the Clark Fork River. As Appendix B to Addendum No. 9 of the Smurfit-Stone/Frenchtown Mill Remedial Investigation Work Plan (RIWP; NewFields 2015), this document describes the field sampling methods, equipment, and procedures for collection of benthic macroinvertebrate, fish, and small mammal tissue for use in the remedial investigation, and in the risk assessments for the Site.

Addendum No. 9 to the RIWP was prepared consistent with the Administrative Settlement Agreement and Order on Consent (AOC) for Remedial Investigation/Feasibility Study (RI/FS) between the potentially responsible parties (PRPs; M2Green Redevelopment LLC, WestRock CP, LLC, and International Paper Company) and the U.S. Environmental Protection Agency (EPA), filed November 12, 2015. As such, it presents the tissue sampling program consistent with applicable guidance, as defined in the AOC and quality assurance project plan (QAPP; Appendix E to NewFields 2015) for the project.

1.1 SITE DESCRIPTION

The Site is located within the northwestern portion of the Missoula Valley, in Montana, approximately 11 miles northwest of Missoula and about 3 miles southeast of Frenchtown (Figures B-1 and B-2). The Site is located adjacent to the Clark Fork River, which flows west through the valley and then north along the Site's western boundary (Figure B-2). The Site project area (including all three Operable Unit [OUs]) encompasses about 3,150 acres. Former mill operations spanned 1,910 acres in OU2 and OU3. A detailed description of the former uses of subareas within OU2 and OU3 is provided in the RIWP (NewFields 2015).

The Site is occupied by a variety of habitats and wildlife. In its current condition, the Site consists of former operational area of OU2, and OU3 which is partially in the upland, and partially in the Clark Fork River floodplain.

- The core industrial footprint of the former operational area (OU2), occupies about 260 acres. In OU2, there are a few buildings and other facilities and structures currently not in use, paved roads and parking areas, the wood chip staging area, and locations where recovery boilers, lime kilns, and other equipment were once located but have been decommissioned. Most of the OU2 area does not currently provide good wildlife habitat. The plant community consists of hearty weeds and shrubs, other forbs, and grasses. Wildlife that may use OU2 in its current state are those adapted to developed or disturbed areas. There are a few aquatic features in OU2: one area formerly used as a borrow pit on OU2, and now fed by groundwater (CL Pond). The other is the non-

contact cooling water ditch (CWD) that runs along the western border of OU2, flowing in a northerly direction along a roadway (Figure B-2).

- OU3 consists of about 1,650 acres that include multiple habitat types: upland meadows, several ponds in areas formerly used for treated water holding ponds and infiltration basins, as well as groundwater-fed borrow pits. Both forested and shrubby riparian areas occur adjacent to two creeks that are south of and along the southern boundary of OU3, the Clark Fork River, and river side channels. The upland meadows are occupied by both native forbs and shrubs, and invasive weeds. Some areas of the OU3 uplands were settling basins or landfills during mill operations; these occur closer to OU2, are currently covered with soil or wood chips, and are sparsely vegetated. OU3 includes riparian forest adjacent to the Clark Fork River.

1.2 DATA GAPS ADDRESSED BY THIS STUDY

EPA has drafted a baseline ecological risk assessment (BERA) work plan (USEPA 2018); as of the time that this document is being prepared (June 2018), the final BERA work plan is pending. In the draft BERA work plan, EPA described several data gaps, including a need for more fish and invertebrate tissue chemistry. A data gaps analysis is presented in the main text of this work plan. The data gaps to be addressed by the study described in this FSP include:

- Measured concentrations of metals and dioxins and furans in benthic macroinvertebrate tissue of ponds and creeks
- Measured concentrations of metals and dioxins and furans in small fish tissue of the Clark Fork and Bitterroot rivers
- Measured concentrations of metals and dioxins and furans in tissue of small mammals living in OU2 and OU3.

Combined with data to be collected for surface water, bulk sediments, and pond sediment porewater, results of this RIWP Addendum No. 9 will be used to prepare a BERA for the Site.

1.3 TISSUE STUDY OVERVIEW

Tissue sample collections are summarized below and on Table B-1. All tissue samples will be submitted to the laboratory for analysis of dioxins and furans, methylmercury, metals, lipid content, and percent moisture (Tables B-2 and B-3).

Benthic macroinvertebrates. Mixed-species composites of benthic macroinvertebrate tissue samples will be collected at 22 sampling locations, as follows:

- One composite benthic macroinvertebrate tissue sample will be collected from each of the 12 ponds to be sampled on the Site (Figure B-7) using a sediment grab sampler. Up to 10 grab samples of sediments per pond will be collected, targeting the sediment from 0–6 in. (0–15 cm) depth, and sediments will be sieved to enable collection of biota from within the sieve for the sample. Tissue sampling locations will be as close as possible to sampling locations from which sediments and porewater are collected.
- One composite benthic macroinvertebrate sample will be collected from each of the 10 sampling locations within O'Keefe and Lavalle creeks (Figure B-8) using kick nets. Tissue sampling locations will be centered on the sediment sampling locations in the creeks, with kick net sampling extending up to 20 m upstream or downstream of the sediment sample location. Organisms captured in the nets will be removed and aggregated for the sample.

The mass required for a tissue composite is 50–60 g. For both methods, invertebrates will be picked out of sieves or nets using forceps and placed into sample jars.

Small fish. Single-species composites of small fish (longnose dace) will be collected at 14 locations in the Clark Fork River and one location in the Bitterroot River (Figure B-3). Longnose dace will be captured using a backpack electrofisher or kick-seining (minnow traps may also be used). Fish sampling will be conducted in river margins with cobble substrate, downstream and as near as possible to depositional areas sampled for sediment and surface water. Longnose dace will be collected at each of 14 locations on the Clark Fork River and one location in the Bitterroot River, as follows:

- Six locations upstream of the Site (Figure B-4)
- Three locations adjacent to the Site and corresponding to outfalls used during mill operations (Figure B-5)
- Six locations downstream of the Site (Figure B-6).

The mass required for a tissue composite is 50–60 g. Between 10 and 15 individual longnose dace will be needed to meet this requirement. Each fish captured will be individually labeled, packaged, and shipped to the laboratory.

Small mammals: Mixed-species composites of small mammals will be collected using live traps at 10 locations (Figure B-9) as follows:

- Two locations in OU1, to represent offsite background
- Two locations in OU2

- Six locations in OU3.

At each small mammal sampling location, live traps will be set in 5 places, all within a distance of 30 m from the central sampling location. The mass required for a tissue composite is 50–60 g.

Both small mammals and small fish will processed and shipped individually, as described below, and composites will be formulated in collaboration with EPA, and processed by the laboratory.

If insufficient biomass can be captured, analyses will prioritize 1) dioxins and furans, 2) methylmercury, 3) lipids, and 4) total metals.

1.4 DOCUMENT ORGANIZATION

This FSP describes the field methods that will be used to collect benthic macroinvertebrate, small fish, and small mammal tissue at the Site in 2018. The background, rationale, data quality objectives, and overall study design are described in detail in the Addendum No. 9 text. Section 2 of this FSP describes the field procedures, sample packaging, and shipping requirements and field quality control (QC) procedures that will be followed by the technical teams during the field study. Section 3 summarizes field documentation and chain-of-custody (COC) procedures and sample numbering. Field data reporting and field custody procedures are also discussed in Section 3.

The following documents are provided as attachments to this FSP:

- Standard Operating Procedures (SOPs). The SOPs describe the procedures that will be used to collect the various tissue types (Attachment B1).
- Field Forms. This attachment contains examples of various forms that will be used during field sampling, including a corrective action record, a field change request form, and a COC form (Attachment B2).
- Tissue Sampling Health and Safety Plan (HASP) Addendum 1. This document describes the specific requirements and procedures that will be implemented to minimize the safety risk to personnel who carry out the field study program for tissue collection (Attachment B3). It is an addendum to the project's overall HASP (NewFields 2015, Appendix F).

2 FIELD INVESTIGATION

This section describes the detailed procedures and methods that will be used during the 2018 tissue collections, including sampling procedures, sample handling, storage, and field QC procedures. Sample collection and processing will be conducted in accordance with the SOPs provided in Attachment B1. Depending on field conditions, procedures specified in the referenced SOPs may be modified, if necessary. All field activities will be conducted in accordance with Tissue Sampling HASP Addendum provided as Attachment B3.

2.1 SCHEDULE AND SITE RECONNAISSANCE VISIT

The start date for the tissue study will be determined following EPA approval of RIWP Addendum No. 9. However, for planning purposes, it is anticipated that the field sampling event will begin in mid-August 2018 and be completed in mid-September.

The field program will be preceded by a Site reconnaissance visit with agency personnel, currently anticipated for mid-July 2018. The purpose of the reconnaissance visit is to finalize sampling locations for sediments, water, and fish tissue in the Clark Fork River, and to finalize onsite ponds to be sampled. The selected sample Site locations will be recorded with a global positioning system (GPS) unit during the reconnaissance visit. Locations shown in tables and figures are preliminary and may be changed depending on the outcome of Site reconnaissance.

2.2 SITE AND CLARK FORK RIVER ACCESS

Access agreements will be obtained by NewFields in accordance with the requirements in the AOC. Portions of the investigation that may require access agreements include the offsite locations in Lavalle and O'Keefe creeks and select locations in the Clark Fork River.

Sampling locations on the Clark Fork River will be accessed by boat. Section 2.3.3 addresses the sampling vessel to be used. NewFields (2015, Appendix F) provides health and safety protocols for vessel safety.

2.3 SAMPLING PROCEDURES

This section and cited SOPs describe field survey equipment requirements and sampling methods and procedures.

2.3.1 Field Equipment and Supplies

Field equipment and supplies include sampling equipment, utensils, decontamination supplies, sample containers, coolers, shipping containers, logbooks and forms, personal protective equipment (PPE), and personal gear. Protective wear (e.g., powder-free nitrile gloves) is required to minimize the possibility of cross-contamination between sampling locations. Additional information on protective wear required for this project is provided in the project HASP (NewFields 2015) and the tissue sampling HASP Addendum (Attachment B3).

Various sampling gear will be deployed in different environments and locations to maximize sampling efficiency for each target tissue type. An assessment of each kind of sampling equipment will be performed in the field to determine which kind of equipment and sampling methods will provide the maximum catch per unit effort. It is possible that some of the equipment listed in the following sections may not be used during the tissue sampling event if it is determined in the field that the catch per unit effort is not sufficient, or if it is determined that other methods provide better sampling results. Proposed sampling methods and equipment for use in tissue collection are discussed in detail in Sections 2.3.7, 2.3.8, and 2.3.9.

Sample jars, laboratory-grade distilled water, coolers, and packaging material for the samples will be supplied by the analytical laboratory. Details on the numbers and type of sample containers are provided in Tables B-1 and B-2 of this FSP. The field lead and field personnel in charge of sample handling in the field will use a sample matrix table (Table B-3) as a QC check to ensure that all samples have been collected at a given station. This table includes the total number and type of tissue samples required at each sampling location.

New, food-grade aluminum foil and large, food-grade resealable plastic bags will be used for the individual fish and small mammal samples. Commercially available, pre-cleaned jars will be used for the equipment filter wipe blanks. The testing laboratories will maintain a record of sample jar certification from the suppliers. The sample jar shipment documentation will include batch numbers. With this documentation, jars can be traced to the supplier, and bottle-wash analysis results can be reviewed. All laboratory records are managed by NewFields.

All samples will be clearly labeled at the time of sampling. Labels will include the task name, sample number, sampler's initials, analyses to be performed, and sample date and time. Sample numbering and identification procedures for tissue sampling are described in detail in Section 3.

2.3.2 Equipment Decontamination

The field team will decontaminate all fish sampling equipment that comes into contact with either fish or sediments prior to the commencement of sampling at each location and upon completion of the study. This will include dip nets, fish traps, seines, and other non-disposable

fish capture equipment. The decontamination of equipment for sampling invertebrates and fish will consist of thoroughly rinsing all of the equipment with Site water away from the shoreline and any areas where sediment has been disturbed.

Sample collection buckets and ice chests will be scrubbed with detergent (i.e., Liquinox®) and rinsed with tap water, laboratory-grade distilled water, or ambient water between uses.

Field equipment used for measuring fish at the onshore processing area will be washed with detergent (i.e., Liquinox®) and rinsed with laboratory-grade distilled water after each use. This will include the fish measuring boards, and the holding containers in which the fish are stored and transported.

The field team will decontaminate all small mammal sampling equipment that comes into contact with either small mammals or soils prior to the commencement of sampling at each location. Decontamination of equipment used to capture and handle small mammals is described in SOP BT-20 (Attachment B1).

Powder-free, nitrile gloves used for handling fish and small mammals in the field and onshore will be discarded, not decontaminated. Clean nitrile gloves will be replaced at each sampling location or as often as needed to avoid transfer of potential contaminants among samples.

2.3.3 Sampling Vessel

Access to the areas for sampling onsite ponds for macroinvertebrates or for fish tissue sampling in the river will require the use of a boat. In ponds, some sampling locations will be sampled by wading or accessed either by boat or by land; a truck or van will be required to access locations by land. The vessel for pond sampling will be obtained and operated by a qualified person and will be capable of deploying and operating a Petite Ponar grab sampler (or similar equipment) for sediment sample collection. The sampling vessel will also be able to deploy a water sampler to collect water samples (see Appendix A of the work plan).

The sampling vessel used on the Clark Fork River will have enough space to accommodate a minimum of four people—two sampling team members, the vessel's operator, and one EPA oversight individual (if required)—and the following gear: fish collection equipment, sample coolers, documentation supplies, and other ancillary equipment. The vessels used for sampling will have navigational lights, ropes, and anchors. The vessel operator will be thoroughly familiar with the area of the river to be navigated.

As needed, weather and river gauge height will be monitored using the following web sites:

- National Weather Service https://forecast.weather.gov/

- U.S. Geological Service for USGS 12353000 Clark Fork below Missoula MT https://waterdata.usgs.gov/

2.3.4 Scientific Collection Permit

Prior to fish tissue sampling, it will be necessary to obtain a scientific collection permit from Montana Fish, Wildlife and Parks (MFWP) for collection of fish tissue and small mammals. These scientific collection permits must be taken into the field when collecting samples. The MFWP enforcement office nearest to the Site will be notified at least 24 hours prior to sampling. The permit applications will be submitted to MFWP and the U.S. Fish and Wildlife Service during summer of 2018 (pending EPA approval of the work plan).

2.3.5 Station Location Positioning

The standard projection method to be used during field activities is Horizontal Datum: NAD 83 Montana State Plane (ft). The positioning objective is to accurately determine and record the positions of all sampling locations and transects to within ±2 m. Trimble GPS units will be used to record coordinate data (see SOP AP-06), the time and date of each sampling effort, and the numbers of biota collected, retained, or released.

Handwritten field logbooks will also be used to duplicate data collected using the GPS units and record any other field observations related to sample location positioning. The coordinate data will be downloaded at the end of each sampling day from the field GPS units and saved to the Integral Consulting Inc. (Integral) project folder on a secure server. The coordinate data will later be differentially corrected by Integral's geographic information system team.

Latitude and longitude coordinates will be obtained at the locations where fish, benthic macroinvertebrate, and small mammal tissue samples are collected. Proposed tissue sampling locations are shown in Figures B-3 through B-6, and specific location coordinates are provided in Table B-4. Fishing and benthic macroinvertebrate sampling that requires coverage of 10–40 m of stream or river length will be documented by recording GPS coordinates of the most upstream point and the most downstream point at the end of each sampling effort. Where fish traps, small mammal traps, or sediment grabs are used, a single coordinate point for the specific location where the sample was actually collected will be recorded.

2.3.6 Tissue Processing Area

At each tissue sampling location, a tissue processing area will be set up near the shoreline where the fish are captured to manage biological samples, including identifying the species and measuring fork length of each fish and recording this information, and documenting the biological samples through photographs. Sample packaging, cooler packing, and sample

shipping (SOP AP-01) will be performed at the tissue processing area. Supplies and equipment used by the processing team are discussed below.

2.3.7 Benthic Macroinvertebrate Tissue Sampling

Benthic macroinvertebrate tissue samples will be collected from all 12 onsite ponds targeted for sampling and from 10 locations in O'Keefe and Lavalle creeks. Sampling in ponds will be conducted using a stainless-steel sediment grab sampling device (e.g., Petite Ponar). Sample collection by kick sampling will be used in the creeks where the more gravelly substrate does not allow for the use of a Petite Ponar. In deeper portions of the streams where kick netting cannot be performed safely, a sediment grab sampling approach may be required to obtain benthic macroinvertebrate tissue samples. The determination will be made by Integral's field lead at the time of sampling.

All tissue samples will be submitted to the laboratory for analysis of dioxins and furans, methylmercury, metals, lipid content, and percent moisture (Tables B-2 and B-3). The numbers of samples are listed in Table B-1. The holding time requirements for the tissue samples following field collection are specified in Table B-2.

2.3.7.1 Benthic Macroinvertebrate Sampling Equipment

Benthic macroinvertebrate sampling equipment includes either a stainless-steel Petite Ponar or equivalent stainless-steel, hand-deployed grab device and a D-net for collection of creek invertebrate samples. Equipment will also include materials and supplies listed in Section 2.3.1, Table B-5, and SOP BT-12.

2.3.7.2 Benthic Macroinvertebrate Sampling Methods

Sampling in ponds will be performed using a sediment grab sampler and washing the resulting sample through 500-μm sieve buckets or similar. Sampling in creeks will be conducted with a kick net sampler.

Sediment Grab Sampling

In onsite ponds, sediment grab samples will be collected from the upper 0 to 6 in. (0–15 cm) of sediment. Multiple grab samples may be required to obtain sufficient biomass (Table B-5); up to 10 grabs will be processed for an individual pond[1]. Samples will be collected as described in Integral SOP BT-12, except that analytical samples will be preserved by freezing using dry ice. Frozen samples will be shipped with dry ice as described in Integral SOP AP-09.

[1] If field personnel determine that one or two additional grabs may provide the required mass, they should proceed. If the resulting biomass at 10 grabs is poor, then additional grab sampling will not be conducted.

1. If on the sampling vessel, position the vessel at the targeted sampling station.
2. Set the sampler jaws in the open position, place the sampler over the edge of the boat, lower the sampler to the bottom, and trip the sampler to collect the sample.
3. Record the sample station coordinates using the GPS; measure and record the water depth.
4. Retrieve the sampler and place it securely on the sampling vessel.
5. Examine the sample for the following acceptance criteria:
   - The sample does not contain large foreign objects such as trash or debris. A sample that is rock/gravel fill will be rejected in favor of depositional material (sand/silt/clay).
   - Overlying water is present in the sampler (indicates minimal leakage).
   - The sediment surface is relatively flat (indicates minimum of disturbance or winnowing).
   - The desired penetration depth is achieved (several centimeters more than the targeted sample depth). If after five attempts the targeted penetration depth (i.e., 4 to 6 in.) cannot be met, the sampling station will be abandoned.

     If the above criteria are not achieved, reject the sample away from the station and collect another sample.
6. Siphon off any overlying surface water.
7. Measure and collect the top 6 in. with a stainless-steel spoon. Sediment will be placed in clean 5-gallon buckets.
8. Record the following observations of sediment sample characteristics in the field logbook; if more sample volume is required, then repeat Steps 1 through 8:
   - Physical sediment description (i.e., sediment classification, density/consistency, color)
   - Odor (e.g., hydrogen sulfide, petroleum)
   - Visual stratification and lenses
   - Vegetation
   - Evidence of biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
   - Presence of debris (natural or anthropogenic objects)
   - Presence of oily sheen or obvious contamination
   - Other distinguishing characteristics or features.

9. Wash excess sediment back into the water away from any areas remaining to be sampled.

Following collection of three or four sediment grab samples, wash the sediment sample through a wash bucket or 500-μm mesh (or similar) sieve or sieve bucket. Add water from the pond to the sample if necessary to create a slurry of the sample. Wash the sediment slurry through the sieve mesh at very low pressure. Gently agitate the sieve or wash bucket to aid in rinsing the fine sediment out of the sample. It may be necessary to sieve the slurry in small portions to percent clogging of the mesh. Remove any large particles manually, but check the particles for the presence of invertebrates before disposing of them.

Manually transfer the invertebrate sample from the sieve to the jar using clean forceps. Once approximately 50 g of sample have been placed into the jar, the sample will be prepared for shipment. Sampling will be performed until up to 10 grab samples have been processed.

All field staff will wear disposable nitrile gloves at all times while sampling. Once sufficient biomass has been collected (50 g), the sample will be sealed in a glass jar, placed in a cooler on wet ice, and maintained at approximately 4°C until ready for preparing to ship to the analytical laboratory. Macroinvertebrate samples will be shipped frozen using dry ice, and maintained at approximately -4°C.

Each sample container will be clearly labeled with the project name, sample identification, type of analysis to be performed, date and time, and initials of person(s) preparing the sample. All sampling equipment will be scrubbed and decontaminated with Alconox® and deionized water before proceeding to the next sampling station.

Kick Net Sampling

General kick sampling procedures for creeks are outlined below and are adapted from multiple sources (Normandeau Associates 2002; Barbour et al. 1999). Kick net sampling at any one location will be limited to approximately 4 hours.

1. Photodocument each sampling station to accurately depict station attributes (e.g., riffles, pools, streamside vegetation, etc.) and record the GPS coordinates of the sample station.
2. At each sampling station, stand facing downstream and place 500-mm dip net perpendicular to substrate.
3. Agitate the substrate immediately upstream of the dip net by kicking the substrate or jabbing with net. Wash collected material every three jabs by running clean stream water through the net, being careful to retain the sample inside the net.
4. Empty dip net into clean sample bucket as necessary.

5. Collect a minimum of 10 representative samples from at least a 10-m length of stream, centered on the target sampling location to prepare each composite sample, moving from downstream to upstream while sampling.
6. Transport sample buckets to processing area.

Field staff will wear nitrile gloves at all times while processing benthic community kick samples. Benthic community kick samples will be processed removing organisms from the collection bucket or stainless-steel bowl using a clean spoon or forceps. Benthic organisms will be placed in labeled glass containers, stored at -4°C, and shipped to the analytical laboratory. Following sample processing, all sample buckets will be scrubbed and decontaminated with Alconox® and deionized water prior to collection of additional samples.

2.3.8 Fish Tissue Sampling

The procedures to be used to collect small fish samples during the 2018 fish tissue study are discussed in the following sections. The target small fish species for this tissue study is the longnose dace, target length of 60–90 mm. If sufficient quantities of the longnose dace are not available at each study location, individuals of alternative species (e.g., redside shiner, peamouth) and within the defined size range will be retained as individual samples and may be used in composites. It is anticipated that 10–15 individual longnose dace from each station will be needed to meet the analytical mass requirements (Table B-1).

Each individual will be assigned a unique identifier, its fork length and species recorded using the small fish sampling field forms (Attachment B2), packaged individually, preserved on ice, and shipped to the laboratory. A subset of individuals at each station will be photographed, with their sample ID clearly shown on a whiteboard or piece of paper or foil. Once all longnose dace or other small fish from all locations have been collected, PRPs will work collaboratively with EPA to determine which individuals will be used in each composite.

All tissue samples will be submitted to the laboratory for analysis of dioxins and furans, methylmercury, metals, lipid content, and percent moisture (Tables B-2 and B-3). The numbers of samples are listed in Table B-1. The holding time requirements for the tissue samples following field collection are specified in Table B-2.

2.3.8.1 Electrofishing Safety

Electrofishing safety is briefly described here and addressed by the HASP Addendum for tissue sampling (Attachment B3).

Field team members using electrofishing equipment will be trained in electrofishing safety precautions and safe unit operation described by the manufacturer. Each team member will be insulated from the water and electrodes, and will be required to wear rubber neoprene chest

waders and rubber gloves during electrofishing. Electrodes and dip net handles must be made of insulating materials (e.g., wood, fiberglass), and the electrofishing devices must be equipped with functional safety switches installed by the manufacturer. Field personnel will not reach into the water unless the electrodes have been removed from the water or the electrofisher has been disengaged or turned off.

At least two sampling team members will be certified in cardiopulmonary resuscitation (CPR). Sampling will involve pulsed DC electrofishing and a minimum of two people conducting the sampling.

Sampling will be conducted only to depths in which wading can be performed safely, within the river margin from the shoreline to about 3 to 5 m from shore. Waders will wear personal flotation devices (PFDs) during sampling.

2.3.8.2 Fish Sampling Equipment

Two types of fish sampling equipment will be used to collect longnose dace. A backpack electroshocker and dip nets will be used initially, and if electrofishing is not effective, sampling using a kick seine will be attempted. Minnow traps are not preferred, but they will be deployed if other methods fail. An equipment list for fish capture is provided in Table B-6.

Equipment will also include materials and supplies listed in Section 2.3.1 and in the electrofishing protocol excerpted from Barbour et al. (1999), included in Attachment B3.

2.3.8.3 Fish Sampling Method

Samples of longnose dace will be collected using electrofishing or kick siene methods, as described below. This species is expected to occur in river margins with cobble substrate in fast-flowing water.

Sampling with either of the two potential methods will be initiated by identifying a defined sampling reach for each sampling location. The sampling reach will be located downstream of associated depositional habitat sampled for sediment and surface water, will be approximately 40 m in length, and will consist of cobble substrate and be free of trip hazards such as complex woody or other (e.g., anthropogenic) debris. The GPS coordinates of the fish tissue sampling reach and other pertinent habitat information and observations will be recorded in the field logbook.

Preparation for fish sampling reach will also include establishment and setting up of a fish tissue processing area, as described in Section 2.3.8.4. Fish tissue sampling at any one location will be limited to approximately 4 hours.

Electrofishing

Electrofishing sampling will follow standard safety protocols established by the EPA (Barbour et al. 1999; Attachment B1), and will be conducted in the following steps.

1. Fish collection via electrofishing will begin at the downstream end of the sampling reach, and a block net will be set up at the downstream end of the sampling reach.
2. Starting at the downstream barrier, the minimum 2-person team will electrofish in a side-to-side sweeping motion within the wadeable depths of the sampling reach.
3. Stunned fish are collected in dip nets by the person(s) not operating the electrofisher. Stunned fish will be maintained in live wells or buckets. No more than 15 individuals should be maintained in a 5-gallon bucket at a time. Any fish at or larger than 8 in. (20.3 cm) will be released immediately, downstream of the barrier net.
4. Once there are 15 specimens in a bucket, electrofishing will be paused and fish will be identified. Any longnose dace can be removed for packaging at that time. Other non-salmonid species within the target size range will remain in the bucket until completion of sampling.
5. Electrofishing will recommence at the point where the sampling left off.
6. Once 12–15 longnose dace have been collected, and all electrofishing in complete, remaining non-target fish will be released back into the river. If 12–15 longnose dace have not been captured, 5–10 additional specimens will be identified to species, measured, and packaged for delivery to the lab. Integral's field lead will contact Integral's project manager and determine whether additional sampling should be conducted using a kick seine.

Kick Seine

The following steps outline the procedure for collecting fish samples using kick nets. Necessary sample equipment is listed in Table B-6:

1. Fish collection utilizing a kick net will begin at the downstream end of the sampling reach.
2. Starting at the downstream end of the sampling reach, place the kick net perpendicular to the stream flow. Manually agitate the substrate by gently moving cobbles immediately upstream of the kick net with a hand tool pushed into the cobble or with feet. To minimize potential for missing fish, ensure that the base of the net is as flush to the bottom as possible.

3. Collected fish will be maintained in live wells or buckets. No more than 15 individuals should be maintained in a 5-gallon bucket at a time. Any fish larger than 8 in. (20.3 cm) will be released immediately, downstream of the sample collection point.
4. Once there are 15 specimens in a bucket, kick netting will be paused and fish will be identified. Any longnose dace can be removed for packaging at that time. Other species within the target size range will remain in the bucket until completion of sampling.
5. Kick netting will recommence at the point where the sampling left off.
6. Once 12–15 longnose dace have been collected, and all kick netting is complete, remaining non-target fish will be released back into the river. If 10–15 longnose dace have not been captured, 5–10 additional specimens will be identified to species, measured, and packaged for delivery to the laboratory. Integral's field lead will contact Integral's project manager and determine whether additional sampling should be conducted.

Multiple passes will be made at each sampling station to obtain the minimum mass (50 g) needed to perform all proposed analyses (Table B-2).

2.3.8.4 Fish Tissue Sample Processing

Once samples are transported to the field processing area, the species of individual fish will be identified and their fork lengths measured, and both will be recorded on the appropriate field forms (Attachment B2). Equipment for fish tissue processing will include materials and supplies listed in Table B-6.

If insufficient mass is captured at a given sampling station, all samples will nevertheless be shipped to laboratory, and the laboratory will be directed to aggregate samples following discussion with EPA, or to abandon selected analyses, as directed by the project manager.

After processing, individual fish will be wrapped in foil and the composite sample placed in a Ziploc® bag. Each sample bag will be clearly labeled with the project name, sample/composite identification, type of analysis to be performed, date and time, and initials of person(s) preparing the sample. Sample bags will be placed in a cooler on wet ice maintained at approximately 4°C and prepared for shipment to the analytical laboratory as described in Section 3. Prior to shipment, the sampling crew will confirm entries are accurate and all field documentation is complete.

Field staff will wear appropriate non-contaminating, disposable, powderless, nitrile gloves at all times while processing fish samples. Decontamination supplies (e.g., buckets, tubs, solvents, scrub brushes) and a freshwater source will be available at each fish processing location to perform decontamination of measuring equipment used at each station.

Fish samples will be frozen and shipped in coolers containing dry ice, maintaining a temperature of -4°C (SOP AP-09).

2.3.9 Small Mammal Tissue Sampling

The procedures that will be used to collect small mammal samples during the 2018 supplemental site investigation are discussed in the following sections. This study is targeting a mixed species composite of small mammals at each location, but will not use specimens of the relatively larger small mammals (e.g., Columbia squirrel). Species targeted for analysis will include small mammals (e.g., shrews and mice) with the target body length of 5 to 10 cm (and no more than 11 cm), typical of small mammal body sizes (e.g., shrews and deer mice, minus the tail; USEPA 1993).

In the ecological risk assessment for OU1 (USEPA 2017a) and the screening level ecological risk assessment for OU2 and OU3 (USEPA 2017b), EPA identified federal and state species of concern potentially present at the Site and no small mammals were listed. The listed species of concern presented in Table 1-1 of the main Addendum No. 9 text was based on a search of the Montana Natural Heritage Program (MTNHP) web site's Species of Concern report completed on June 12, 2018 (MTNHP 2018) and the U.S. Fish and Wildlife Service Montana Field Office and Information for Planning and Consultation (IPaC) query results. Small mammal sampling will be conducted using procedures that ensure the safety of field personnel (Attachment B3).

If sufficient quantities of the mammals in this size range are not available at one or more study locations, the field team will contact Integral's project manager, who will engage EPA to address whether alternative (larger) species or specimens should be captured and retained for analysis. All individual small mammals will be preserved as individual samples. Each individual will be assigned a unique identifier, its species and body length will be recorded, and it will be packaged individually, preserved on ice, and shipped to the laboratory. A subset of individuals at each station will be photographed, with their sample ID clearly shown on a whiteboard or piece of paper or foil. Once all small mammals from all locations have been collected, PRPs will work collaboratively with EPA to determine which individuals will be used in each composite.

All tissue samples will be submitted to the laboratory for analysis of dioxins and furans, methylmercury, metals, lipid content, and percent moisture (Tables B-2 and B-3). The numbers of samples are listed in Table B-1. The holding time requirements for the tissue samples following field collection are specified in Table B-2.

2.3.9.1 Small Mammal Capture and Handling Safety

In addition to the physical and chemical hazards associated with field sampling at the Site, there are special hazards posed by handling small mammals that may carry Hantavirus. All

field staff will review the HASP Addendum (Attachment B3) prior to conducting field activities in order to familiarize themselves with these hazards. The following procedures will be used by field personnel handling small mammal samples:

- Field staff will wear disposable nitrile gloves, half- or full-face respirators with HEPA filters, Tyvek coveralls, and eye protection at all times while setting, checking, and re-setting traps in accordance with the Tissue HASP Addendum (Attachment B3). Sleeves should be taped to gloves.

- Each animal-trapping team will consist of two field persons, each with the following roles:
  - The primary handler (Field Person 1) opens the traps and handles the mammals. This person is equipped with impermeable nitrile gloves, coveralls, full-face respirator, and chemical-resistant boots.
  - The assistant (Field Person 2) provides support to the primary handler, but does not handle traps or mammals unless the traps or mammals have been placed in sample containers (plastic bags).

Following sample collection and processing, field personnel are required to prevent the potential spread of excreta by decontaminating boots with a bleach solution or commercial disinfectant spray (such as Lysol®) before getting into a vehicle. All personnel wearing potentially contaminated gloves must wash and disinfect those gloves with a bleach solution of commercial disinfectant prior to removing them.

2.3.9.2 Small Mammal Sampling Equipment

Multiple types of equipment can be used to capture small mammals (see SOP BT-20); for the 2018 study at the Site, field crews will use Sherman live traps (or equivalent). Additional equipment will include the PPE and decontamination equipment and supplies described above, cotton or wool stuffing, a euthanasia chamber (plastic tub or a cooler with lid of sufficient size to hold a live trap and plastic tubing), carbon dioxide gas tank with regulator orange flags, stakes, field notebooks, measuring tape, a portable scale, a camera, and sample packaging and storage equipment. A full equipment checklist is provided in Table B-7.

2.3.9.3 Small Mammal Trap Deployment

- Sherman live traps (or equivalent) will be used to collect small mammals at the Site following the procedures in SOP BT-20. The following steps summarize the method for live trap deployment:

- Small mammal live traps will be set in the evening of the first day of trapping to allow for overnight sampling. If set earlier in the day, traps should be closed immediately after placement and reopened and baited in the evening.
- Trap locations will be selected in the vicinity of the target sample location based on the availability of suitable habitat (e.g., brush piles, fallen logs, and burrows). Traps should be set along small mammal paths, indicated by features such as grass runways or scat, if such features are observed. Traps will be placed in areas that are out of sight of roads, sidewalks, paths, or other areas of human activity.
- After setting traps flush with the ground, field personnel will check sensitivity of trap release mechanism and bait the traps. Each trap will be baited with a mixture of peanut butter and oats. Field personnel will place a piece of felt or wool beneath each Sherman trap to provide warmth in the case that an animal is caught. For Sherman live traps, a small amount of bait will be placed in the back on the spring platform and depress trigger mechanism.
- Five live traps will be set within 30 m of the central location of each mammal station (where soil samples were collected in 2017).
- Traps will be individually marked with a 2.5-ft bright orange flag and secured using metal stakes to reduce tampering and trap removal by predators (e.g., red fox).
- The location of each trap will be noted in the field notebook with GPS coordinates.
- Traps will be checked early each morning and collect small mammal captures, as described below. After checking traps, field personnel will close traps for the remainder of the day. Traps will be reopened and re-baited, if necessary, each evening.

Small mammal populations can become depleted and community composition can be altered if trapping is conducted for extended time periods; thus, trapping will be limited to a maximum of four consecutive nights per week, for a maximum of two consecutive weeks at each sampling location.

A total of 10–15 individual small mammals will be targeted for collection at each station. The number of traps set up each day will be adjusted based on the trapping success, so as to minimize the number of animals sacrificed.

A sample of the bait will be submitted to the laboratory for analysis of dioxins and furans, metals, and methylmercury to confirm the absence of contamination.

2.3.9.4 Small Mammal Collection

For collecting and handling traps, Field Person 1 will follow the steps below:

- Prior to handling traps, Field Person 1 will don appropriate PPE. Each trap will be checked for evidence of capture or visitation. If a trap appears to have been visited but not sprung (e.g., contains urine, feces, or nesting material in or on the trap), the trap will be placed in a double plastic bag to be washed with soap and water and checked for proper function. The used trap will be replaced with a clean trap.
- When a live trap is encountered with the door closed, Field Person 1 will lift the trap without shaking it. Standing with the trap held at arm's length, the door will be pushed open just enough to peer into the trap and confirm the presence of a captured animal. If there is no capture and no evidence of visitation, the adjustment of the trap will be checked and replaced.
- If a non-target species has been captured, the animal will be carefully released at the Site of capture and then the trap will be reset or placed in a bag for decontamination.
- If the trap contains a target species, the trap door will be closed. Field Person 1 will then prepare to euthanize the animal(s) by placing the trap in a plastic container or a cooler connected to a carbon dioxide canister. A lid will be placed on the plastic container and the carbon dioxide regulator will be turned on slowly. Careful attention will be paid to the gas release rate, so as not to blow off the container lid. The carbon dioxide will be allowed to run for 60 seconds and then the regulator will be shut off.
- Field Person 1 will wait for 5 minutes for the specimen to asphyxiate before removing the trap from the plastic container. Field Person 1 will ensure that the specimen is dead before further handling and removal by gently shaking the plastic container/cooler and listening for movement, or by visual inspection.

Depending on trapping success, traps may be placed in a different location for the next evening or, if trap success was reasonable (10 percent or better), they may be left in the same location for additional nights. Additionally, traps may be set during the day if trapping success is limited during the night, in which case traps will be checked more regularly to prevent traps from overheating and killing the animals inside the traps.

Field Person 2 will record species and body length of each adult specimen using the small mammal collection forms (Attachment B2). If appropriate, photographs will be taken of representative specimens for proof of collection and summary reporting.

Field Person 1 will place the specimen in a Ziploc® bag in the field. Traps will be reset following the procedures in SOP BT-20 until the minimum mass needed for proposed analyses is obtained (60 g; 180 g for matrix spike/matrix spike duplicate [MS/MSD]).

2.3.9.5 Small Mammal Sample Processing

If insufficient mass is captured at a given sampling station, all samples will nevertheless be shipped to laboratory, and the laboratory will be directed to aggregate samples with those from

adjacent monitoring stations to ensure sufficient mass for analytical requirements, or to abandon selected analyses, as directed by the project manager.

Composite small mammal samples from each station will be formulated by the laboratory, following instructions to be prepared by Integral in collaboration with EPA.

Bags containing individual small mammal specimens for use or potential use in a single composite will be bagged as a group or groups in larger plastic bags with the station ID written on it, and then stored in dedicated sample storage coolers on dry ice maintained at approximately -20°C. No other samples will be stored with the small mammal samples. These coolers will be labeled with the words "Contains potentially infectious substance," and all staff will be made aware of the hazards posed by small mammal samples. Small mammals will be prepared for shipment to the analytical laboratory as described in SOP AP-01 and SOP BT-20.

2.3.9.6 Decontamination and Disposal of Small Mammal Sampling Material and Wastes

All coolers, counters, equipment, and other surfaces or items that come into contact with rodents, rodent excreta, or otherwise potentially contaminated items (including vehicles and boots) must be washed with a detergent and thoroughly disinfected using a bleach solution, alcohol, or a commercial disinfectant such as Lysol®. Contaminated reusable clothing should be double-bagged for laundering using a detergent. After decontamination of surfaces, warning labels or signs should be removed, indicating that the area is clean. In the event of skin contact with potentially infected materials, the field person must immediately wash the affected skin with soap and water and then wipe the area with alcohol. All personnel wearing potentially contaminated gloves must wash and disinfect those gloves with a bleach solution of commercial disinfectant prior to removing them.

To prevent the spread of contaminants, traps or other contaminated items must be thoroughly decontaminated (including the use of disinfectant) in the field prior to being placed into a building or vehicle. Uncleaned traps must be double-bagged prior to transporting in a vehicle (i.e., to a new sample location).

All potentially infectious wastes (including animal tissue, gloves, and paper towels) must be separated from noninfectious trash for disposal. The potentially infectious trash should be double-bagged and labeled as potentially infectious materials. Actual disposal will depend on local regulations. Alternatives include contracting with a service providing incineration of infectious wastes or thoroughly wetting waste materials with disinfectant prior to disposing the materials as solid waste. Potentially infectious materials must not be placed into a dumpster or other receptacle for collection by municipal waste haulers. These materials must be properly disposed of by a licensed hazardous waste hauler.

2.4 FIELD QUALITY CONTROL SAMPLES

Field QC samples will be used to assess sample variability and evaluate potential sources of contamination. The types of QC samples that will be collected for the 2018 tissue study are described in this section. Detailed information on quality assurance and quality control (QA/QC) procedures, limits, and reporting are described in detail in the EPA-approved QAPP for this project (NewFields 2015, Appendix E). The estimated numbers of field QC samples to be collected are listed in the sample matrix table (Table B-3). If QC problems are encountered, they will be brought to the attention of NewFields laboratory QA coordinator. Corrective actions, if appropriate, will be implemented to meet the task's data quality indicators.

Field QC samples will include equipment filter wipe blanks and filter blanks. The following QC samples will be collected in the field and analyzed by the analytical laboratory:

- Equipment filter wipe blanks will be collected to help identify possible contamination from the sampling environment. In addition, equipment filter wipes will be collected at the analytical laboratory on their homogenization equipment. Whatman filter papers will be used for organic blanks, and Ghost wipes will be used for metals/mercury blanks.
- Equipment filter wipe blanks will be generated at a frequency of 1 per 20 samples at a minimum. All equipment wipe samples will be clearly noted in the field log or laboratory log, respectively (e.g., sample identifier, equipment type, date and time of collection, analysis, and filter lot number).
- Filter blanks are prepared in the field to evaluate potential background concentrations present in filter paper used for the equipment filter wipe blank. Filter blanks will be collected at a minimum frequency of one for each lot number in both the field and at the laboratory of filter papers used for collecting the equipment wipe blanks.

2.5 LABORATORY QUALITY CONTROL SAMPLES

Additional tissue mass will be required for 1 out of every 20 samples, or 1 sample per species (whichever is more frequent), to allow the analytical laboratory to analyze QC samples. Approximately 180 g of tissue will be required for the laboratory QC samples. The location where this additional tissue mass will be collected will be determined in the field, based on the abundance of the target species to be collected.

3 SAMPLE MANAGEMENT AND DOCUMENTATION

A complete record of field activities will be maintained as described in SOP AP-02, Field Documentation (Attachment B1).

3.1 FIELD DOCUMENTATION

The integrity of each sample from the time of collection to the point of data reporting must be maintained. Proper record-keeping and COC procedures will allow samples to be traced from collection to final disposition. Representative photographs will be taken at each location where samples are collected. Photographs will be taken before fish processing. Site photographs from various angles and close-up views of the overall sampling conditions will also be collected.

3.1.1 Field Logbook

All field activities and observations will be noted in a logbook. The field logbook will be a bound document and may contain individual field and sample log forms (depending on the sampling activity). Information recorded will include personnel, date, time, station designation, sampler, types of samples collected, and general observations. Any changes that occur during sampling (e.g., personnel, responsibilities, or deviations from the FSP) and the reasons for these changes will be documented. The logbook will identify visitors (if any) on the Site and the number of photographs taken at each sampling location. Each field lead is responsible for ensuring that their respective field logbook and all field data forms are correct. Requirements for logbook entries will include the following:

- Logbooks will be bound with consecutively numbered pages.
- Removal of any pages, even if illegible, will be prohibited.
- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be recorded, as well as the time of the observation itself).
- Each consecutive day's first entry will be made on a new, blank page.
- The date and time, based on a 24-hour clock (e.g., 0900 for 9:00 a.m. and 2100 for 9:00 p.m.), will appear on each page.

In addition to these requirements, the person recording the information must initial and date each page of the field logbook. If more than one individual makes entries on the same page,

each recorder must initial and date each entry. The bottom of the page must be signed and dated by the individual who makes the last entry.

Logbook corrections will be made by drawing a single line through the original entry, allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed and dated and may require a footnote for explanation.

The type of information that may be included in the field logbook and/or field data forms includes the following:

- Task name, task location, and task number
- Task start date and end date
- Weather conditions
- Name of person making entries and other field staff
- Onsite visitors, if any
- Sampling vessel, if any
- Sampling station number and location
- Date and collection time of each sample
- Sample number for each sample to be submitted for laboratory analysis
- Specific date and time with corresponding station number associated with the sampling location coordinates derived from GPS
- Specific information on each type of sampling activity
- Sample number, date and time of collection, equipment type, and the lot number for the box of filter papers used for field QC samples
- Observations made during sample collection, including weather conditions, complications, and other details associated with the sampling effort
- Sample description (e.g., species, sex [crabs only], length, and weight)
- Sampling method
- List of target and non-target fish species caught and released
- Sampling station GPS coordinates (see Section 2.3.5)
- Number of photographs taken at the sampling location
- Record of Site health and safety meetings, updates, and related monitoring
- Any deviation from the FSP and reasons for deviation.

In addition, a sampling location map will be updated during sampling and will be maintained throughout the sampling event. All logbooks must be completed at the time that any observations are made. Copies of all logbooks and forms will be retained in Integral's project files.

3.1.2 Chain-of-Custody Procedures

The integrity of each sample from the time of collection to the point of data reporting must be maintained throughout the study. Samples will be retained in the field team's custody at all times until the samples are transported to the appropriate laboratory. Proper record-keeping and COC procedures will be implemented to allow samples to be traced from collection to final disposition.

At the end of each day and prior to shipping or storage, COC forms will be prepared for all samples to ensure that all collected samples are properly documented and traceable through storage, transport, and analysis (example provided in Attachment B2). The sample number (Section 3.1.3) of each sample container will be recorded on the COC form and will also include the following:

- Site name
- Field lead's name and team members responsible for collection and processing of the listed samples
- Collection date and time for each sample
- Sample type (e.g., sample for immediate analysis or archive, sediment, tissue, or filter blank)
- Number of sample containers shipped
- Requested analyses
- Sample preservation information (if any)
- Name of the carrier relinquishing the samples to the transporter, noting date and time of transfer and the designated sample custodian at the receiving facility.

The signed COC form will be secured to the inside top of each cooler identifying the sample collection date and time, the type of sample, the project, and the field personnel. The COC form will be sent to the laboratory along with the sample. The COC forms will be completed in triplicate, with one copy retained by the field team lead.

An additional component of the COC process is the use of custody seals during sample shipping. Two custody seals will also be placed across the lid of the cooler prior to shipping.

Additional details regarding COC procedures to be followed for this sampling event are provided in SOP AP-03 (Attachment B1).

3.1.3 Station Numbering, Sample Identifiers and Sample Labels

All sample identifiers have been established in advance using NewFields' SOP-3. For managing individual specimens of small mammals and fish, an individual sample number will be used, as follows:

- A two-letter prefix will be included to indicate the tissue type: FI = fish, MA = small mammal.
- The sample ID will be followed by a numeric code: 01, 02, 03 (e.g., FI-TI44-CFR-LD-**01**).
- Thus, an individual to be considered for use in a fish tissue composite will be recorded and labeled. An example would be FI-TI44-CFR-LD-01.

In the field notebook, this code will be followed by a 4-letter abbreviation for the species using the two first letters of the genus and first two letters of the species name (e.g., *Rhinichthys cataractae* = RHCA).

The sample number is an arbitrary number assigned to each tissue sample collected (e.g., TS0001, TS0002) for chemical analysis. All subsamples (individual specimens) that may be used to form a tissue composite or subsamples of a composited field sample will have the same sample number. The sample numbers of related field QC samples may not share any content. The sample number appears on the sample containers and the COC forms.

A unique numeric sample tag number will be attached to each sample container. If the amount of material (i.e., everything associated with a single sample number) is too large for a single container, each container will have the same sample number and a different sample label with a unique sample tag number. The sample tag number will appear on the COC forms. Tag numbers are used by laboratories only to confirm that they have received all of the containers that were filled and shipped. Data are reported by sample number.

Sample numbers will be assigned sequentially in the field, and sample labels will be preprinted with tag numbers.

For equipment filter wipe blanks, sequential numbers starting at 900 will be assigned instead of station numbers. For example, the first filter wipe blank for a tissue sample collected with a benthic sediment grab sampler will be labeled as GRFW-901, whereas the second filter wipe blank for benthic invertebrate sieves will be labeled as SIBI-902 (GR = grab sampler, FW = filter wipe, SI= sieve, BI = benthic invertebrate sieve).

3.2 MANAGEMENT OF INVESTIGATION-DERIVED WASTES

Investigation-derived wastes will be handled according to NewFields' SOP-13 (Attachment B1).

3.3 FIELD DATA MANAGEMENT AND REPORTING PROCEDURES

During field operations, effective data management is critical to providing consistent, accurate, and defensible data and data products. Daily field records (a combination of field logbooks, field forms [if any], and COC forms) will make up the main documentation for field activities. Upon completion of sampling, field notes, data sheets (if any), and COC forms will be scanned to create an electronic record. Field data will be manually entered into the project database. One hundred percent of the transferred data will be verified based on hard copy records. Electronic QA checks to identify anomalous values will also be conducted following entry.

4 REFERENCES

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USEPA. 2017b. Draft Screening Level Ecological Risk Assessment for Operable Units 2 & 3 of the Smurfit Stone Frenchtown Mill Site Located in Missoula County, Montana. E-mail from Brian Sanchez, (EPA Region 8, Denver, CO), July 28, 2017.

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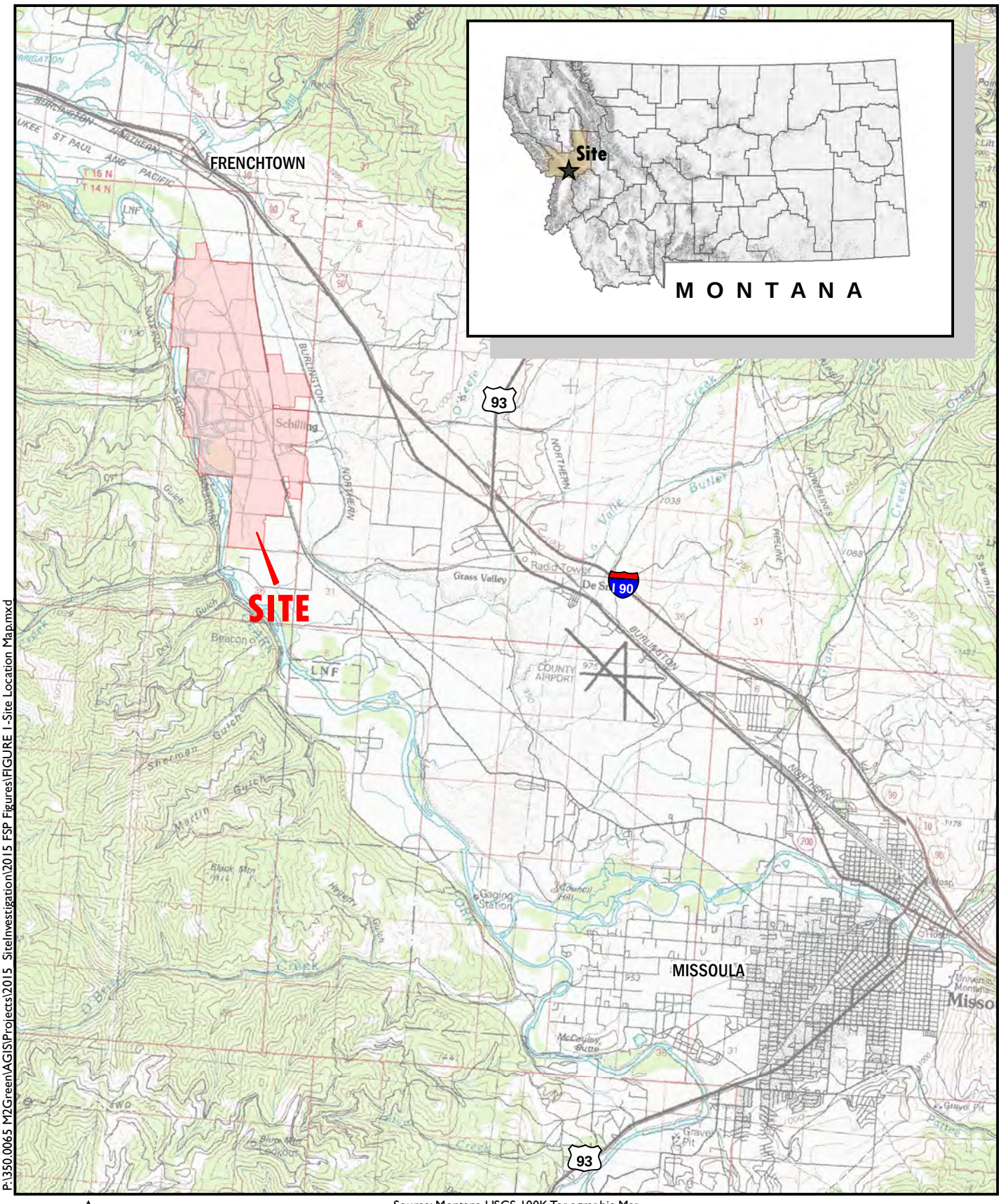
FIGURES



P:\350.0065 M2Green\AGIS\Projects\2015 SiteInvestigation\2015 FSP Figures\FIGURE 1-Site Location Map.mxd

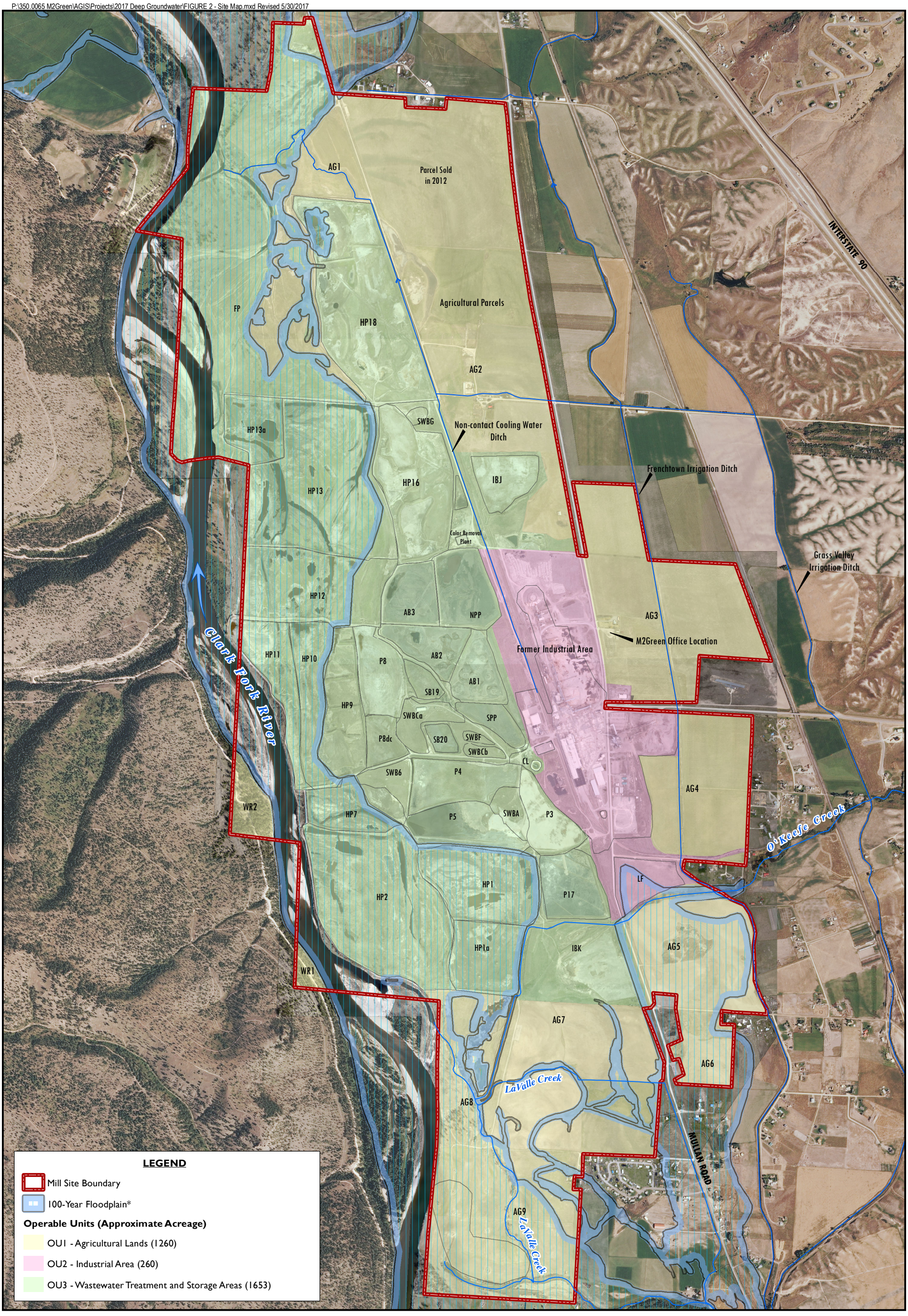
Source: Montana USGS 100K Topographic Map

0 Feet 10,000

NewFields

Site Location Map
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE B-1

P:\350.0065 M2Green\AGIS\Projects\2017 Deep Groundwater\FIGURE 2 - Site Map.mxd Revised 5/30/2017



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0 Feet 1,600

Aerial Photo Source: NAIP 2011 and Newfields 2016 (Within Site Boundary)

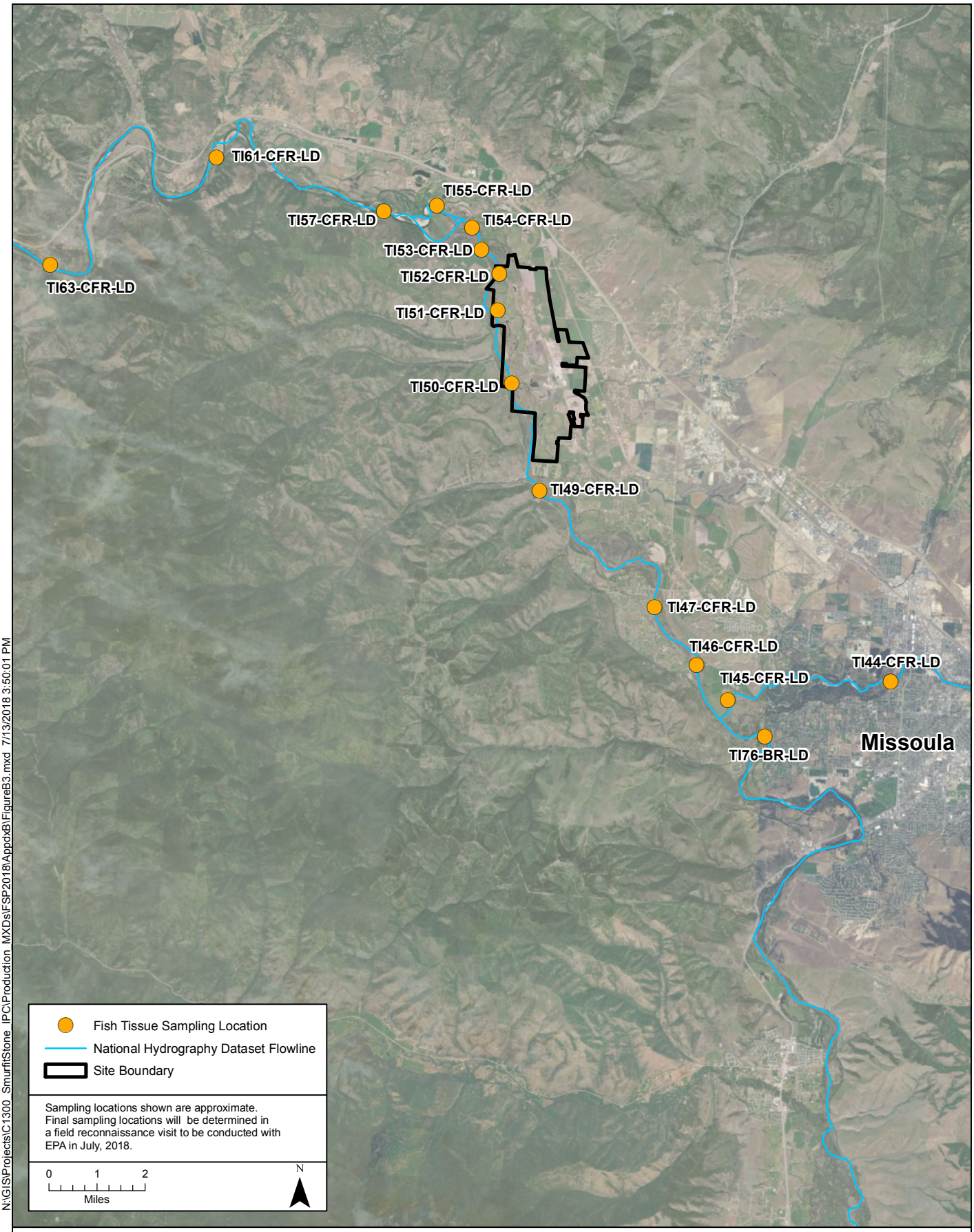
*Floodplain Source:
As defined by the Federal Emergency Management Agency (FEMA) 2013 Digital Flood Insurance Rate Map (DFIRM). (NFIP 2013)

Notes

AG - Agricultural Land
AB - Aeration Stabilization Basin
CFR - Clark Fork River
CL - Clarifier
FP - Floodplain
HP - Holding or Storage Pond
IB - Rapid Infiltration Basin
NPP - North Polishing Pond
P - Settling Pond
SB - Spoils Basin
SPP - South Polishing Pond
SWB - Solid Waste Basin
WR - West of River

NewFields

Site Map
Former Frenchtown Mill Site
Missoula County, Montana
FIGURE B-2



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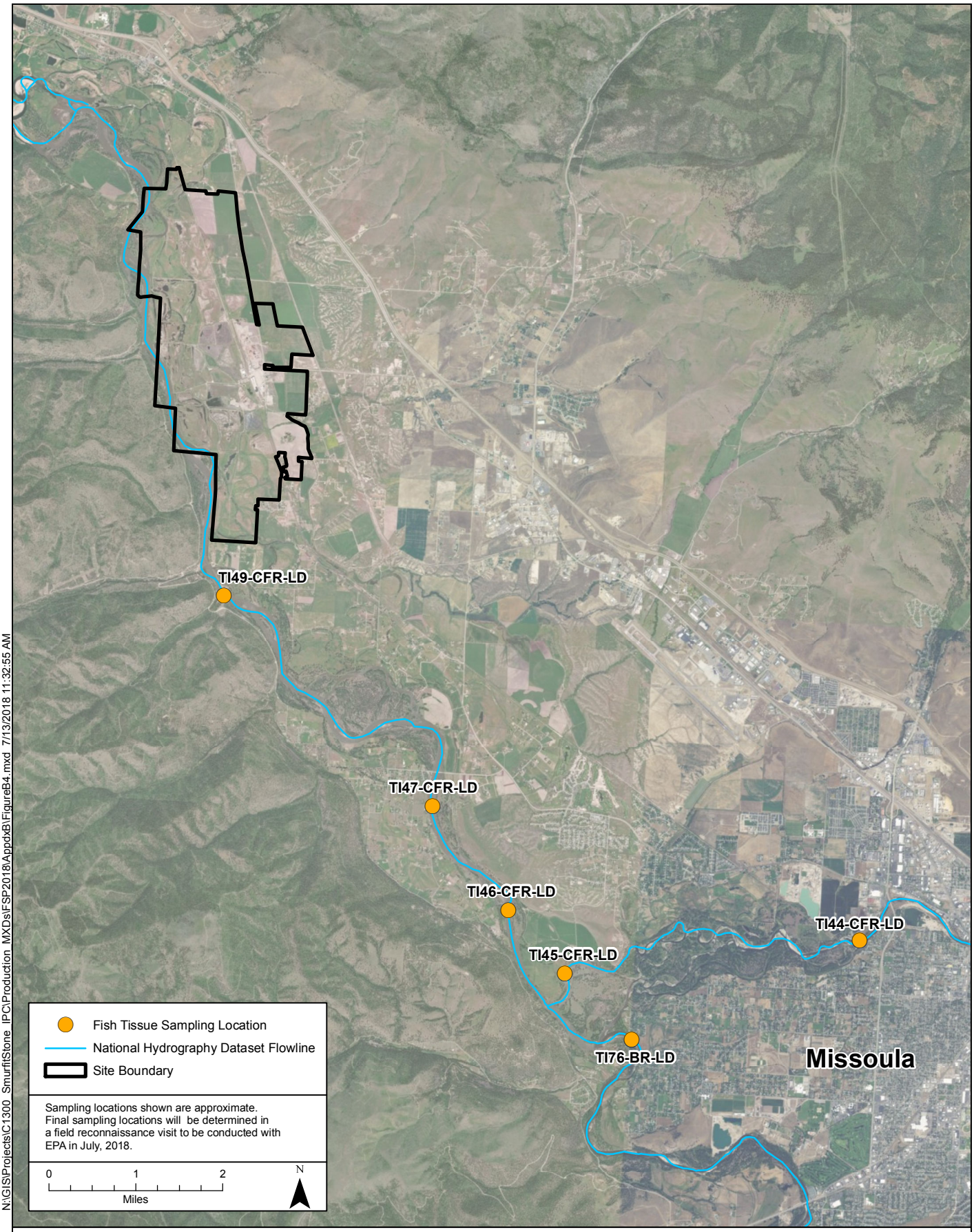
Fish Tissue Sampling Locations in the Clark Fork and Bitterroot Rivers
Former Frenchtown Mill Site
Missoula County, Montana
Figure B-3



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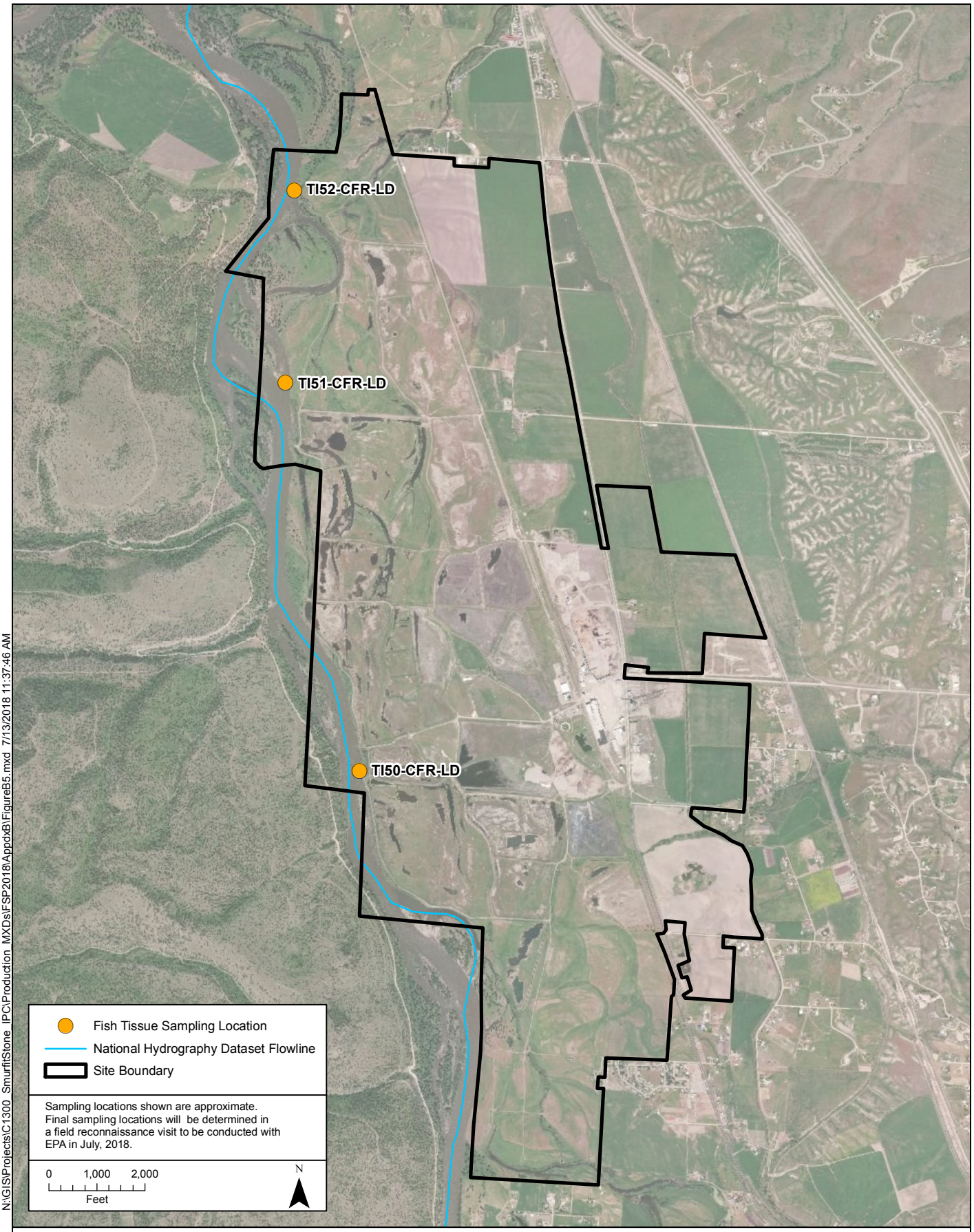
Fish Tissue Sampling Locations in the Clark Fork and Bitterroot Rivers, Upstream of the Site
Former Frenchtown Mill Site
Missoula County, Montana
Figure B-4



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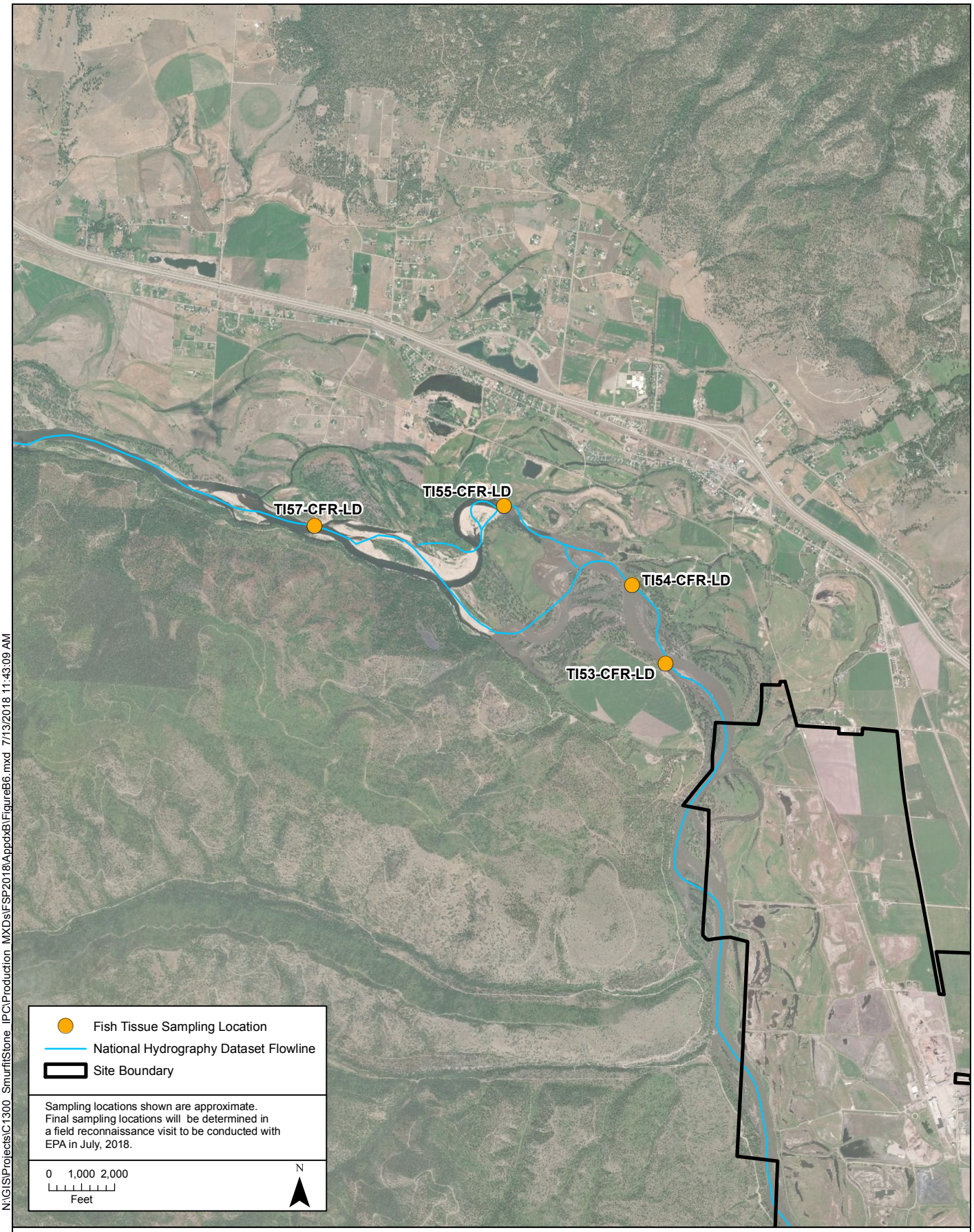
Fish Tissue Sampling Locations in the Clark Fork River, Adjacent to the Site
Former Frenchtown Mill Site
Missoula County, Montana
Figure B-5



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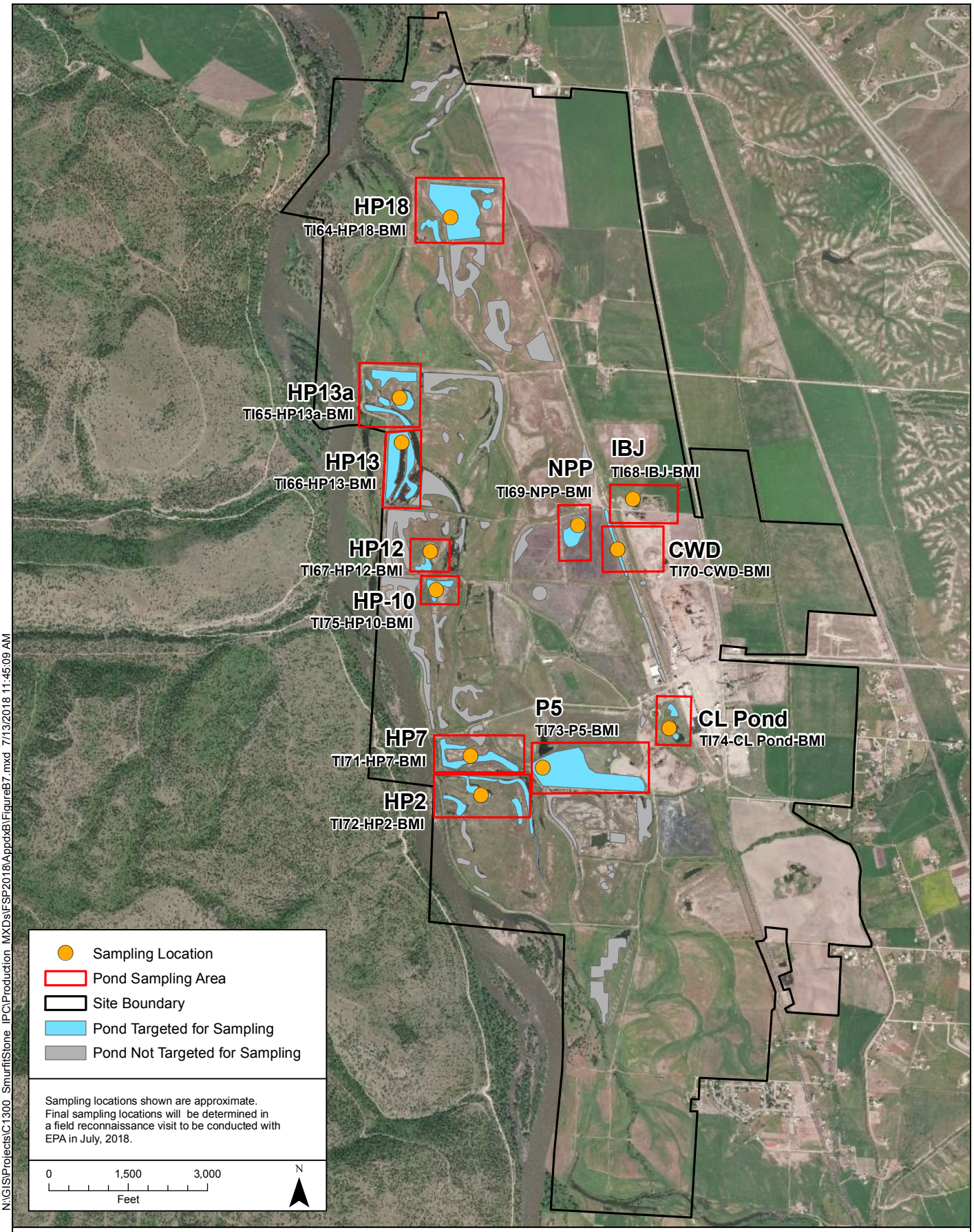
Fish Tissue Sampling Locations in the Clark Fork River, Downstream of the Site
Former Frenchtown Mill Site
Missoula County, Montana
Figure B-6



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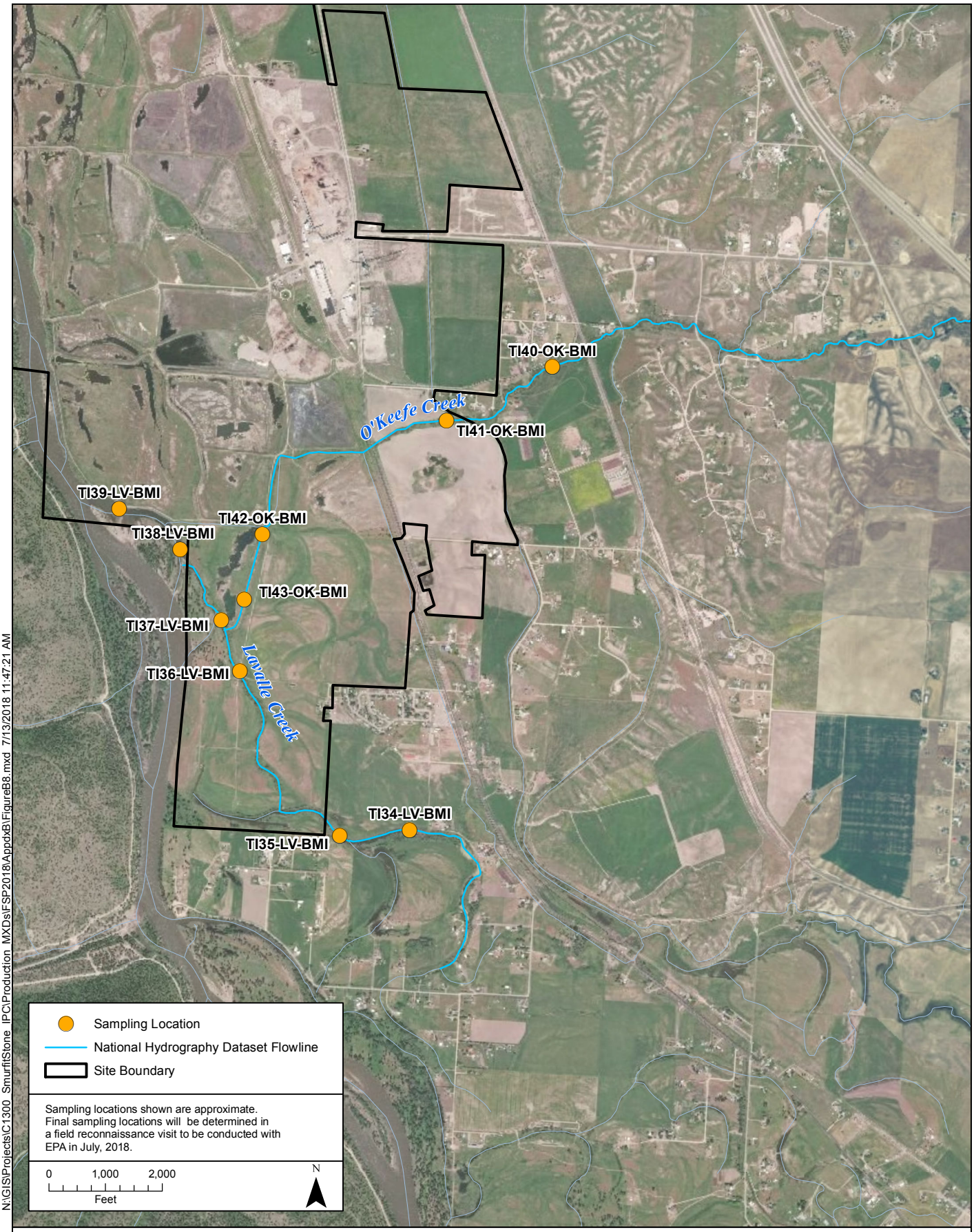
Benthic Macroinvertebrate Tissue Sampling Locations in Ponds
Former Frenchtown Mill Site
Missoula County, Montana
Figure B-7



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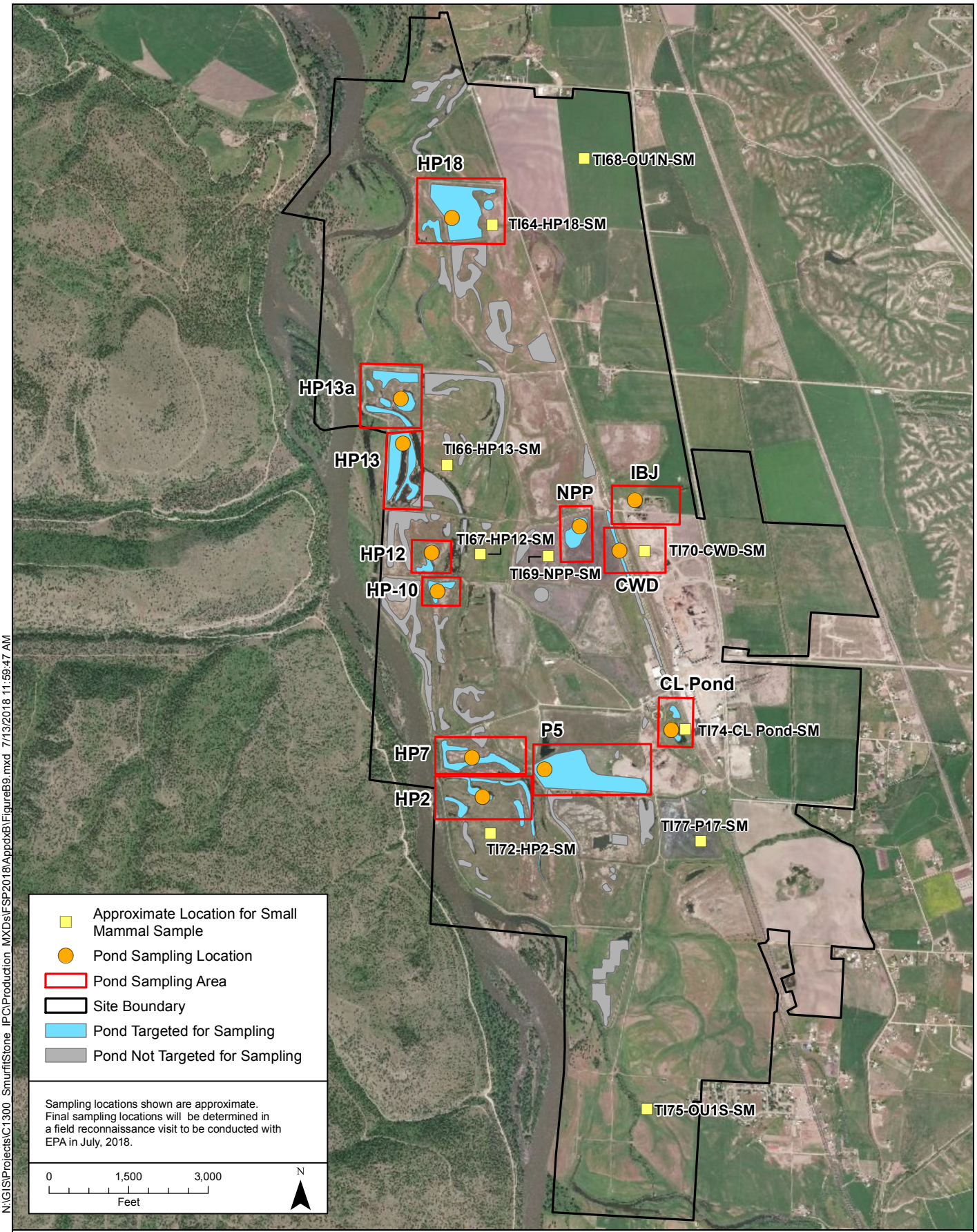
Benthic Macroinvertebrate Tissue Sampling Locations in Creeks
Former Frenchtown Mill Site
Missoula County, Montana
Figure B-8



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Small Mammal Tissue Sampling Locations
Former Frenchtown Mill Site
Missoula County, Montana
Figure B-9

TABLES

Table B-1. Summary of Tissue Sample Types, Sample Sizes, and Collection Methods

Area	Aquatic Tissue	Small Mammal Tissue	Tissue Type	Sampling Method
Lavalle and O'Keefe Creeks	10		Benthic Macroinvertebrate Mixed-Species Composite 50–60 g	Kick Nets
Clark Fork River[a]	15		Small Fish (Longnose Dace) Single Species Composite 50–60 g 10–15 individuals	Backpack Electrofisher, Kick Seine, Minnow Traps
Onsite Ponds	12		Benthic Macroinvertebrate Mixed-Species Composite 50–60 g	Benthic Grabs
Terrestrial Areas		10	Small Mammal Mixed-Species Composite 50–60 g 10–15 individuals	Sherman Live Traps

Notes:

[a] One of the 15 fish tissue samples will be from the Bitterroot River.

Table B-2. Sample Containers, Preservation and Holding Time Requirements

Container[a,b]						
Type	Size	Laboratory	Parameter	Preservation	Holding Time	Sample Size[c]
Tissue						
WMAG	4 oz	Frontier Analytical	Dioxins/Furans Lipids	Deep frozen (-20°C)	1 year	20 g
WMG	4 oz	Pace Analytical	TAL Metals[d]	Deep frozen (-20°C)	1 year/6 months[e] 1 year/28 days (Hg)	6 g
			Methylmercury		1 year	2 g
			Percent moisture		1 year	2 g
Equipment Filter Wipe Blanks[f]						
WMG	4 oz	Frontier Analytical	Dioxins/Furans	4 ± 2°C	1 year/1 year[e]	1 wipe
WMG	4 oz	Pace Analytical	TAL Metals[d]	4 ± 2°C	6 months	1 wipe
WMG	4 oz	Pace Analytical	Methylmercury	4 ± 2°C	6 months	1 wipe

Notes:
AG = amber glass
HDPE = high density polyethylene
TAL = target analyte list
WMAG = wide mouth amber glass
WMG = wide mouth glass

[a] The containers listed for tissues reflect the jars necessary for storage of homogenized tissue samples at the testing laboratory. Prior to homogenization (i.e., in the field), samples will be wrapped in foil and double-bagged in resealable plastic bags. All tissues will be processed by ALS-Houston prior to analysis.

[b] The size and number of containers may be modified by the analytical laboratory.

[c] Sample sizes are estimated.

[d] TAL metals include the following: Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, and Zn.

[e] Holding time for samples prior to extraction/holding time for extracts.

[f] Whatman filter papers will be used for organic blanks, and Ghost wipes will be used for metals/mercury blanks.

Table B-3. Field Sample Collection Matrix for Tissue

					Sample Homogenization	Tissue Chemistry		Equipment Filter Wipe Blank Chemistry		
						Metals, methylmercury, percent moisture	Dioxin/furans, percent lipids	Dioxin/furans	Metals	Methylmercury
					TBD	Pace Analytical	Frontier Analytical	Frontier Analytical	Pace Analytical	Pace Analytical
						4 oz WMG	4 oz WMG	4 oz WMG	4 oz WMG	4 oz WMG
						10g	20 g	1 wipe (Whatman)	1 wipe (Ghost)	1 wipe (Ghost)
Station Location	Sample ID	Sample Date	Sample Time	Sample Type		Deep frozen (-20°)	Deep frozen (-20°)	4 ± 2°C	4 ± 2°C	4 ± 2°C
Lavalle and O'Keefe Creeks										
34-LV	TI34-LV-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
35-LV	TI35-LV-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
36-LV	TI36-LV-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
37-LV	TI37-LV-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
38-LV	TI38-LV-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
39-LV	TI39-LV-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
40-OK	TI40-OK-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
41-OK	TI41-OK-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
42-OK	TI42-OK-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
43-OK	TI43-OK-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
Bitterroot River										
76-BR	TI76-BR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
Clark Fork River										
44-CFR	TI44-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
45-CFR	TI45-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
46-CFR	TI46-CFR-LD-c			Longnose Dace (composite)	X	X	X			
47-CFR	TI47-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
49-CFR	TI49-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
50-CFR	TI50-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
51-CFR	TI51-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
52-CFR	TI52-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
53-CFR	TI53-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
54-CFR	TI54-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--

Table B-3. Field Sample Collection Matrix for Tissue

					Sample Homogenization	Tissue Chemistry		Equipment Filter Wipe Blank Chemistry		
						Metals, methylmercury, percent moisture	Dioxin/furans, percent lipids	Dioxin/furans	Metals	Methylmercury
					TBD	Pace Analytical	Frontier Analytical	Frontier Analytical	Pace Analytical	Pace Analytical
						4 oz WMG	4 oz WMG	4 oz WMG	4 oz WMG	4 oz WMG
						10g	20 g	1 wipe (Whatman)	1 wipe (Ghost)	1 wipe (Ghost)
Station Location	Sample ID	Sample Date	Sample Time	Sample Type		Deep frozen (-20°)	Deep frozen (-20°)	4 ± 2°C	4 ± 2°C	4 ± 2°C
55-CFR	TI55-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
57-CFR	TI58-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
61-CFR	TI61-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
63-CFR	TI63-CFR-LD-c			Longnose Dace (composite)	X	X	X	--	--	--
Small Mammal Sampling Areas										
64-HP18	TI64-HP18-SM			Small mammal (composite)	X	X	X	--	--	--
66-HP13	TI66-HP13-SM			Small mammal (composite)	X	X	X	--	--	--
67-HP12	TI67-HP12-SM			Small mammal (composite)	X	X	X	--	--	--
68-OU1N	TI68-OU1N-SM			Small mammal (composite)	X	X	X	--	--	--
69-NPP	TI69-NPP-SM			Small mammal (composite)	X	X	X	--	--	--
70-CWD	TI70-CWD-SM			Small mammal (composite)	X	X	X	--	--	--
72-HP2	TI72-HP2-SM			Small mammal (composite)	X	X	X	--	--	--
74-CL Pond	TI74-CL Pond-SM			Small mammal (composite)	X	X	X	--	--	--
75-OU1S	TI75-OU1S-75			Small mammal (composite)	X	X	X	--	--	--
77-P17	TI77-P17-SM			Small mammal (composite)	X	X	X			
NA	TI78-BAIT			Small mammal trap bait sample	X	X	X	--	--	--
Pond Areas										
64-HP18	TI64-HP18-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
65-HP13a	TI65-HP13a-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
66-HP13	TI66-HP13-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
67-HP12	TI67-HP12-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
68-IBJ	TI68-IBJ-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
69-NPP	TI69-NPP-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--

Table B-3. Field Sample Collection Matrix for Tissue

					Sample Homogenization	Tissue Chemistry		Equipment Filter Wipe Blank Chemistry		
						Metals, methylmercury, percent moisture	Dioxin/furans, percent lipids	Dioxin/furans	Metals	Methylmercury
					TBD	Pace Analytical	Frontier Analytical	Frontier Analytical	Pace Analytical	Pace Analytical
						4 oz WMG	4 oz WMG	4 oz WMG	4 oz WMG	4 oz WMG
						10g	20 g	1 wipe (Whatman)	1 wipe (Ghost)	1 wipe (Ghost)
Station Location	Sample ID	Sample Date	Sample Time	Sample Type		Deep frozen (-20°)	Deep frozen (-20°)	4 ± 2°C	4 ± 2°C	4 ± 2°C
70-CWD	TI70-CWD-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
71-HP7	TI71-HP7-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
72-HP2	TI72-HP2-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
73-P5	TI73-P5-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
74-CL Pond	TI74-CL Pond-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
75-HP10	TI75-HP10-BMI-c			Benthic macroinvertebrate (composite)	X	X	X	--	--	--
Field Quality Control Samples										
TBD	TI100-DUP			Field duplicate	X	X	X	--	--	--
TBD	TI102-DUP			Field duplicate	X	X	X	--	--	--
TBD	TI103-MS			Matrix spike/matrix spike duplicate	X	X	X	--	--	--
TBD	TI104-MS			Matrix spike/matrix spike duplicate	X	X	X	--	--	--
Equipment Filter Wipe Blanks										
NA	TI105-FW-BMI			Whatman filter wipe (equipment)	--	--	--	X	--	--
NA	TI106-FW-BMI			Ghost filter wipe (equipment)	--	--	--	--	X	--
NA	TI107-FW-BMI			Ghost filter wipe (equipment)	--	--	--	--	--	X
NA	TI108-FW-LD			Whatman filter wipe (equipment)	--	--	--	X	--	--
NA	TI109-FW-LD			Ghost filter wipe (equipment)	--	--	--	--	X	--
NA	TI110-FW-LD			Ghost filter wipe (equipment)	--	--	--	--	--	X
NA	TI111-FB			Whatman filter wipe (blank)	--	--	--	X	--	--
NA	TI112-FB			Ghost filter wipe (blank)	--	--	--	--	X	--
NA	TI113-FB			Ghost filter wipe (blank)	--	--	--	--	--	X

Notes:
AG = amber glass
HDPE = high density polyethylene
WMG = wide mouth glass

Table B-4. Station Coordinates for Tissue Sampling Locations

		WGS84 Datum		State Plane Montana FIPS 2400 NAD83 (ft)	
Sample ID	Location	Latitude N	Longitude W	Easting	Northing
34-LV	Lavalle Creek	46.93634861	-114.1916482	797833.2083	1014418.025
35-LV	Lavalle Creek	46.93589061	-114.1965651	796597.7723	1014324.908
36-LV	Lavalle Creek	46.94355459	-114.2042941	794839.1995	1017229.196
37-LV	Lavalle Creek	46.94596759	-114.2058441	794505.77	1018130.396
38-LV	Lavalle Creek	46.94925058	-114.2090331	793783.0489	1019372.73
39-LV	Lavalle Creek	46.95102858	-114.2135241	792703.0479	1020087.04
40-OK	O'Keefe Creek	46.95916257	-114.1835372	800351.6247	1022597.933
41-OK	O'Keefe Creek	46.95625357	-114.1907922	798480.8028	1021647.762
42-OK	O'Keefe Creek	46.95021558	-114.2033131	795229.3606	1019638.111
43-OK	O'Keefe Creek	46.94703459	-114.2043121	794910.8543	1018495.667
44-CFR	Clark Fork River	46.87565415	-114.0453151	833021.8753	990178.6713
45-CFR	Clark Fork River	46.867282	-114.116356	815115.5899	988170.0282
46-CFR	Clark Fork River	46.87720893	-114.130974	811681.2621	991997.8842
47-CFR	Clark Fork River	46.8938689	-114.1508867	807073.2251	998354.5653
49-CFR	Clark Fork River	46.92678704	-114.2045061	794419.5115	1011131.477
50-CFR	Clark Fork River	46.95866907	-114.219611	791354.1952	1022958.45
51-CFR	Clark Fork River	46.98053562	-114.2276975	789820.5423	1031036.156
52-CFR	Clark Fork River	46.99151059	-114.227959	789996.769	1035033.305
53-CFR	Clark Fork River	46.99843999	-114.2364508	788035.2907	1037682.421
54-CFR	Clark Fork River	47.00481476	-114.2410815	787023.1621	1040071.67
55-CFR	Clark Fork River	47.0108073	-114.2573294	783111.7149	1042497.506
57-CFR	Clark Fork River	47.00817746	-114.280373	777318.5262	1041890.268
61-CFR	Clark Fork River	47.021338	-114.355616	758890.3182	1047831.691
63-CFR	Clark Fork River	46.985891	-114.425872	740599.2644	1036029.211
76-BR	Bitterroot River	46.856938	-114.099143	819189.8593	984153.143
64-HP18	Onsite Ponds	46.98693751	-114.2204031	791777.4918	1033255.793
65-HP13a	Onsite Ponds	46.97741353	-114.2234691	790804.8816	1029836.583
66-HP13	Onsite Ponds	46.97513264	-114.2231009	790846.4744	1029001.151
67-HP12	Onsite Ponds	46.96955954	-114.2204091	791394.477	1026932.925
68-IBJ	Onsite Ponds	46.97293654	-114.2053201	795226.5308	1027935.254
69-NPP	Onsite Ponds	46.97139154	-114.2093861	794180.0495	1027434.037
70-CWD	Onsite Ponds	46.97024566	-114.2062619	794933.0886	1026970.281
71-HP7	Onsite Ponds	46.95910956	-114.2164711	792146.0627	1023071.55
72-HP2	Onsite Ponds	46.95712557	-114.2154681	792352.4121	1022334.612
73-P5	Onsite Ponds	46.95873056	-114.2109351	793516.854	1022850.556
74-CL Pond	Onsite Ponds	46.96114156	-114.2015621	795904.5502	1023587.338
75-HP10	Onsite Ponds	46.96761775	-114.2198241	791497.5617	1026217.616

Table B-4. Station Coordinates for Tissue Sampling Locations

		WGS84 Datum		State Plane Montana FIPS 2400 NAD83 (ft)	
Sample ID	Location	Latitude N	Longitude W	Easting	Northing
64-HP18	Small Mammal	46.986708401	-114.217347462	792533.2753	1033126.54
66-HP13	Small Mammal	46.974143948	-114.219668136	791679.6598	1028589.822
67-HP12	Small Mammal	46.969663489	-114.216735068	792311.833	1026915.553
68-OU1N	Small Mammal	46.990396702	-114.210718507	794264.6024	1034369.081
69-NPP	Small Mammal	46.969748909	-114.211607416	793590.8255	1026869.675
70-CWD	Small Mammal	46.970298927	-114.204350876	795410.2182	1026961.034
72-HP2	Small Mammal	46.955225193	-114.214700962	792501.8576	1021631.644
77-P17	Small Mammal	46.955501870	-114.198800577	796469.2283	1021493.984
74-CL Pond	Small Mammal	46.961208717	-114.200473759	796177.1434	1023595.481
75-OU1S	Small Mammal	46.941484217	-114.201672269	795447.2654	1016436.608

Notes:
FIPS = Federal Information Processing Standards
NAD83 = North American Datum of 1983
WGS84 = World Geodetic System of 1984

Table B-5. Field Equipment/Supplies Needed for Benthic Macroinvertebrate Sampling and Processing

Stainless steel grab sampler (Petite Ponar)
Fathometer
Bucket sieves
D-frame kick nets
Forceps
Neoprene chest waders (equipped with wading cleats, when necessary)
Polarized sunglasses
Coolers for samples
Sample containers for macroinvertebrate tissue samples
Waterproof jar labels
Balance (gram scale)
Packing tape
Applicable topographic maps
Field Sampling Plan
Health and Safety Plan
Field note book
Field Forms
First aid kit
Global Positioning System (GPS) unit
Camera
Head lamp
Pens
Aluminum Foil
Resealable plastic bags
Dry ice
Wet ice
Bubble wrap
Cell phone
White board

Table B-6. Field Equipment/Supplies Needed for Fish Sampling and Processing

Appropriate scientific collection permit(s)
Backpack electrofisher (spare anode and battery)
Conductivity meter, thermometer
Mult meter
Non-conductive dip nets
Block nets (i.e., seines)
Kick seines
Elbow-length insulated waterproof gloves
Neoprene chest waders (equipped with wading cleats, when necessary)
Polarized sunglasses
Buckets/livewells
Battery powered aerator
Coolers for samples
Sample containers/bags for fish tissue samples
Waterproof jar labels
10% buffered formalin (formaldehyde solution)
Measuring board (500 mm minimum, with 1 mm increments)
Balance (gram scale)
Tape measure (100 mm minimum)
Applicable topographic maps
Field Sampling Plan
Health and Safety Plan
Field note book
Field Forms
First aid kit
Global Positioning System (GPS) unit
Camera
Head lamp
Pens
Aluminum Foil
Resealable plastic bags
Dry ice
Wet ice
Packing tape
Chain of custody forms
Custody seals
Bubble wrap
Cell phone
White board

Table B-7. Field Equipment/Supplies Needed for Small Mammal Sampling and Processing

Sherman live traps (or equivalent)
Museum special snap traps (or equivalent)
Drift fences (e.g., metal or plastic sheeting)
Bait balls (organic peanut butter, rolled oats, and sunflower seeds and/or corn meal)
Brightly colored wire flags or wooden stakes (1 x 2 x 24 in. or 1 x 2 x 36 in.)
Clipboard and data sheets
Small mammal identification book
Keys to identification, sex, and age
Copy of applicable trapping and salvage permits and scientific collection permits
Research site map with grid overlay
Field Sampling Plan
Health and Safety Plan
Field note book
Coolers
Digital scales:
0–10 g for shrews
100 g for most rodents
300 g for *Sigmodon* , large *Microtus* , rats (i.e., *Neotoma, Rattus*)
Plastic bags (e.g., Ziploc®)
Extra 4 x 4 in. waxed paper square
Markers (e.g., Sharpie® pens)
Digital camera
GPS device (e.g., Trimble or other similar equipment)
Appropriate safety equipment (Tyvek® suits, half-face respirators, disposable nitrile gloves, leather gloves, eye protection) as required by the site health and safety plan
Polyester fiberfill (or similar nonabsorbent material)—during cold or inclement weather
Flashlights/headlamps
CO_2 bottle with plastic tubing
Euthanasia chamber (plastic container with a lid or cooler large enough to hold a live trap and equipped with ingress point for CO_2)
Dry ice
Packaging material for laboratory shipment (tape, labels, and other specifics required by the laboratory)

ATTACHMENT B1

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE (SOP) AP-01

SAMPLE PACKAGING AND SHIPPING

SCOPE AND APPLICATION

This SOP describes specific requirements for sample packaging and shipping to ensure the proper transfer and documentation of environmental samples collected during field operations. Procedures for the careful and consistent transfer of samples from the field to the laboratory are outlined herein. This SOP also presents the method to be used when packing samples that will either be hand delivered or shipped by commercial carrier to the laboratory.

EQUIPMENT AND SUPPLIES REQUIRED

Make sure that you have the equipment and supplies necessary to properly pack and ship environmental samples, including the following:

- Project-specific sampling and analysis plan (SAP)
- Project-specific field logbook
- Sealable airtight bags in assorted sizes (e.g., Ziploc®)
- Wet ice in doubled, sealed bags; frozen Blue Ice®; or dry ice
- Cooler(s)
- Bubble wrap
- Fiber-reinforced packing tape, clear plastic packing tape, and duct tape
- Scissors or knife
- Chain-of-custody (COC) forms
- COC seals
- Large plastic garbage bags (preferably 3 mil [0.003 in.] thick)
- Paper towels
- "Fragile," "This End Up," or "Handle With Care" labels
- Mailing labels
- Air bills for overnight shipment

PROCEDURE

Customize the logistics for sample packaging and shipping to each study. If necessary, transfer samples from the field to a local storage facility where they can be frozen or refrigerated. Depending on the logistics of the operation, field personnel may transport samples to the laboratory or use a commercial courier or shipping service. In the latter case, Integral field personnel must be aware of any potentially limiting factors to timely shipping, such as availability of overnight service and weekend deliveries to specific areas, and shipping regulations regarding "restricted articles" (e.g., dry ice, formalin) prior to shipping the samples.

SAMPLE PREPARATION

Take the following steps to ensure the proper transfer of samples from the field to the laboratories:

At the sample collection site:

1. Document all samples using the proper logbooks or field forms (see SOP AP-02), required sample container identification (i.e., sample labels with tag numbers), and COC form (example provided in SOP AP-03). Fill out the COC form as described in SOP AP-03, and use the sample labeling techniques provided in SOP AP-04.
2. Make all applicable laboratory quality control sample designations on the COC forms. Clearly identify samples that will be archived for future possible analysis. Label these samples as follows: "Do Not Analyze: Hold and archive for possible future analysis." Some laboratories interpret "archive" to mean that they should continue holding the residual sample after analysis.
3. Notify the laboratory contact and the Integral project quality assurance/quality control (QA/QC) coordinator that samples will be shipped and the estimated arrival time. Send copies of all COC forms to Integral's project QA/QC coordinator or project manager, as appropriate.
4. Keep the samples in the possession of the sampling personnel at all times. Lock and secure any temporary onsite sample storage areas to maintain sample integrity and COC requirements.
5. Clean the outside of all dirty sample containers to remove any residual material that may lead to cross-contamination.
6. Complete the COC form as described in SOP AP-03, and retain the back (pink) copy for project records prior to sealing the cooler. Check sample containers against the COC form to ensure all the samples that were collected are in the cooler.

7. Store each sample container in a sealed plastic bag that allows the sample label (example provided in SOP AP-03) to be read. Before sealing the bags, ensure that volatile organic analyte (VOA) vials are encased in a foam sleeve or in bubble wrap.
8. If the samples require storage at a specific temperature, place enough ice in the sample cooler to maintain the temperature (e.g., 4°C) throughout the sampling day.

At the sample processing area (immediately after sample collection) take the following steps:

1. If the samples require a specific storage temperature, then cool the samples and maintain the temperature prior to shipping. For example, place enough ice in each sample cooler to maintain the temperature at 4°C until processing begins at the testing laboratory.
2. Be aware of holding time requirements for project-specific analytes and arrange the sample shipping schedule accordingly.
3. Place samples in secure storage (i.e., locked room or vehicle) or keep them in the possession of Integral sampling personnel before shipment. Lock and secure any sample storage areas to maintain sample integrity and COC requirements.
4. Store samples in the dark (e.g., keep coolers shut).

At the sample processing area (just prior to shipping), do the following:

1. Check sample containers against the COC form to account for all samples intended for shipment.
2. Choose cooler(s) of appropriate size and make sure they are clean of gross contamination inside and out. If the cooler has a drain, close the drain and secure it with duct tape.
3. Line the cooler with bubble wrap and place a large plastic bag (preferably with a thickness of 3 mil), open, inside the cooler.
4. Individually wrap each glass container (which was sealed in a plastic bag at the collection site) in bubble wrap and secure with tape or a rubber band. Place the wrapped samples in the large plastic bag in the cooler, leaving room for ice to keep the samples cold (i.e., 4°C).
5. If temperature blanks have been provided by the testing laboratory, place one temperature blank in each sample cooler.
6. If the samples require a specific storage temperature, add enough wet ice or Blue Ice® to maintain that temperature during overnight shipping (i.e., 4°C). Always overestimate the amount of ice that will be required. Keep ice in a sealed plastic bag, which is placed in a second sealed plastic bag to prevent leakage. Avoid separating the samples from the ice with excess bubble wrap because it may insulate the samples from the ice. After adding all samples and ice to the cooler, use bubble wrap (or other

available clean packing material) to fill any empty space and prevent the samples from shifting during transport.

7. If possible, consolidate all VOA samples in a single cooler and ship them with (a) trip blank(s) if the project-specific QA project plan calls for them.
8. Sign, date, and include any tracking numbers provided by the shipper on the COC form. Remove the back (pink) copy of the original COC form and retain this copy for the project records.
9. Seal the rest of the signed COC form in a bag and tape the bag to the inside of the cooler lid. Each cooler should contain an individual COC form for the samples contained inside it. If time is short and it becomes necessary to combine all the samples onto a single set of COC forms and ship multiple coolers together, then indicate on the outside of the appropriate cooler, "Chain-of-Custody Inside."
10. After the cooler is sufficiently packed to prevent shifting of the containers, close the lid and seal it with fiber-reinforced packing tape. Tape the cooler around the opening, joining the lid to the bottom, and around the circumference of the cooler at both hinges.
11. As security against unauthorized handling of the samples, apply two COC seals across the opening of the cooler lid (provided with example field forms). Place one seal on the front right portion of the cooler and one on the back left. Be sure the seals are properly affixed to the cooler to prevent removal during shipment. Additional tape across the seal may be necessary if the outside of the cooler is wet.

SAMPLE SHIPPING

Hand Delivery to the Testing Laboratory

1. Notify the laboratory contact and the Integral project QA/QC coordinator that samples will be delivered to the laboratory and the estimated arrival time.
2. When hand-delivering environmental samples, make sure the testing laboratory receives them on the same day that they were packed in the coolers.
3. Fax or scan and e-mail copies of all COC forms to the Integral project QA/QC coordinator. Note: It may be necessary to photocopy the COC form on a slightly darker setting so the form is readable after it has been faxed. Never leave the original COC form in the custody of non-Integral staff.

Shipped by Commercial Carrier to the Laboratory

1. Apply a mailing label to the cooler with destination and return addresses, and add other appropriate stickers, such as "This End Up," "Fragile," and "Handle With Care." If the shipment contains multiple coolers, indicate on the mailing label the number of coolers that the testing laboratory should expect to receive (e.g., 1 of 2; 2 of 2). Place clear tape over the mailing label to firmly affix it to the cooler and to protect it from the weather. This is a secondary label in case the air bill is lost during shipment.
2. Fill out the air bill and fasten it to the handle tags provided by the shipper (or the top of the cooler if handle tags are not available).
3. If samples must be frozen (–20°C) during shipping, make sure that dry ice has been placed in the sample cooler. Be aware of any additional shipping, handling, and special labeling requirements that the shipper may require.
4. Make sure that benthic infauna samples have been preserved with formalin in the field prior to shipping. Be aware of any additional shipping, handling, and special labeling requirements that the shipper may require for these samples.
5. Notify the laboratory contact and the Integral project QA/QC coordinator that samples will be shipped and the estimated arrival date and time. If environmental samples must be shipped at 4°C or –20°C, choose overnight shipping for delivery next morning. Fax or scan and e-mail copies of all COC forms to the Integral project QA/QC coordinator. Note: It may be necessary to photocopy the COC form on a slightly darker setting so the form is readable after faxing. Never leave the original COC form in the custody of non-Integral staff.

STANDARD OPERATING PROCEDURE (SOP) AP-02

FIELD DOCUMENTATION

SCOPE AND APPLICATION

This SOP describes the Integral procedure for accurate record-keeping in the field for the purposes of ensuring that samples can be traced from collection to final disposition.

Document all information relevant to field operations properly to ensure that activities are accounted for in written records to the extent that someone not present at the site could reconstruct the activity without relying on the memory of the field crew. Several types of field documents are used for this purpose and should be consistently used by field personnel. Field documentation should include only a factual description of site-related activities and observations. Field personnel should not include superfluous comments or speculation regarding the field activities or observations.

FIELD LOGBOOKS

During field sampling events, field logbooks must be used to record all daily activities. The purpose of the field logbook is to document events and record data measured in the field to the extent that someone not present at the site could reconstruct the activity without relying on the memory of the field crew. The project manager (or designee) should issue a field logbook to the appropriate site personnel for the direction of onsite activities (e.g., reconnaissance survey team leader, sampling team leader). It is this designee's responsibility to maintain the site logbook while it is in his or her possession and return it to the project manager or turn it over to another field team.

Make entries in the field logbook as follows:

1. Document all daily field activities in indelible ink in the logbook and make no erasures. Make corrections with a single line-out deletion, followed by the author's initials and the date. The author must initial and date each page of the field logbook. The author must sign and date the last page at the end of each day, and draw a line through any blank space remaining on the page below the last entry.

2. Write the project name, dates of the field work, site name and location (city and state), and Integral job number on the cover of the field logbook. If more than one logbook is used during a single sampling event, then annotate the upper right-hand corner of the logbook (e.g., Volume 1 of 2, 2 of 2) to indicate the number of logbooks used during the field event. Secure all field logbooks when not in use in the field. The following is a list of the types of information that is appropriate for entry in the field notebook:
   - Project start date and end date
   - Date and time of entry (24-hour clock)
   - Time and duration of daily sampling activities
   - Weather conditions at the beginning of the field work and any changes that occur throughout the day, including the approximate time of the change (e.g., wind speed and direction, rain, thunder, wave action, current, tide, vessel traffic, air and water temperature, thickness of ice if present)
   - Name and affiliation of person making entries and other field personnel and their duties, including what times they are present
   - The location and description of the work area, including sketches, map references, and photograph log, if appropriate
   - Level of personal protection being used
   - Onsite visitors (names and affiliations), if any, including what times they are present
   - The name, agency, and telephone number of any field contacts
   - Notation of the coordinate system used to determine the station location
   - The sample identifier and analysis code for each sample to be submitted for laboratory analysis, if not included on separate field data sheets
   - All field measurements made (or reference to specific field data sheets used for this purpose), including the time of collection and the date of calibration, if appropriate
   - The sampling location name, date, gear, water depth (if applicable), and sampling location coordinates, if not included on separate field data sheets
   - For aquatic sampling, the type of vessel used (e.g., size, power, type of engine)
   - Specific information on each type of sampling activity
   - The sample type (e.g., groundwater, soil, surface sediment), sample number, sample tag number, and any preservatives used, if not included on separate field data sheets
   - Sample storage methods

- Cross-references of numbers for duplicate samples
- A description of the sample (source and appearance, such as soil or sediment type, color, texture, consistency, presence of biota or debris, presence of oily sheen, changes in sample characteristics with depth, presence/location/thickness of the redox potential discontinuity [RPD] layer, and odor) and penetration depth, if not included on separate field data sheets
- Estimate of length and appearance of recovered cores, if not included on separate field data sheets
- Photographs (uniquely identified) taken at the sampling location, if any
- Details of the work performed
- Variations, if any, from the project-specific sampling and analysis plan (SAP) or standard operating protocols and reasons for deviation
- Details pertaining to unusual events that might have occurred during sample collection (e.g., possible sources of sample contamination, equipment failure, unusual appearance of sample integrity, control of vertical descent of the sampling equipment)
- References to other logbooks or field forms used to record information (e.g., field data sheets, health and safety log)
- Any field results not appearing on the field data sheets (if used), including station identification and location, date, and time of measurement
- Sample shipment information (e.g., shipping manifests, chain-of-custody (COC) form numbers, carrier, air bill numbers, time addresses)
- A record of quantity of investigation-derived wastes (if any) and storage and handling procedures.

3. During the field day, as listed above, record in the logbook a summary of all site activities. Provide a date and time for each entry. The information need not duplicate anything recorded in other field logbooks or field forms (e.g., site health and safety officer's logbook, calibration logbook, field data sheets), but should summarize the contents of the other logbooks and refer to the pages in these logbooks for detailed information.
4. If measurements are made at any location, record the measurements and equipment used, or refer to the logbook and page number(s) or field forms on which they are recorded. All maintenance and calibration records for equipment should be traceable through field records to the person using the instrument and to the specific piece of instrumentation itself.

5. Upon completion of the field sampling event, the sampling team leader will be responsible for submitting all field logbooks to be copied. A discussion of copy distribution is provided below.

FIELD DATA FORMS

Occasionally, additional field data forms are generated during a field sampling event (e.g., groundwater monitoring form, sediment core profile form, water quality measurement form) to record the relevant sample information collected. For instructions regarding the proper identification of field data forms, sampling personnel should consult the project-specific SAP.

Upon completion of the field sampling event, the sampling team leader will be responsible for submitting all field data forms to be copied. A discussion of copy distribution is provided below.

PHOTOGRAPHS

In certain cases, photographs (print or digital) of sampling stations may be taken using a camera-lens system with a perspective similar to the naked eye. Ensure that photographs include a measured scale in the image, when practical. If you take photographs of sample characteristics and routine sampling activities, avoid using telephoto or wide-angle shots, because they cannot be used in enforcement proceedings. Record the following items in the field logbook for each photograph taken:

1. The photographer's name or initials, the date, the time of the photograph, and the general direction faced (orientation)
2. A brief description of the subject and the field work shown in the picture
3. For print photographs, the sequential number of the photograph and the roll number on which it is contained
4. For digital photographs, the sequential number of the photograph, the file name, the file location, and back-up disk number (if applicable).

Upon completion of the field sampling event, the sampling team leader is responsible for submitting all photographic materials to be developed (prints) or copied (disks). Place the prints or disks and associated negatives in the project files (at the Integral project manager's location). Make photocopies of photo logs and any supporting documentation from the field logbooks, and place them in the project files with the prints or disks.

EQUIPMENT CALIBRATION RECORDS

Record in the field logbook all equipment calibration records, including instrument type and serial number, calibration supplies used, calibration methods and calibration results, date, time, and personnel performing the calibration. Calibrate all equipment used during the investigation daily, at a minimum, in accordance with the manufacturers' recommendations.

DISTRIBUTION OF COPIES

When the field team has returned from the sampling event, the field team leader is responsible for making sure that the field documentation is 1) scanned and placed into the project file on the portal (in a subfolder named Field under Working_Files), and 2) a copy of all field logbooks and additional field data forms is made and placed into the project file. Both the scanned copy and the hard copy will be available for general staff use.

The original field logbooks and forms will be placed in a locked file cabinet for safekeeping. One file cabinet at each Integral office will contain the original field documentation for multiple projects. The original field documentation will be filed at the Integral office where the project manager is located.

SET-UP OF LOCKING FILE CABINET

Place each project in its own file folder in a locking file cabinet. On the folder label, include the project name and contract number. Each project folder will include up to six kinds of files:

- Field logbook(s)
- Additional field data forms
- Photographs
- COC forms
- Acknowledgment of Sample Receipt forms
- Archive Record form (to be completed only if samples are archived at an Integral field storage facility or Integral laboratory).

STANDARD OPERATING PROCEDURE (SOP) AP-03

SAMPLE CUSTODY

SCOPE AND APPLICATION

This SOP describes Integral procedures for custody management of environmental samples.

A stringent, established program of sample chain of custody will be followed during sample storage and shipping activities to account for each sample. The procedure outlined herein will be used with SOP AP-01, which covers sample packaging and shipping; SOP AP-02, which covers the use of field logbooks and other types of field documentation; and SOP AP-04, which covers sample labeling.

SAMPLE CUSTODY

A sample is considered to be in a person's custody if any of the following criteria are met:

1. The sample is in the person's possession
2. The sample is in the person's view after being in his or her possession
3. The sample has been transferred to a designated secure area to prevent tampering after it was in the person's possession.

At no time is it acceptable for samples to be outside of Integral personnel's custody unless the samples have been transferred to a secure area (i.e., locked up). If the samples cannot be placed in a secure area, then an Integral field team member must physically remain with the samples (e.g., at lunch time one team member must remain with the samples).

CHAIN-OF-CUSTODY FORMS

Chain-of-custody (COC) forms ensure that samples are traceable from the time of collection through processing and analysis until final disposition. The COC form is critical because it documents sample possession from the time of collection through final disposition. The form also provides information to the laboratory regarding what analyses are to be performed on the samples that are shipped.

Complete the COC form after each field collection activity and before shipping the samples to the laboratory. Sampling personnel are responsible for the care and custody of the samples

until they are shipped. The individuals relinquishing and receiving the samples must sign the COC form(s), indicating the time and date of the transfer, when transferring possession of the samples.

Record on the COC form the project-assigned sample number and the unique tag number at the bottom of each sample label. The COC form also identifies the sample collection date and time, type of sample, project name, and sampling personnel. In addition, the COC form provides information on the preservative or other sample pretreatment applied in the field and the analyses to be conducted by referencing a list of specific analyses or the statement of work for the laboratory. The COC form is sent to the laboratory along with the sample(s).

PROCEDURES

Use the following guidelines to ensure the integrity of the samples:

1. At the end of each sampling day and prior to shipping or storage, enter information for all samples on a COC form. Check the information against the sample container labels and tags and field logbook entries.
2. Do not sign the COC form until the team leader has checked the information for inaccuracies. Make corrections by drawing a single line through any incorrect entry, and then initial and date it.
3. Mark out any blank lines remaining on the COC form, using single lines that are initialed and dated. This procedure will prevent any unauthorized additions.
4. Sign and date each COC form. At the bottom of each COC form is a space for the signatures of the persons relinquishing and receiving the samples and the time and date of the transfer. The time the samples were relinquished should match exactly the time they were received by another party. Under no circumstances should there be any time when custody of the samples is undocumented.
5. If samples are being sent by a commercial carrier not affiliated with the laboratory, such as FedEx or United Parcel Service (UPS), record the name of the carrier on the COC form. Also enter on the COC form any tracking numbers supplied by the carrier. The time of transfer should be as close to the actual drop-off time as possible. After signing the COC forms and retaining a copy (e.g., the pink copy if the COC form is in triplicate, or an electronic or photocopy if not), seal them inside the transfer container.
6. If errors are found after the shipment has left the custody of sampling personnel, make a corrected version of the forms and send it to all relevant parties. Fix minor errors by making the change on a copy of the original with a brief explanation and signature. Errors in the signature block may require a letter of explanation.

Upon completion of the field sampling event, the sampling team leader is responsible for providing copies of all COC forms to the project chemist or laboratory coordinator. A discussion of copy distribution is provided in SOP AP-02.

CUSTODY SEAL

As security against unauthorized handling of the samples during shipping, affix two signed and dated custody seals to each sample cooler. Place the custody seals across the opening of the cooler prior to shipping. Be sure the seals are properly affixed to the cooler so they cannot be removed during shipping. Additional tape across the seal may be prudent.

SHIPPING AIR BILLS

When samples are shipped from the field to the testing laboratory via a commercial carrier (e.g., FedEx, UPS), the shipper provides an air bill or receipt. Upon completion of the field sampling event, the sampling team leader will be responsible for submitting the sender's copy of all shipping air bills to be copied at an Integral office. A discussion of copy distribution is provided in SOP AP-02. Note the air bill number (or tracking number) on the applicable COC forms or, alternatively, note the applicable COC form number on the air bill to enable the tracking of samples if a cooler becomes lost.

ACKNOWLEDGMENT OF SAMPLE RECEIPT FORMS

In most cases, when samples are sent to a testing laboratory, an Acknowledgment of Sample Receipt form is faxed to the project QA/QC coordinator the day the samples are received by the laboratory. The person receiving this form is responsible for reviewing it, making sure that the laboratory has received all the samples that were sent, and verifying that the correct analyses were requested. If an error is found, call the laboratory immediately, and document any decisions made during the telephone conversation, in writing, on the Acknowledgment of Sample Receipt form. In addition, correct the COC form and fax the corrected version to the laboratory.

Submit the Acknowledgment of Sample Receipt form (and any modified COC forms) to be copied. A discussion of copy distribution is provided in SOP AP-02.

ARCHIVE RECORD FORMS

On the rare occasion that samples are archived at an Integral office, it is the responsibility of the project manager to complete an Archive Record form. This form is to be accompanied by a

copy of the COC form for the samples, and will be placed in a locked file cabinet. The original COC form remains with the samples in a sealed resealable (e.g., Ziploc®) bag.

STANDARD OPERATING PROCEDURE (SOP) AP-06

NAVIGATION AND STATION POSITIONING

SCOPE AND APPLICATION

This SOP describes procedures for accurate navigation and station positioning required to ensure quality and consistency in collecting samples. Station positioning must be both absolutely accurate, in that it correctly defines a position by latitude and longitude, and relatively accurate, in that the position must be repeatable, allowing field crews to reoccupy a station location in the future (e.g., for long-term monitoring programs).

This SOP is structured as follows:

- Procedures
- Equipment capabilities
- Basic data collection, navigation, and file transfer.

PROCEDURES

A global positioning system (GPS) is used to obtain latitude and longitude coordinates for locations where samples are to be collected and to verify the accuracy of coordinates through use of control points and post-processing differential correction to industry standards.

For most sampling events, the GPS unit is used to direct the sampling team to the proposed sampling location, having loaded target locations onto the device prior to field deployment. For some sampling events, the GPS unit is used to record positions on the fly, in the field.

A typical positioning objective is to accurately determine and record the positions of all sampling locations to within 2 m. Positioning accuracies on the order of 1 to 5 m can be achieved[1] but may be diminished during times when the geometry of the satellites above the GPS antenna does not provide the optimum signal. The time intervals during the day when accuracies are decreased are available on Trimble Navigation Limited's (Trimble's) web site: http://www.trimble.com/gnssplanningonline/#/Settings.

[1] GPS accuracy depends on the unit (Table 1).

Use of Control Points

GPS accuracy should be verified at the beginning and end of each sampling day through use of one (or more) known horizontal control point(s) in the study area. The GPS position reading at any given station can then be compared to the known control point. All GPS signal propagation is controlled by the U.S. government (the U.S. Department of Defense for satellite signals and the U.S. Coast Guard for differential corrections).

Daily GPS Activities

A consistent routine should be established for each day's positioning activities. After successful reception of differential signals is confirmed, the GPS can be powered up and the software booted. As stated above, accuracy of the system should be verified through use of a horizontal control point.

The sampling team will proceed to the vicinity of a target station location selected by the team leader. That station location is then selected from a number of preloaded station locations that have been entered into the integrated navigation system database. Once the station has been selected, the positioning data are displayed on the computer screen or hand-held unit to assist in proceeding to the station and in maintaining the station position during sampling. A confirmed position is recorded electronically each time a sample collection is attempted (i.e., during sediment grab sampling and coring, the locations of both accepted and rejected grab samples or cores are recorded). Upon recovery of the sampling device, the station position latitude and longitude coordinates from the archived GPS file are read and recorded in the field logbook or on log sheets as a backup to the GPS record. The sampling time and water depth are also recorded, if applicable. Ancillary information recorded in the field logbook may include personnel operating the GPS, tidal phase, type of sampling activity, and the time when coordinates were collected.

On-Water Sampling Events

For on-water GPS navigation, an assessment should be made of the type of vessel that will be used to do the work and from what type of structure (e.g., side davit, A-frame, moon pool) the sampling equipment be deployed. A GPS antenna must be installed immediately above the location where the sampling equipment will be deployed.

> **Note:** On-water GPS navigation can be affected by overhead structures. If sampling from a boat is conducted underneath a bridge or adjacent to tall buildings, a laser range finder such as the Trimble TruPulse 200 Rangefinder may be needed. If sampling is performed in deep water from a boat (e.g., collecting sediments with a remotely operated vehicle), it may be necessary to install an ultrashort baseline (USBL) underwater acoustic positioning system on the sampling equipment. The USBL

system is set up differently from a common GPS unit. **This SOP does not address USBL or laser range-finder navigation.**

When a GPS antenna is mounted on a movable A-frame, the antenna should face up when the A-frame is extended out. The antenna may be mounted on an angle when the A-frame is retracted and not in use. This will optimize satellite signal reception during sampling.

If an antenna cannot be mounted exactly above the point of sampling, an offset should be incorporated into the navigation software so that each time a sample is taken, the correct location of its deployment will be accurately recorded/placed on the map (Figure 1).

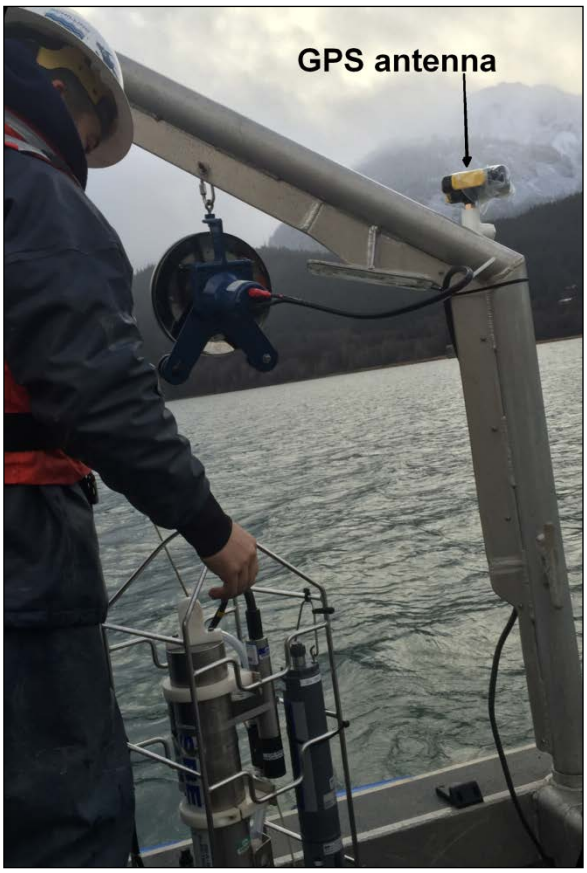


Figure 1. GPS Antenna Mounted with an Offset from the Winch Location

GPS antennae can be connected through a cable or via wireless Bluetooth® connection. Bluetooth® connections are typically limited by distances less than 10 m. If the GPS antenna is to be mounted at distances beyond 10 m, a cable connection may be needed.

The GPS antenna should be mounted vertically, with the dome facing toward the sky, at the time of deployment. The GPS antenna can be mounted on top of a davit or A-frame, or offset

over a cabin roof or other boat structure. The GPS antenna may be coupled with a receiver such as the Trimble Pro XH model and connected to a Trimble Yuma tablet or field laptop. The Yuma tablet is waterproof and therefore does not need to be situated inside a cabin (consult user manual for its operation). However, if a standard laptop is used for navigation, there must be enough cable available to connect the laptop to the antenna from inside a cabin or protected area, unless a Bluetooth® connection is available.

1. Mount the GPS antenna for receiving differential corrections on a convenient fixture outside the cabin.
2. Locate the differential corrections receiver and the computer in the cabin. Orient the video screen of the computer to allow the vessel operator to observe on-screen positioning data from the helm. A second monitor may be necessary if the distance between navigator and boat operator makes this setup impractical.
3. Alternatively, manually place a GPS antenna as close as possible to where the sampling will occur (e.g., the moon pool on a barge), and direct the vessel operator to the sampling station location.
4. Once the sampling vessel is anchored or is maintaining its position at the sampling station location, record the horizontal coordinates of the station on the GPS unit and in the field logbook. In some instances, coordinates should be recorded once the sampling device (e.g., core or grab sampler) has contacted the bottom of the water body, or if collecting surface water samples, when the sampling device is in the water at a specific sampling depth.

All target GPS coordinates should be loaded into the GPS unit before field sampling activities begin. The navigator should make sure that the sampling coordinate system is set up according to field sampling plan specifications (e.g., World Geodetic System 1984 [WGS84] or a site-specific state plane, if required). To facilitate navigation, additional background files containing georeferenced aerial photos or polygons of river edges, facility structures, etc. may be preloaded as well.

After sample collection, actual sample location positioning will be checked for precision against the target sampling location to ensure that samples were collected at the target location within the project's navigational error specifications (e.g., within ± 2 to 10 m from the target, depending on project data quality objectives).

EQUIPMENT CAPABILITIES

GPS Units

Integral maintains up-to-date navigation equipment and some units may not be listed in this SOP. However, the basic principles of GPS navigation, field setup, and data collection are, for

the most part, similar to the ones described herein. Integral owns several types of Trimble GPS units, such as the GeoXH, Yuma with a ProXH receiver, and Juno 3B.

The GeoXH GeoExplorer 2008 series (Figure 2) runs the Windows Mobile operating system, and the newer Juno 3B (Figure 3) runs Windows Handheld Professional. The Trimble Yuma rugged tablet computer (Figure 4) runs the Windows 7 Professional operating system. All units utilize Trimble TerraSync software for GPS data collection. The GeoXH and Yuma are capable of offering submeter accuracy (the Yuma has an internal GPS antenna capable of 2 to 5 m accuracy, but requires an external ProXH antenna for subfoot accuracy). The Juno is capable of 1 to 3 m post-processed accuracy. Table 1 presents an accuracy comparison between the different units. Integral also owns a Trimble TruPulse 200 laser range finder (described in the "Sources of Error" section, below).

Figure 2. GeoXH GeoExplorer 2008 Series Unit

Figure 3. Trimble Juno

Figure 4. Trimble Yuma Rugged Tablet Computer with Pro XH Receiver Mounted on a Waist Belt

Table 1. GPS Unit Comparison

GPS Unit	Horizontal Accuracy[a,b]	Vertical Accuracy[a,b]
GeoXH handheld 2008	≥15 cm–1 m	≥ 2x horizontal error
Yuma with ProXH antenna	≥15 cm–1 m	≥ 2x horizontal error
Yuma without ProXH antenna	2–5 m	≥ 2x horizontal error
Juno 3B	2–5 m	≥ 2x horizontal error

Notes:

[a] The stated accuracy assumes post-processing differential correction.

[b] The vertical and horizontal precisions are provided for each GPS point to a specified confidence level.

Sources of Error

GPS error is temporal- and location-specific depending on satellite locations and atmospheric conditions. Obtaining high-accuracy GPS data requires rigorous data collection techniques, and data collection can be compromised by inconsistent antenna height, obstructed view of the sky (e.g., tree canopy, docks, bridges), available satellites in view, station occupation time, atmospheric conditions, and distance from the base station. A laser range finder can be used with the unit if the target location is obstructed by tree canopy or structures. Consistently achieving 15 to 30 cm horizontal accuracy for large field-collection efforts requires preplanning and optimal conditions. Users should confirm GPS accuracy by collocating GPS coordinate collection with a surveyed monument (i.e., base station) prior to high-accuracy fieldwork. Users must set the positional dilution of precision (PDOP) value to 6 as the standard setup for accuracy. However, if field conditions preclude receiving a good satellite signal, the PDOP can be set to "Productivity" in the TerraSync software during fieldwork. This will allow the unit to accept available satellite signals to navigate to a target location; an example of the means for this adjustment is shown in Figure 5 (not applicable for the Juno). Setting the PDOP to Productivity will, however, decrease the level of accuracy in the field.

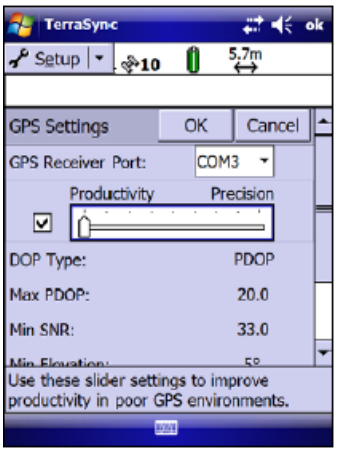


Figure 5. Recommended TerraSync GPS Settings

Differential Correction

Estimated accuracies for 18012 corrected positions are as follows:

Range	Percentage
0-15cm	27.3%
15-30cm	43.1%
30-50cm	15.4%
0.5-1m	11.1%
1-2m	2.7%
2-5m	0.4%
>5m	0.0%

Figure 6. Error Ranges from Differential Correction Report

To achieve optimal accuracy, GPS data must be post-processed using GPS Pathfinder Office. Differential correction reduces errors and provides a report that states the estimated horizontal accuracies in error ranges. With the GeoHX and Yuma (with ProXH antenna), the average horizontal error of most GPS field efforts is typically within 0.5 m, although individual station location errors may range from <15 cm to >1 m (Figure 6). With the Juno, the average horizontal error in the field is typically 2 to 5 m. Vertical error is at a minimum 2 to 3 times that of horizontal error, but vertical error is not estimated with the differential correction report. The corrected GPS data include horizontal and vertical precision calculated to a specified confidence level.

Integral's geographic information system (GIS) staff can assist with loading station coordinates and base maps onto the GPS units prior to fieldwork mobilization.

Following field collection, Integral GIS staff can assist with transferring, correcting, archiving, and preparing source files for integration into Integral's data management processes. If a project requires greater accuracy and less uncertainty, a licensed surveyor can provide subcentimeter horizontal and vertical location accuracy using a survey-grade GPS unit or total station instrument.

BASIC DATA COLLECTION, NAVIGATION, AND FILE TRANSFER

This section outlines basic data collection, navigation, and file transfer using Trimble's TerraSync software. Questions regarding GPS use for fieldwork should be directed to Integral's GIS team. GPS settings related to data accuracy (PDOP, signal-to-noise ratio [SNR], etc.) should not be changed.

If new to using Trimble software, it is strongly recommended that a mock data collection event be conducted *before* actual data collection begins in the field. Any area outside of an office building, in a nearby parking lot, or anywhere that is relatively free of obstructions such as tall buildings or large trees will suffice.

Basic Data Collection

Create a New File

1. In the upper left corner, select Data from the Section button.
2. Directly below in the Subsection button, select New and then New File.
3. In the New File screen, set File Type to Rover, Location to Default, type in a File Name, and set Dictionary Name to Generic (unless a specific data dictionary has been created).
4. Confirm antenna height dialogue appears. Enter the correct height if collecting vertical. Select OK.

Create (Log) GPS Features

1. Tap Create, and the Collect Features screen appears. If the generic data dictionary is chosen (typical), there are three feature options: Point_generic, Line_generic, and Area_generic.
2. To record a point feature, select Point_generic and tap Create. An attribute entry screen will appear, and the GPS unit will start logging positions. All logging positions will be averaged to compute a final GPS position. The running number of logging positions appears next to the pencil icon at the top of the screen.
3. While the unit is logging positions, remain stationary and fill out the Comment field. The Comment field is a text field that can have any combination of letters, numbers, or symbols (up to 30 characters). Typically, by the time the Comment field is completed, the unit has logged enough positions. Approximately 20 to 30 positions are sufficient; however, a minimum of 40 to 60 logged positions is required for a greater level of positioning accuracy. In theory, a greater number of positions results in a more accurate final position, although additional factors also contribute to accuracy (satellite distribution, canopy cover, etc.); with a very large number of positions, there comes a point of diminishing returns.
4. To stop logging positions and to record the feature, press OK. This returns you to the Collect Features screen.

Line and area features are collected in much the same manner, except that the user walks along the alignment or outline of the feature instead of remaining in place. The pace of the walk should be rather slow, to allow the GPS unit to log enough positions along the way. A line feature will simply create a line that follows the walked path. An area feature will always be a closed polygon, so if the end is not at the point of beginning, the GPS will automatically

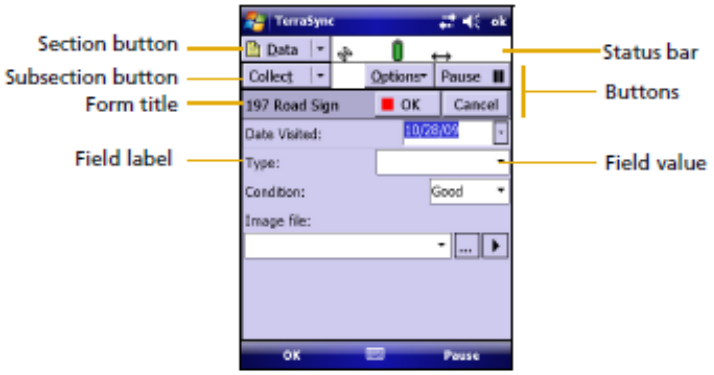
close the loop by connecting the first and last position, regardless of how far apart the two might be. During collection of lines and features, position logging can be paused if there is a need to deviate from the line. Operations are resumed by tapping Resume.

The map can be viewed at any time while features are being collected:

1. Tap the Section button and select Map.
2. To go back to data collection, tap the Section button again, and select Data.
3. To end data collection, tap the Collect button and select Close.

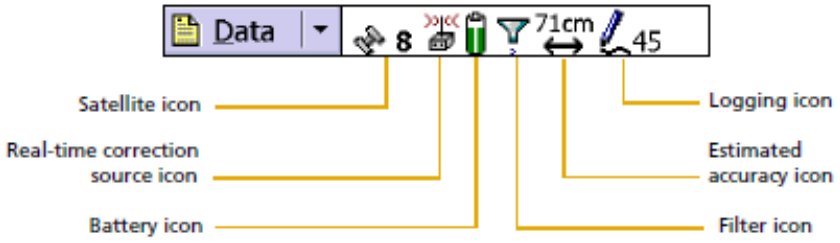
The TerraSync interface and icons are shown below:

The screen below shows elements that are common to all screens in the TerraSync software:



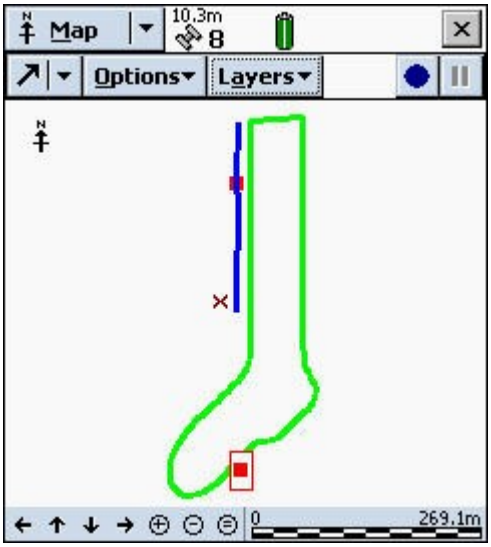
Status bar

The status bar appears at the top of the TerraSync software screen and provides basic status information about the connected GPS receiver. For information about how to connect to a GPS receiver, see Connecting to a GPS receiver, page 48.

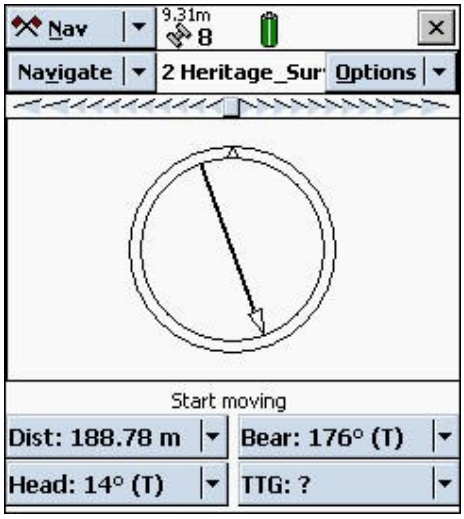


Navigation

The Navigation section of the program permits users to navigate from their current position (small red ×) to a selected target or feature.



1. To open the Navigation section, tap the Section List button and select Navigation.
2. To navigate to a point, select the desired point feature in Map view. The selected feature will be displayed as the boxed point feature symbol (at right).
3. Tap Options—Set Nav Target in Map view. The navigation target will now be displayed as a blue crossed-flags navigation target symbol.
4. Select Navigation from the section list, and note the following items (depicted in the example to the right):
   - Target's identification and type (2 Heritage_Survey_pt)
   - Distance to target (188.78 m)
   - Bearing to target (176°); the arrow pointer indicates the bearing graphically
   - User's current heading (14°); the pointer on top of the dial represents the user's heading.



TerraSync's "compass" depends on a series of GPS positions to detect the direction of travel, so users must keep moving for the compass to stay in an active state. If they stop, the compass will wander and drift.

Users follow the arrow pointer until the target feature is reached. As the target is approached, an alert tone will sound, and the view changes to a zoomed-in representation of the target feature and the current GPS position.

File Transfer

Data files are transferred to and from the GPS unit using the Data Transfer utility. This utility is part of the GPS Pathfinder Office software but can also be used as a stand-alone program (free to download onto any computer).

1. Before using the software, connect the GPS unit to your computer via the universal serial bus (USB) cable. Microsoft Mobile Device Center (Windows 7) should successfully connect to the GPS unit.
2. Once that connection is successful, open GPS Pathfinder Office; select Utilities and then Data Transfer (if you are using the stand-alone version, simply open the program).
3. In the device box, select GIS Datalogger on Windows. It should show the GPS as successfully connected. There are two options—Send and Receive.
4. To download your data, select the Receive tab, and hit Add and then Data File. The files that appear are the files in the GPS unit. Any files that have not been downloaded (or modified since the last download) will be selected in bold.
5. Click Open; the Files to Receive dialog box appears. A list of all files that will be downloaded appears, and you can remove any from the list as needed.
6. Click Transfer All; a message box showing summary information about the transfer appears.

Transferring data on the Yuma tablet is done somewhat differently. With the Yuma, the GPS and the computer are both on the same device. The difference is that the files still need to be transferred to and from the computer portion of the device. The easiest method is to use a thumb drive.

1. To load data onto the unit (Send, in the Data Transfer utility), point the path to the thumb drive containing the files to upload.
2. To download data, follow the instructions above, and take note as to where the files are being transferred in the Yuma computer, in the Destination field.
3. After transferring files, navigate to the files in Windows Explorer and copy them to the thumb drive.

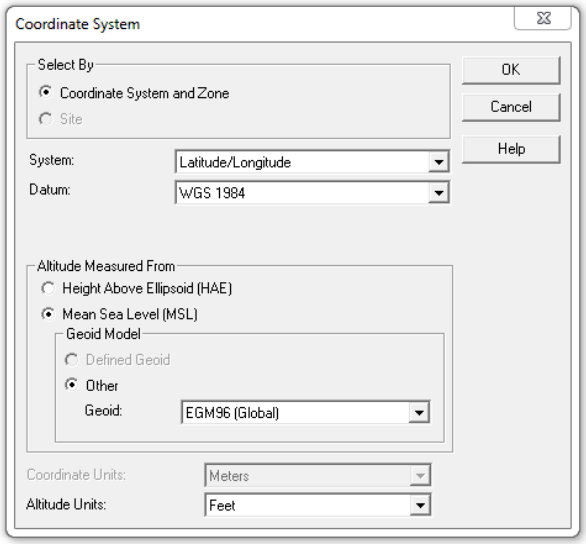
Loading Background Files

File Types

Background layers supported by TerraSync include vector data (.shp) and raster data (.bmp, .jpg, .sid, and .tif). The raster data must be uploaded with a world file (.wld, .jgw, .tfw, .sdw), which tells TerraSync the coordinate system in which the data is projected. All data should be projected into WGS84 before it is uploaded to the GPS unit.

Uploading to the GPS Unit

1. To transfer background data to the GPS unit, open the file in Pathfinder.
2. Set the coordinate system of the Pathfinder Office display to WGS 1984 by going to Options > Coordinate System.
3. To open the background file, go to File > Background and navigate to the file by clicking Add.
4. To check that it is displaying correctly, click on View > Map. Once it is displayed in Pathfinder, it can be transferred to the GPS unit.
5. Connect the GPS unit to the computer and click Utilities > Data Transfer.
6. On the Send tab, click Add > Background and add the file.
7. Click Transfer All for the file to be uploaded to the unit.



Displaying on the GPS Unit

1. Open TerraSync on the GPS unit and click on the drop-down menu next to Setup.
2. Go to Map, click Layers > Background Files, and choose the background file.
3. Click OK and the file will be added to the map.

STANDARD OPERATING PROCEDURE (SOP) AP-09

SAMPLE SHIPPING USING DRY ICE

INTRODUCTION

The procedures outlined in this SOP must be used when a shipment includes *no hazardous materials other than dry ice* for transport by air with a carrier that subscribes to U.S. Department of Transportation (DOT) International Air Transport Association (IATA) standards. DOT and IATA regulate shipments of dry ice because it is a hazardous material. As a result, specific procedures must be followed when packaging and shipping materials refrigerated with dry ice.

Whenever possible, Federal Express (FedEx) should be used as preferred shipping service for sample shipments containing dry ice. Shipments using dry ice can be dropped off at some, but not all, staffed FedEx locations, so it is important to confirm which FedEx locations near the project-specific sampling area will handle dry ice shipments. Packages containing frozen samples and dry ice can be shipped by air to reach their destinations rapidly. However, if time permits, it is permissible to use ground (freight) transportation to save on shipping expenses.

Because UPS and the U.S. Postal Service have extremely restrictive policies concerning shipments of hazardous materials, these carriers should not be used to ship packages containing dry ice.

HAZARD IDENTIFICATION

Dry ice is carbon dioxide in a solid state. It has no liquid state; it sublimates, or turns directly from a solid to a gas. When exposed to room temperature, dry ice will evaporate and release carbon dioxide gas. Caution should be used when handling and using dry ice. DOT and IATA classify dry ice as a "miscellaneous" hazard, class 9. Dry ice is considered hazardous during transport for three reasons:

1. **Explosion hazard:** Dry ice releases a large volume of carbon dioxide gas as it sublimates. If packaged in a container that does not allow for release of the gas, it may explode and cause personal injury or property damage.
2. **Suffocation hazard:** A large volume of carbon dioxide gas emitted in a confined space may create an oxygen deficient atmosphere and may lead to asphyxiation.

3. **Inhalation hazard:** Inhalation of carbon dioxide gas may cause dizziness, an irregular heartbeat, narcosis, or nausea.
4. **Contact hazard:** Dry ice is a cryogenic material that causes severe frostbite upon contact with skin. Do not wear contact lenses when handling dry ice; it may cause burns similar to frostbite between the contact lens and the eye.

All sampling personnel will read the Material Safety Data Sheet (attached) before handling dry ice. Packaging dry ice properly will minimize the risk to personnel transporting the material. The explosion hazard will be eliminated with a package designed to vent gaseous carbon dioxide. Suffocation and inhalation hazards will be greatly reduced by labeling the package correctly, so those who come in contact with it will be aware of the contents. Contact and dermal hazards will be minimized when sampling personnel wear safety glasses, thermal gloves, and closed-toe shoes when working with dry ice. Personnel should also use tongs to transfer the dry ice from one container to another.

U.S. DOT DRY ICE REGULATIONS

Dry ice requires special packaging precautions before shipping by aircraft to comply with U.S. DOT regulations. The *Code of Federal Regulations* (49 CFR 173.217) classifies dry ice as Hazard Class 9 UN1845 (Hazardous Material). These regulations specify the amount of dry ice that may be shipped by air transport and the type of packaging required. Only personnel who have received U.S. DOT Hazardous Material training can ship packages containing dry ice if it is shipped by air or water. Personnel at FedEx have received this training and are able review packaging, labeling, and shipping papers and will authorize the shipment for you.

Labeling Regulations

When shipping with dry ice, correct identification, classification, markings, and labeling must be provided on the outer carton to comply with current requirements of IATA dangerous goods regulations. General marking and labeling requirements must be observed, such as all markings must be in English; all markings and labels must be durable and in the correct location; and only relevant markings and labels are allowed. The following permanent markings are required on the outer packaging of all IATA dry ice shipments:

- "Dry Ice" or "Carbon Dioxide Solid"
- "UN 1845"
- Net weight of dry ice in kilograms (2.2 lb = 1 kg)
- Name and address of the shipper
- Name and address of the recipient.

Packaging Regulations

Packing instructions 954 (listed in the table below) references the general packaging requirements of IATA 5.0.2, meaning that the packaging must be of good quality, compatible with the contents, and sufficient size to accommodate the required labeling.

IATA Table for List of Dangerous Goods (Dry Ice)

Proper shipping name	"Carbon dioxide, solid" or "Dry ice"
UN/ID Number	UN 1845
Class or Division	9
Hazard Label	Miscellaneous
Packing Group	III
Packing Instructions	954
Passenger/Cargo Aircraft	200 kg
Cargo Aircraft Only	200 kg

IATA requirements specific to dry ice include the following:

- Packaging must be designed and constructed to permit the release of carbon dioxide gas. This usually means that the shipping container is not completely sealed at all seams.
- The package must be of adequate strength for the intended use. It must be strong enough to withstand the loading and unloading normally encountered in transport. It must also be constructed and closed to prevent any loss of contents that might be caused by vibration or changes in temperature, humidity, or altitude.
- The package must be of sufficient size to allow for marking and labeling. No labels may fold over from one surface of the container to the next.
- Total net weight of dry ice in the package must be less than the maximum amount specified in the above table.

When using FedEx as the shipper, for both air transportation (including overnight) and ground transportation, packages with 200 kg (441 lb) or less of dry ice are not considered hazardous (unless the shipping container contains other hazardous materials).

PACKING SAMPLES WITH DRY ICE

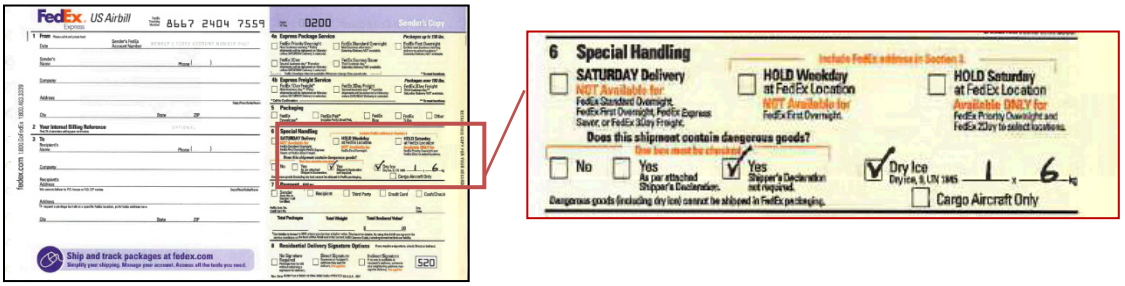
Integral SOP AP-01, *Sample Packaging and Shipping*, SOP AP-02, *Field Documentation*, and SOP AP-03, *Sample Custody,* should be followed when shipping samples using dry ice (e.g., chain-of-custody [COC] forms placed inside a Ziploc® bag and taped to the inside of the

container lid, COC seals affixed to three points outside of container, and if required, project-specific COC tape placed across the lid of the container). A few exceptions to SOP AP-01 are discussed below.

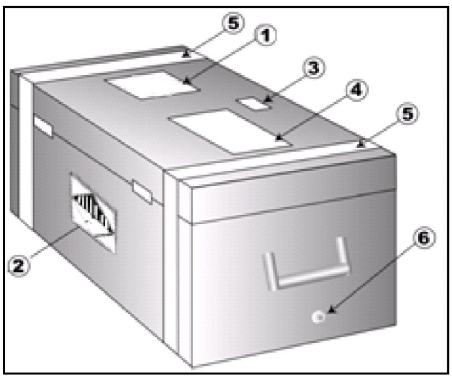
Shipping Requirements

There are five basic requirements for shipments of dry ice:

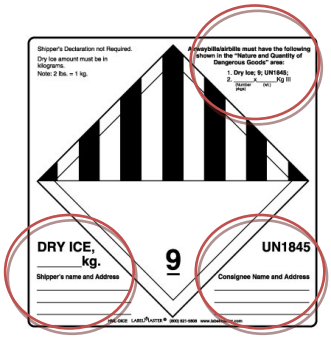
1. **Gas venting**: Packages must allow for release of carbon dioxide gas. Dry ice must never be sealed in a container with an airtight seal such as a jar with a threaded lid or a completely sealed plastic cooler (e.g., do not affix duct tape around gap between lid and body of the cooler; see other options provided below to allow for gas venting during shipment).
2. **Package integrity**: A package containing dry ice must be of adequate strength for its intended use. It must be strong enough to withstand the loading and unloading normally encountered in transport. It must also be constructed and closed to prevent any loss of contents that might be caused by vibration or by changes in temperature, humidity, or altitude.
3. **Package materials**: Do not use plastics that can be rendered brittle or permeable by the temperature of dry ice. This problem can be avoided by using commercially available packages intended to contain dry ice; see below for a list of manufacturers of dry ice shipping containers.
4. **Airbill**: The airbill (also referred to as the air waybill) must include the statement "Dry Ice, Class 9, UN1845, *number of packages* X *net weight in kilograms.*" FedEx has a check box in section 6 of its airbill to satisfy this requirement:



5. **Labeling:** The outermost container must be labeled with a hazard class 9 label, UN 1845, and total weight of dry ice in kilograms. The label should be affixed to a vertical side of the box (not the top or bottom) and oriented as follows:



- **Laboratory Address Label:** Ensure the address label for the analytical laboratory is secure and completely taped over with clear tape.
- **Class 9 Dangerous Goods Label**: List the amount of dry ice in kg (2.2 lb = 1 kg). Place the label on a vertical side of the box (not the top as shown above) and completely tape over the label with clear tape.



- **Fragile and Perishable Goods Labels**: Be sure to completely tape over these labels with clear tape.

- **Airbill**: Fully complete the airbill; enter the information in the following sections:
  - ✓ Section 1 (sender's name, date)
  - ✓ Section 4 (number of total packages, total weight, commodity description
  - ✓ **Commodity Description: Please enter the following "Environmental Samples for RESEARCH PURPOSES ONLY."**

- ✓ Section 7 (dry ice weight in kg)
- ✓ Section 10 (signature, date).

Sample Packaging

The following actions need to be implemented when shipping with dry ice:

1. Freeze samples, blue ice, and a plastic temperature blank solid prior to shipping. Pre-cool the insulated shipping container, if possible. **Note**: When filling the sample jar in the field, be sure to leave headspace in the sample jar to allow for expansion of sample (e.g., sediment or water) when frozen. Otherwise, sample jars will crack and the sample will be lost.
2. Wrap all glass or plastic sample jars, or sediment core tubes in bubble wrap as per the usual packing protocol. **Do not place the dry ice in direct contact with any glass or plastic sample jars or core tubes.** The glass and plastic will crack and break if it comes into direct contact with the dry ice. If necessary, place a barrier between the glass or plastic jars or core tubes (e.g., a layer of clean cardboard, clean packing peanuts, or a layer of wadded-up clean paper on top of the samples).
3. Purchase dry ice from local supplier (determine dry ice purchase locations near the project-specific sampling area prior to field event).
4. For overnight shipments to the laboratory, ensure the weight of the sample shipping container (i.e., insulated box or cooler) does not exceed 150 lb.
5. Weigh the dry ice before you put it in the sample shipping container (the weight of the dry ice MUST be written on the Class 9 Dangerous Goods label prior to shipping) (see item #5 under "Labeling" section provided above).
6. Choose the correct size of sample shipping container to provide sufficient dry ice exposure to the samples to keep them frozen (i.e., small amount of sample planned for shipment, then use a smaller container); do not ship in Styrofoam cooler (the dry ice could "melt" through the container).
7. Keep the dry ice, blue ice, and pre-frozen samples, in the freezer for as long as possible on the day of shipping; coordinate with FedEx regarding the best time to get the sample to the counter for shipping. When shipping samples with dry ice, it is advisable to package and ship the samples later in the afternoon to give the dry ice as much "staying power" as possible. Five pounds of dry ice will sublimate within 24 hours.
8. Minimize the volume of air to which the dry ice is exposed to slow the rate of sublimation. If there is any air space after the package is filled with dry ice and blue ice, fill the space with packing peanuts or crumpled paper.

9. Secure the samples in such a way that when the dry ice sublimates, the samples will not move freely inside of the shipping container (i.e., insulated box or cooler). This can be accomplished by wedging the samples in place with clean cardboard or clean Styrofoam. As mentioned above, fragile containers such as glass jars or vials should be individually wrapped with cushioning material.
10. When using dry ice for shipping, it is important to determine how much dry ice is needed to maintain the proper temperature throughout the entire transit time of the shipment. The table below provides a guide to determine how much dry ice is needed, based on the weight of the perishable product and transit time.

Average Amounts of Dry Ice for Packing Frozen Samples in a Single Well-Insulated Container

Weight of Frozen Sample	Time In Transit			
	4 Hours	12 Hours	24 Hours	2 Days
2 lb	2 lb Dry Ice	3 lb Dry Ice	5 lb Dry Ice	10 lb Dry Ice
5 lb	3 lb Dry Ice	4 lb Dry Ice	8 lb Dry Ice	15 lb Dry Ice
10 lb	4 lb Dry Ice	5 lb Dry Ice	10 lb Dry Ice	20 lb Dry Ice
20 lb	5 lb Dry Ice	8 lb Dry Ice	15 lb Dry Ice	25 lb Dry Ice
50 lb	10 lb Dry Ice	15 lb Dry Ice	20 lb Dry Ice	30 lb Dry Ice

Note: For each additional day, add 8 to 15 lb.

Example: For an overnight shipment of 5 lb of sample, a minimum of 8 lb of dry ice should be placed in the shipping container.

11. Ask FedEx about the length of time for ground shipping to the laboratory, add a day, and then determine the weight of dry ice to sample mass in the cooler.
12. Do not write "specimens" or "samples" on the outside of the shipping container; there should not be any misunderstanding about the shipment.
13. Wear work gloves and use tongs when handling the dry ice; do not use nitrile gloves, which provide insufficient dermal protection, when handling the dry ice.
14. Pack the sample shipping container. If using a cooler, place a layer of bubble wrap (per Integral SOP AP-01) in the bottom of the cooler, and line the cooler with a 2-mil plastic "contractor-type" garbage bag (per Integral SOP AP-01). If shipping frozen tissue samples, place adequate absorbent material such as pads, cellulose wadding or paper towels in the bottom of the garbage bag to prevent leakage.

15. Place the individually bagged and bubble wrapped sediment or tissue samples within the garbage bag on the bottom of the cooler, place the dry ice on top of and around the samples. If the samples are in glass or plastic containers, place a piece of clean cardboard, packing peanuts, or a layer of wadded-up clean paper on top of the samples (to prevent sample jar/core tube breakage) and then place the dry ice on top of this layer. As mentioned above, glass and plastic sample jars/core tubes will crack and break if they come into direct contact with the dry ice.
16. Place frozen blue ice packets around the samples as a backup to keep the samples cold in the event that the dry ice sublimates during transit to the laboratory.
17. Make sure that any extra space within the sample shipping container is filled. This will prevent the samples from shifting during transport and any extra space may cause the dry ice to warm faster. Filling in any extra space will keep the samples frozen longer. Dead air space will cause the dry ice to sublimate faster.
18. Place the frozen plastic temperature blank in the sample shipping container with the frozen samples.
19. Close the liner bag, but *do not* seal it or tie it closed; the carbon dioxide gas created by the dry ice must be allowed to vent.
20. Wrap each end of the cooler needs with strapping tape at least three times.
21. ***Ensure proper venting of the dry ice***. There are three possible options for venting if samples are to be transported in a cooler rather than packaging specifically designed for dry ice transport (see below). The first and preferred option is not to place duct tape around the cooler between the cooler's body and lid. A second option is to leave the cooler drain hole open (inside and outside). A third option is to drill several vent holes near the top of the vertical sides of the cooler (not in the lid) to allow carbon dioxide gas to escape. If vent holes are drilled into the cooler, place the dry ice on the bottom of the cooler rather than the top to keep samples as cold as possible (i.e., dry ice, insulating layer such as piece of clean cardboard, packing peanuts, or a wadded-up clean paper, then the samples). To prevent debris from falling into the cooler, install wire screen or cheesecloth in the vents to keep foreign materials from contaminating the cooler. When the samples are packaged, exercise care to keep these vents open to prevent the buildup of pressure.
22. Place correct labels (as specified above) and completed airbill on the sample shipping container.
23. Complete the IATA "Acceptance Checklist for Dry Ice" shipment form (attached) to confirm that the package meets IATA specifications. Notify the project manager if any box on the form is checked "yes."

24. Make arrangements with the testing laboratory to ensure the package will be received on its intended delivery date. When shipping samples, take into account holidays or closings that might delay package delivery.

Alternate Shipping Containers

Pre-made shipping container specifically designed for transport of perishable items are available for purchase. These containers are designed and constructed to permit the release of carbon dioxide gas to prevent a buildup of pressure that could rupture the package. Interior supports are provided to secure the secondary packaging in the original position after the dry ice has dissipated.

There is a 2-week lead time from January 15 through October 31 on all orders:

R.N.C. Industries, Inc.
Control Temp Packaging
(770) 368-8453
(888) 844-3864
http://www.rncind.com/index.php?page=control-temp-blue

Reusing an insulated dry ice shipping box can be a good use of resources. If a box is reused, then completely obliterate all unnecessary marking such as hazard labels, addresses, used FedEx labels, and barcodes. Only reuse a box if it is not contaminated and its integrity is intact. A box should not be reused if it is torn, cut, or stained, or if the insulation is cracked or broken.

ACCIDENT RESPONSE

Sampling personnel should follow all of the recommendations in the MSDS (attached) and take the following actions if they have an accident while using dry ice:

Inhalation: In case of inhalation, conscious persons should be assisted to an uncontaminated area and inhale fresh air. The person should be kept warmed and calm. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an

uncontaminated area and given assisted resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

Skin contact: Remove contaminated clothing and rinse affected skin with *lukewarm* water. Do not rinse with hot water. Provide medical prompt attention. Frozen tissue is painless and appears waxy, with a possible yellow color. Frozen tissue will become swollen, painful, and prone to infection when thawed.

Eye contact: Individuals in contact with this product should not wear contact lenses. Check for and remove any contact lenses. In case of contacts are worn, immediately flush eyes with plenty of water for at least 20 minutes. Seek medical attention.

Ingestion: If potentially dangerous quantities of this material are swallowed, call a physician immediately. Do not induce vomiting unless directed to do so by medical personnel.

Notes for physician: Notify medical personnel that the person may suffer from anoxia.

Material Safety Data Sheet
Dry Ice

NSN: 685000F002383
Part Number/Trade Name: Carbon Dioxide/Dry Ice

General Information

Date MSDS Prepared: 01 Jun 90
Safety Data Review Date: 06 Apr 94
Company Identification:
Air Products And Chemicals Inc.
7201 Hamilton Blvd
Allentown, PA 18195-1501
MSDS Serial Number: BBKVW

Ingredients/Identity Information

CAS#	Chemical Name	Percent	EINECS/ELINCS
124-38-9	Carbon Dioxide	100	

Proprietary: No
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: FF6400000
Exposure Limits:
OSHA PEL: 5000 PPM
ACGIH TLV: 9000 MG/CUM
Other Recommended Limit: 10000 PPM

Physical/Chemical Characteristics

Appearance And Odor: Colorless, odorless
Boiling Point: -109.3F
Melting Point: -69.9F
Vapor Pressure (MM Hg/70 F): 831 PSIA
Vapor Density (Air=1): 0.115
Specific Gravity: 1.56
Solubility In Water: APPRECIABLE

Fire and Explosion Hazard Data

Reactivity Data

Stability: Yes
Conditions To Avoid (Stability): Moisture

Materials To Avoid: Carbonic acid/salt/corrosive chemicals
Hazardous Polymerization Occurrence: No

Health Hazard Data

Route Of Entry - Inhalation: Yes
Route Of Entry - Skin: No
Route Of Entry - Ingestion: No
Health Hazard Acute and Chronic: Concentration in excess of 1.5% carbon dioxide may cause death. At higher concentrations, displaces oxygen in air below levels necessary to support life.
Carcinogenicity - NTP: No
Carcinogenicity - IARC: No
Carcinogenicity - OSHA: No
Explanation Carcinogenicity: None
Signs/Symptoms Of Overexposure: At concentrations >1.5%: Hyperventilation/headahces/ dyspnea/perspiration. At 6-10%: Headahces/dyspnea/perspiration/tremors/visual disturbances. >10%: Unconsciousness w/out warning. Cryogenic burns.
Emergency/First Aid Procedures: Inhalation: Remove to fresh air. Assisted respirant & supplemental oxygen should be given if not breathing. Frozen tissues should be flooded/soaked w/tepid water. Don't use hot water. Obtain medical attention in all cases.

Precautions for Safe Handling and Use

Steps if Material Released/Spill: Ventilate indoor areas well to avoid hazardous CO_2 concentrations. Ventilate area well & avoid contact w/cold vapors/dry ice. CO_2 is heavy gas & will remain in low spots w/out assisted ventilation.
Waste Disposal Method: Don't attempt to dispose of residual CO_2 in compressed gas cylinders. Return cylinders to air products w/residual pressure, cylinder valve tightly closed/the valve cap in place. Dispose of iaw/local/stat/ federal regulations. nonflammable gas. UN1013.
Precautions-Handling/Storing: Compress gas cylinders contain gaseous/liquid CO_2 at extremely high pressure/should handled w/care. Keep cylinders away from heat.
Other Precautions: Prevent contact of CO_2 on skin. Use pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Keep from combustibles. Avoid exposure to areas where salt/other corrosive materials are present.

Control Measures

Respiratory Protection: SCBA in oxygen deficient atmospheres/where CO_2 >1.5%. Don't use air purifying respirators.
Ventilation: Local Exhaust: At point sources of CO_2 vapors. Mechanical(general): Low lying area are not naturally ventilated.
Protective Gloves: Impermeable/loose fitting (leather)
Eye Protection: Safety glasses
Supplemental Safety & Health Data: CO_2 is stored in containers under its own vapor pressure. If the pressure is suddenly relieved, the liquid rapidly cools as it evaporates & sublimes, forming dry ice at -109.3F.

Transportation Data

Disposal Data

Disposal Data Review Date: 89018
Record # For This Disp Entry: 01
Total Disp Entries Per NSN: 001
Landfill Ban Item: Yes
Disposal Supplemental Data: Box 538, Allentown, PA 18105. Item not regulated as a RCRA Hazardous Waste by the Federal EPA, but may be regulated in certain states.
1st EPA Hazardous Waste Name New: Not regulated
1st EPA Hazardous Waste Char New: Not regulated by RCRA
1st EPA Acute Hazard New: No

Label Data

Label Required: Yes
Technical Review Date: 06 Apr 94
Label Date: 06 Apr 94
Label Status: F
Common Name: Carbon Dioxide/Dry Ice
Chronic Hazard: Yes
Signal Word: Danger!
Acute Health Hazard-Severe: X
Contact Hazard-Slight: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: Concentration in excess of 1.5% carbon dioxide may cause death. At higher concentrations, displaces oxygen in air below levels necessary to support life.
Target organs: Respiratory system, skin.
Carcinogen: Formaldehyde.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y

IATA

2011

ACCEPTANCE CHECKLIST FOR DRY ICE (Carbon Dioxide, solid)

(For use when a Shipper's Declaration for Dangerous Goods is not required)

A checklist is required for all shipments of dangerous goods (9.1.4) to enable proper acceptance checks to be made. The following example checklist is provided to assist shippers and carriers with the acceptance of dry ice when packaged on its own or with non-dangerous goods.

Is the following information correct for each entry?

	YES	NO	N/A
The Air Waybill contains the following information in the "Nature and Quantity of Goods" box (8.2.3)			
1. The UN Number "1845", preceded by the prefix "UN"	❑	❑	
2. The words "Carbon dioxide, solid" or "Dry ice"	❑	❑	
3. The number of packages of dry ice	❑	❑	
4. The net quantity of dry ice in kilograms	❑	❑	
Note: **The packing instruction "954" is optional.**			
Quantity			
5. The quantity of dry ice per package is 200 kg or less [4.2]	❑	❑	
Packages and Overpacks			
6. The number of packages containing dry ice delivered as shown on the Air Waybill	❑	❑	
7. Packages are free from damage and in a proper condition for carriage	❑	❑	
8. The packaging conforms with Packing Instruction 954 and the package is vented to permit the release of gas	❑	❑	
Markings & Labels			
9. The words "Carbon dioxide, solid" or "Dry ice" [7.1.5.1(a)]	❑	❑	
10. The UN number "1845" preceded by prefix "UN" [7.1.5.1(a)]	❑	❑	
11. Full name and address of the shipper and consignee [7.1.5.1(b)]	❑	❑	
12. The net quantity of dry ice within each package [7.1.5.1(d)]	❑	❑	
13. Class 9 label affixed [7.2.3.9]	❑	❑	
14. Irrelevant marks and labels removed [7.1.1(b); 7.2.1(a)]	❑	❑	❑
Note: **The Marking and labelling requirements do not apply to ULDs containing dry ice**			
State and Operator Variations			
15. State and operator variations complied with [2.8]	❑	❑	❑

Comments: _____

_____

Checked by: _____

Place: _____ Signature: _____

Date: _____ Time: _____

***IF ANY BOX IS CHECKED "NO", DO NOT ACCEPT THE SHIPMENT AND GIVE A DUPLICATE COPY OF THIS COMPLETED FORM TO THE SHIPPER.**

STANDARD OPERATING PROCEDURE (SOP) BT-12

BENTHIC MACROINVERTEBRATE SAMPLING USING A GRAB SAMPLER

SCOPE AND APPLICATION

This SOP describes the procedures used to sample benthic macroinvertebrate assemblages by using a grab sampler (e.g., modified van Veen, Ekman, Ponar). Benthic assemblages are typically analyzed for the abundances and biomass of various species and major taxa. The project-specific field sampling plan (FSP) should stipulate the number of replicate samples (i.e., individual grabs) that need to be collected at each station. The personnel performing the benthic macroinvertebrate collection and sample processing will wear protective clothing as specified in the site-specific health and safety plan.

All benthic macroinvertebrate samples will be packaged and shipped in accordance with procedures outlined in SOP AP-01, *Sample Packaging and Shipping*. Sample custody will be maintained in accordance with procedures outlined in SOP AP-03, *Sample Custody*. Field activities will be recorded in accordance with procedures outlined in SOP AP-02, *Field Documentation*.

The grab sampler used for benthic infauna studies should be capable of collecting acceptable samples from a variety of substrates, including mud, sand, gravel, and pebbles (APHA 1991). The procedures for sampling benthic macroinvertebrate assemblages by using a grab sampler are described below.

EQUIPMENT AND REAGENTS REQUIRED

Equipment required for benthic macroinvertebrate sampling includes the following:

- Grab sampler (e.g., modified van Veen, Ekman, Ponar)
- Winch and hydrowire (if grab sampler is of considerable weight) with load capacities ≥3 times the weight of a full sampler
- Sample collection table (if vessel deck space allows)
- Sample collection tub
- Ruler

- Sieve(s) (typically with a 0.595-mm mesh for freshwater studies or a 1.0-mm mesh for marine studies; consult project-specific FSP for correct sieve size); multiple sieves can be stacked on top of each other to capture different size fractions of benthic macroinvertebrates that will be processed separately; consult project-specific FSP for correct number of sieves
- Scoop (for transferring sediment sample aliquots to the sieve)
- Sample containers (clean, 1-L wide mouth plastic jars with plastic screw-on lids)
- Internal labels
- 10 percent buffered formalin
- Rose bengal (depending on study objectives, rose bengal stain may or may not be added; consult project-specific FSP)
- Scrub brush and soft-bristle nylon brush or toothbrush
- If necessary, socket and crescent wrenches (for adding or removing detachable weights of the grab sampler)
- Water pump and hose (for sieving samples and for rinsing the grab sampler, sample collection tub, and sample collection table).

PROCEDURES

Grab Sampler Deployment

1. Prior to deployment, clean the inside of the grab sampler with a scrub brush and site water.
2. Consult SOP SD-04, *Surface Sediment Sampling,* for the correct deployment techniques for the appropriate grab sampler.
3. Lower the sampler through the water column at a slow and steady speed (e.g., 30 cm/second).
4. Allow the grab sampler to contact the bottom gently, with only its weight being used to force it into the sediments. Never allow the sampler to "free fall" to the bottom because this may result in premature triggering, or improper orientation upon contact with the bottom.

Grab Retrieval

1. After the grab sampler has rested on the bottom for approximately 5 seconds, begin retrieving it at a slow and steady rate (e.g., 30 cm/second).

2. Ensure that the sampling vessel is not headed into any waves before the sampler breaks the water surface to minimize vessel rolling and potential sample disturbance.
3. After the grab sampler breaks the water surface and is raised to the height of the sample collection table or sample collection tub, rinse away any sediments adhering to the outside of the grab sampler (it is essential that the sediments adhering to the outside of the grab are removed because those sediments and any associated benthic macroinvertebrates are not part of the sample).
4. After finishing the rinsing, raise the grab sampler above the height of the collection table or sample collection tub, swing it inboard, and gently lower it into the sample collection tub on the sample collection table while maintaining tension on the hydrowire to prevent the grab sampler from rolling when it contacts the bottom of the tub.
5. When the grab sampler contacts the bottom of the table or tub, insert wedges under both jaws, if necessary, so that the grab sampler is held in an upright position.
6. Open the doors on the top of the grab sampler, and inspect the sample for acceptability. The following acceptability criteria should be satisfied:
   - The sampler is not overfilled with sample to the point that the sediment surface presses against the top of the sampler or is extruded through the top of the sampler (organisms may have been lost)
   - Overlying water is present (indicating minimal leakage)
   - The overlying water is not excessively turbid (indicating minimal disturbance or winnowing)
   - The sediment surface is relatively undisturbed; the sediment–water interface is intact and relatively flat with no sign of channeling or sample washout
   - The desired penetration depth is achieved (see project-specific FSP); the following penetration depths should be achieved at a minimum:

     4–5 cm for medium-coarse sand
     6–7 cm for fine sand
     >10 cm for silty sediment
   - There is no sign of sediment loss (incomplete closure of the sampler, penetration at an angle, or tilting upon retrieval).

If a sample fails to meet the above criteria, reject it and discard it away from the station. Keep the location of consecutive attempts as close to the original attempt as possible, and if sampling on a river or stream, make consecutive attempts in the "upstream" direction of any existing current. Discard rejected sediment samples in a manner that does not affect subsequent samples at that station or other possible sampling stations.

Determine penetration depth by placing a ruler against the center of the inside edge of the opening on the top of one side of the grab sampler and extending it into the grab sampler until it contacts the top of the sample. The penetration depth is determined by the difference between that measurement and the total depth of the grab sampler.

Sample Removal and Processing

1. For each acceptable sample, characterize the sample as specified in the study design. Characteristics that are often recorded include the following:
   - Sediment type (e.g., silt, sand)
   - Texture (e.g., fine-grain, coarse, poorly sorted sand)
   - Color
   - Biological structures (e.g., chironomids, tubes, macrophytes)
   - Approximate percentage of biological structures
   - Presence of debris (e.g., twigs, leaves, wood chips, wood fibers, manmade debris)
   - Approximate percentage of organic debris
   - Presence of shells
   - Approximate percentage of shells
   - Presence of a sheen
   - Odor (e.g., hydrogen sulfide, oil, creosote)
   - Changes in sediment characteristics
   - Presence and depth of redox potential discontinuity layer (if visible)
   - Maximum penetration depth
   - Distinctions in sample quality (i.e., leakage, winnowing, disturbance).
2. After characterizing the sample, open the jaws of the grab sampler so that its contents (i.e., sediments and overlying water) are released into the sample collection tub.
3. Rinse any remaining sediment inside the grab into the collection tub, being careful not to overfill the tub with water.
4. Before sieving each sample, examine all sieves for damage and wear. Look for rips in the mesh, irregular mesh spacing, and sand grains caught in the mesh. Use water pressure or a soft nylon brush to dislodge sand. DO NOT use sharp objects or stiff brushes, as the mesh may be damaged or torn.
5. After the entire sample has been collected in the sample collection tub, carefully transfer aliquots of the sample to the sieve by using a scoop.

6. Sieve each sample aliquot by rotating the sieve (in an up-and-down, not swirling, motion) in a bucket of water or by passing a gentle stream of water through the sieve from above or using a combination of these techniques. By whatever method is used, wash the samples *gently* to minimize specimen damage.
7. After sieving each aliquot, carefully rinse all of the retained material into a sample container, and carefully check the sieve to ensure that no organisms are trapped in its mesh (do not fill any sample container more than three-quarters full to ensure that a sufficient amount of space is available for the preservative).
8. If an organism is found trapped in the sieve, dislodge it with a gentle stream of water or by using forceps, and transfer it to the sample container.
9. Continue sieving aliquots of the sample until the entire sample has been processed.
10. Thorough and carefully rinse off any large stones or other debris in the sample too large to fit in the sample jar into the sieve, remove and discard them under the supervision of the field team leader, and make a note in the field logbook.
11. After sieving the entire sample, clean the sieve by turning it over and back-washing it with a high-pressure spray to dislodge any sediment grains or detritus that are lodged in the mesh.
12. Fix each sample by filling each sample container with a 10–15 percent solution of borax-buffered formalin and inverting the container at least five times to ensure that the preservative penetrates all parts of the sample.
13. Depending on the sampling environment and the preferences of the taxonomic laboratory, the samples may be dyed with rose bengal (see project-specific FSP). If required, rose bengal should be added to the formalin solution prior to fixing the samples.
14. Label each sample container (both internal and external labels are required; see below), and store it in a protective container.

Internal Labels

In addition to the label on the outside of the sample container (i.e., external label, see SOP AP-02, *Field Documentation*), a complete label must be placed inside each sample container. The internal label must be preprinted and should be made of at least 100 percent waterproof rag paper. The internal labels should be filled out using a pencil (i.e., no ink).

Sample Containers

Samples can be stored in various containers including glass or plastic jars, and plastic bags. Integral prefers that plastic jars with plastic screw-on lids (formalin corrodes metal) be used to

store benthic macroinvertebrates samples. The use of this type of sampling container lessens the possibility of formalin leakage during shipping and the breaking or tearing of the sample container. In general, a single 500-mL or 1-L container is large enough to hold a sieved sample from a van Veen grab sampler, and 1-L container is large enough to hold a sieved sample from an Ekman or Ponar grab sampler. If the sample volume exceeds one-half of the container volume, more than one container should be used. Use of multiple containers for single replicates should be recorded in the field logbook.

After the buffered formalin has been added to a sample container, it is critical that the contents be mixed adequately. This usually can be accomplished by inverting the container several times (make sure that the lid is tightly screwed on). After mixing, the sample container should be placed in protective containers for storage and transport to the laboratory. After being stored for approximately 1 hour, samples should be inverted several times again to ensure adequate mixing. Onboard the sampling vessel, samples should be stored so as to minimize exposure to sunlight and temperature extremes. They should also be stored in a stable part of the vessel to minimize agitation.

Buffered Formalin Preparation

The preservative most commonly used for marine benthic macroinvertebrate samples is formalin, an aqueous solution of formaldehyde gas. However, for freshwater benthic macroinvertebrates, ethanol or isopropanol is the most commonly used preservative. Under no circumstances should ethanol or isopropanol be used as a preservative in place of the formalin for marine organisms. Penetration of the alcohol into body tissues is too slow to prevent decomposition of the marine specimens.

Solutions of 10–15 percent buffered formalin are most commonly used to preserve samples collected from the marine environment and solutions of either 95 percent ethanol or 30–40 percent isopropanol are most commonly used to preserve samples collected from freshwater systems. However, samples containing large amounts of organic debris (e.g., peat, woody plant material) may require higher concentrations. The volume of preservative should be at least twice the volume occupied by the sample. If possible, the preservative solution should be added to the sample container until it is completely filled. This will minimize abrasion during shipping and handling. It is recommended that at least 2 L of diluted preservative solution be on hand for each replicate van Veen grab collected and at least 0.75 L of diluted preservative solution be on hand for each replicate Ekman or Ponar grab collected.

If formalin is used as the preservative solution, it should always be buffered to reduce acidity. Failure to buffer may result in decalcification of molluscs and echinoderms. Ideally, pH should be at least 8.2, as calcium carbonate dissolves in more acidic solutions. Borax (sodium borate) should be used as the buffer because other buffering agents may hinder identification by leaving a precipitate on body tissues.

To prepare a 10 percent buffered formalin solution, add 4 oz of borax to each gallon of concentrated formalin (i.e., a 40 percent solution of formaldehyde in water). This amount will be in excess, so use the clear supernatant when making seawater dilutions. Dilute the concentrate to a ratio of one part concentrated formalin to nine parts site water (sea water or tap water). If seawater is used, it will further buffer the solution. Fresh buffered formalin should be made prior to each sampling event, because formalin will eventually consume all of the buffering capacity of the borax.

Rose Bengal Preparation

If staining is used (see project-specific FSP), rose bengal is often added to the buffered formalin as a vital stain to facilitate sorting benthic organisms. The stain colors most infauna and thereby enhances their contrast with the debris from which they are sorted. Taxa that do not always stain adequately include ostracods and gastropods. Be careful when adding rose bengal to the buffered formalin solution. Add only a very small amount (e.g., a few drops or grains) of rose bengal; a little rose bengal goes a very long way. Remember, you can always add more stain to the buffered formalin if you need to, but you can not remove the rose bengal once it has been added.

REFERENCES

APHA. 1991. Standard methods for the analysis of water and wastewater. 18th ed. American Public Health Association, American Water Works Association, Water Pollution Control Federation, Washington, DC.

STANDARD OPERATING PROCEDURE (SOP) BT-20

SMALL MAMMAL TRAPPING AND HANDLING

This SOP describes the process for collecting small mammals for population analysis or tissue sampling. These techniques are generally useful for the collection of mammals ranging in body size from a shrew to an adult raccoon. The methods described in this SOP include both live-collection and kill-collection techniques. The SOP discusses the use of live traps, snap traps, and pitfall traps.

EQUIPMENT

The following is a list of typical equipment used for the collection of small mammals:

- Sherman live traps (or equivalent)
- Museum special snap traps (or equivalent)
- Tomahawk live traps (or equivalent)
- Drift fences (e.g., metal or plastic sheeting)
- Pitfall traps (e.g., metal cones, metal or plastic buckets)
- Bait balls (organic peanut butter, rolled oats, and sunflower seeds and/or corn meal)
- Brightly colored wire flags or wooden stakes (1 x 2 x 24 in. or 1 x 2 x 36 in.)
- Clipboard and data sheets
- Small mammal identification book
- Keys to identification, sex, and age
- Copy of applicable trapping and salvage permits and scientific collection permits
- Research site map with grid overlay
- Coolers
- Digital scales:
  - 0–10 g for shrews
  - 100 g for most rodents

  - 300 g for *Sigmodon*, large *Microtus*, rats (i.e., *Neotoma, Rattus*)
  - 1.5–2.5 kg for ground squirrels, tree squirrels, and rabbits
- Plastic bags (e.g., Ziploc®)
- Glass jars (12 oz.)
- Aluminum foil
- Extra 4 x 4 in. waxed paper square
- Markers (e.g., Sharpie® pens)
- Digital camera
- GPS device (e.g., Trimble or other similar equipment)
- Appropriate safety equipment (Tyvek® suits, half-face respirators, disposable nitrile gloves, leather gloves, eye protection) as required by the site health and safety plan (SHSP).

The following equipment is optional:

- Polyester fiberfill (or similar nonabsorbent material)—during cold or inclement weather
- Flashlights/headlamps.
- CO_2 bottle with plastic tubing.

PROCEDURES

Personnel

Only personnel trained to use small mammal traps, and whose names are listed on the appropriate permits (if necessary), are authorized to capture and handle small mammals. All required research protocols, federal regulations, and other applicable regulatory guidelines should be studied before initiating trapping operations. Personnel without previous experience should be under the guidance and direct supervision of an experienced trapper.

Collection Methods and Trap Types

The choice of collection method will be specific to the size of the animals being sought and the objectives of the sampling and analysis plan (SAP).

- If animals are to be captured, marked, and released, Sherman live traps or their equivalent (i.e., Longworth traps, Havahart traps) should be used. The 3 x 3.5 x 9 in. traps will capture most small mammal species, including most species of shrews and

most species of microtine, cricetid, and heteromyid rodents. The traps are also capable of capturing young rabbits, young opossums, young raccoons, and adult squirrels.

- If it is necessary to collect animals for analyses, museum special snap traps or their equivalent (i.e., Victor traps) may be used for rodents up to small ground squirrel size. For kill-trapping of large squirrels, rats, and mammals up to the size of small rabbits, Victor rat traps or their equivalent should be used.

Grids vs. Trap Lines

The trapping method to be used (grids, trap lines, or randomly placed traps) is specified in the SAP for the field effort. Whenever possible, traps should be set in a single habitat type, not overlapping habitat types. If density information is sought, grids should be used whenever possible. The approach recommended by White et al. (1982) requires a sufficient grid size to contain at least three, preferably four, nested subgrids for use in density estimation models, with the subgrids preferably separated by two rings of traps. Density estimation lines may also be used with trapping grids. Analysis with density estimation lines is more complex and should be performed only after consultation with a statistician to ensure an adequate study trapping design. It is also necessary for density estimation to uniquely mark individuals so that capture histories and capture probabilities of individuals can be calculated. Finally, the grid method has a high trapping success. Grids may be square or rectangular, with one, two, or three traps set at each grid intersection. Thus, a 10 x 10 m grid would contain 100 grid intersections. One trap per grid intersection requires placement of 100 traps. If all traps were left open for one 24-hour day, the total trapping effort would be 100 trap-nights, less any correction for sprung traps. More traps per station are required in habitats with greater densities of small mammals, where competition for the traps (as shelter) or the food resources within (bait) is likely to occur.

If the habitats to be sampled are too small to permit use of grids, randomly placed trap lines or individual traps may be used. If the study objectives require only a general description or assessment of the small mammal fauna (indices of relative frequency or relative abundance), randomly placed trap lines or individual traps may be preferable. The number of trap lines per habitat type, length of trap lines, and number of traps per station will be specified in the SAP and be dependent on the extent of area to be sampled and features of the habitat.

The distance between adjacent trap stations, adjacent trap lines, or grid lines will also be stated in the SAP. If the study objectives require an assessment of a single species, trap spacing and traps per station should be based on the home range size of the species being studied, with a minimum of three trap stations within each animal's home range (White et al. 1982). If a multispecies habitat assessment is required, traps are generally set at a spacing of 5.0, 7.5, 10.0, 15.0, or 22.5 m. If multiple traps are placed per station, they should be approximately equidistant and within 1.0–1.5 m of the station center.

Grid/Trap Line Marking

Individual traps at a station should be placed in locations that sample various microhabitat features because microhabitat differences have been shown to influence small mammal occurrence. For example, traps should be set at the bases of trees and shrubs, at the edge of the shrub canopy, in the open, in microtine runways, alongside fallen trees, in short and tall grass, and in disturbed areas of forbs and shrubs.

The beginning and end of trap lines, the corners of grids, and individual stations should be marked whenever possible. Generally, the fewer markers the better to avoid attracting predators (ground and aerial) that may cue on the markers, which would thereby increase mortality in the trapping area and influence the density/abundance/occurrence estimations. If wire flags are used, the flag should be trimmed to a 1-in. width to reduce flapping. A color visible to humans but not readily visible (and therefore an attractant) to wildlife should also be used. An alternative to the use of wire flags is to use painted wooden stakes, willow stems, or rebar driven into the ground to mark the station center, with only the top few inches painted. In wooded habitats, surveyor flagging may be tied to the vegetation to mark the station center. All grid and trap line locations should be marked on field site maps to aid relocation and provide a permanent record of where trapping occurred and what trapping method was used. If a global positioning system unit is available, readings of the beginning and end markers of a trap line or the corners of the grid should be logged.

Trap Functioning

Each trap should be cleaned and checked for proper functioning before placing it in the field. When trapping is being conducted to address small mammal tissue contamination or bioaccumulation, or where the hantavirus or other pathogens are of concern, all traps should be cleaned and disinfected before placement at a station or before moving to a different station. Disinfection of traps is discussed in the SHSP. All urine and fecal materials should be washed off. Traps may be disassembled for cleaning beneath the treadle mechanism by removing the wires from selected trap sides, permitting easy access to the trap interior.

Snap traps should be checked to ensure that all parts are securely fastened so that when the trap is sprung, the trap does not disassemble. Trap sensitivity is adjustable on all snap traps. To adjust the sensitivity of museum special snap traps, bow (i.e., bend) or straighten the holding bar that passes across the snap bar and inserts into the bait treadle (bowing the holding bar increases sensitivity, straightening the holding bar decreases sensitivity). On Victor snap traps (mouse or rat size), push the metal bait treadle holder to the sides of the trap to increase or decrease sensitivity.

Treadles on live traps should release doors with only very light fingertip pressure on the treadle or a light tap on the top of the trap. Sensitivity of the mammal trap is varied by pulling forward or pushing back the treadle lock mechanism.

Pitfall traps cannot be adjusted and can fill with water, either from groundwater seepage, percolation from the surrounding soil, or rainfall entering the trap. Animals will drown in water-filled pitfalls if a dry refuge is not provided. Holes can be punched in pitfalls to allow water to drain out, although in some habitats and soil types, this step may cause the pitfall to fill with water more quickly. In conical pitfalls, synthetic batting (i.e., Dacron) or rocks can be placed in the bottom to keep the animals out of the water. In flat-bottomed pitfalls (e.g., buckets or cans), a rock or brick can be placed in the bottom to provide a dry resting area for captured animals.

Bait

Bait balls are very attractive to a wide variety of small mammals ranging from shrews to raccoons. Snap traps can be baited with a mixture of peanut butter, rolled oats, and sunflower seeds and/or cornmeal. Organic bait materials should be obtained to minimize the potential for bait to contain contaminants. Peanut butter should first be warmed until easily stirred, then the remaining ingredients should be added. This mixture is then allowed to cool. A small amount of the peanut butter mixture (approximately the size of an M&M® Peanut candy) is spooned into the middle of a 4 x 4 in. waxed paper square. The waxed paper is folded around the bait ball and the ends are twisted (such that the bait ball looks like a Hershey's® Kiss). If using snap traps, the sampler should roll a small ball of bait mixture and place it directly on the trap's trigger, taking care to avoid bait placement on the trap surface. This will help prevent the small mammal from prematurely setting off the trap.

In some instances (e.g., tundra areas in Alaska), it may not be necessary to apply any bait because many of the species are herbivores and thus unlikely to be attracted to bait. These species will be caught as they encounter traps through their daily movements (i.e., if the trap is in the runway or an area in which the animal is foraging). Pitfalls are not typically baited, although a bait such as sardines that provide an attractant for some species (i.e., shrews) may be considered.

Dry baits are readily available and easy to use. Rolled oats or horse feeds, such as Purina Omolene, make good dry baits. Dry baits may not be as effective as moist baits, but this may be advantageous depending on study objectives. Care should be taken when using live traps to ensure that dry bait does not prevent the treadle from working properly.

Trap Deployment

The following procedures should be used to place traps:

1. For nocturnal species, set small mammal snap traps in the afternoon to allow for overnight sampling. If the targeted mammals are more active in the daytime, set traps in the morning and check them before sunset.

2. Select trap locations based on the availability of suitable habitat. Prior to trap deployment, qualitatively characterize the plant community of the sample station or reference area in terms of dominant plant species and structure.
3. Clear the immediate area of debris and cover material where each trap will be placed so that each trap sets level firmly on the ground and is easily accessible. Level the ground, but take care not to disturb an area much larger than the size of the trap.
4. For snap traps, ensure that the entire platform sits firmly on the ground. If the trap moves when a small mammal begins to enter, the animal may retreat and thereafter avoid the trap. Ensure that when the door of a live trap is set open, there is no wobble as the animals step into the entrance of the trap.

   Bait each trap as necessary in a way that bait cannot be removed by the mammals without triggering the trap; that is, place bait only on the trap's trigger and avoid spillage onto other trap parts.
5. Note the GPS location of each trap in the field notebook and mark with a 2.5 ft brightly colored flag, colored stake, or similar visual cue.
6. Secure traps to reduce tampering and trap removal by predators. For snap traps (i.e., mouse or rat traps), drill a small hole in the corner of the wooden trap board on the non-baited end and stake the trap into the ground using a pin flag. If wind or a steep slope causes trap instability, anchor each trap with a U-shaped piece of #12 wire, open-end down, that straddles the center of each trap. Force the wire ends into the ground to prevent each trap from being moved.
7. If using snap traps, approximately 20 should be set within 30 ft of each sampling station using a grid orientation.
8. If using dry bait, place a handful of bait inside the trap, turn the trap upside down, and shake it so that the bait is on the opposite side of the treadle, and then quickly turn the trap right side up. The dry bait should now be on the treadle. Make sure the bait is on the treadle and not under it. Too much bait under the treadle will hamper operation of the trap. If using bait balls to bait traps, determine which is the front end of the trap by pressing open each door in turn and looking inside. The front of the trap is the end that has the metal door catch on the floor of the trap. Then hold the twisted ends of a bait ball, and push the ball through the top of the back door. Once it is inside the trap, pull the ball back toward you. The bait ball will catch the inside the trap door and pull it shut.
9. If temperatures below 5°C are expected or extended periods of rain are anticipated, place a wad of bedding material (polyester fiberfill or similar nonabsorbent material) in each trap to serve as nesting material. This step will help insulate animals from potentially fatal cold weather.

10. For pitfalls, use a shovel, post-hole digger, or sharp metal rod to create a hole in the soil of sufficient depth to hold the pitfall. The pitfall is placed correctly if the lip of the pitfall is slightly below the level of the ground or substrate.
11. In general, try to limit trapping to a maximum of four consecutive nights per week for two consecutive weeks, so that small mammal populations do not become depleted and community composition is not altered by extended trapping periods.

Field Staff Roles

Each animal-trapping team is to consist of two field persons, each with the following roles:

- The primary handler (field person 1) opens the traps and handles the mammals. This person is equipped with impermeable nitrile gloves covering leather work gloves, coveralls or long-sleeved shirt and pants, a half-face respirator, eye protection, and chemical-resistant boots.
- The assistant (field person 2) provides support to the primary handler, but does not handle traps or mammals unless the traps or mammals have been placed in glass sample containers and then bagged. The assistant will also wear all relevant personal protective equipment.

Following sample collection and processing, field personnel are required to prevent the potential spread of excreta by decontaminating boots with a bleach solution or commercial disinfectant spray (such as Lysol®) before entering a vehicle. Potentially contaminated nitrile gloves worn during sampling should be removed by employing sterile technique and placed in a sealed and labeled plastic bag. All personnel wearing potentially contaminated work gloves (e.g., if the nitrile gloves worn over the work gloves tear during sampling activities) must wash and disinfect those gloves with a bleach solution or commercial disinfectant after removing them and thoroughly wash their hands as well.

Trap Checking

Traps set overnight should be checked early each morning of sampling and reset by late afternoon for nocturnal mammals. If traps are left open all day, they should be checked at least twice daily. Heavy rain, cold, or extreme heat can kill trapped animals; trap checks should be performed as expeditiously as possible. Pitfalls may need to be checked more frequently. Pitfalls are the most successful method for capturing shrews, and shrews will tend to eat any other animals in the trap, including other shrews. Extra bait should be carried during trap checks. Soiled bedding material should be replaced as needed.

Sprung and unsprung traps that have signs of potential visitation will be recorded in the field logbook, with field person 2 taking pictures as necessary. Missing traps will also be recorded and replaced with a baited trap by field person 1.

Suspension of trapping due to inclement weather is at the discretion of designated field personnel. Any time trapping efforts are suspended, entrance doors on live traps are to be shut and snap traps deactivated. All traps are to be closed, deactivated, or removed before any scheduled days off. Pitfalls are to be covered, either with a board, a lid, or some type of plug placed into the container when not in use.

Small Mammal Collection

All field staff will review the SHSP for specific protective requirements before handling small mammals that may carry hantavirus and/or other pathogens.

The contents of snap traps that have successfully deployed will be reviewed for small mammal species (e.g., white-footed mouse, voles). All other species will be disposed of at their respective capture locations. Adult specimens will be placed in glass jars or wrapped in aluminum foil and then bagged in the field using the following procedures:

- Field person 2 will label a glass sample jar and/or a plastic Ziploc® bag. Each jar and/or plastic bag will have the date and time sampled, sample ID, sampler's initials, and the words "potentially infectious substance."
- Field person 1 will remove the specimen from the trap, identify the species, and then place the captured specimen into the jar (see below for removal procedures) or wrap in aluminum foil. Field person 1 will inspect the outside of the jar or foil wrap for evidence of gross contamination and clean the outside with disinfectant, if necessary.
- Field person 2, wearing clean gloves, will hold open a 1-gallon Ziploc® bag so that field person 1 can drop the glass sample jar or wrapped specimen into it. Field person 1 may not touch or handle the outside of the outer bag.
- Field person 2 will seal the bag and place it in a cooler on dry ice for storage until processing takes place.

Traps will be reset until the minimum mass needed for proposed analyses is obtained (60 g; 180 g for matrix spike/matrix spike duplicate).

The following procedures are used to remove and weigh small mammals captured using live traps:

1. A shut door may indicate a capture. To check, hold the trap with the baited end of the trap facing the ground. Gently press the front door open only as far as necessary to determine if an animal is inside.
2. If an animal has been captured, press the front door open further, adjusting the trigger mechanism slightly with a finger of the hand that is holding the trap so that the door remains open. Shield the opening of the trap with the other hand to prevent the animal from escaping.

3. Once the door is secure, place the capture bag over the mouth of the trap, gathering any loose edges.
4. Turn the trap upside down. If the animal does not readily fall out, gently shake the trap.
5. Once the animal is in the bag, make sure it is not near the open end, quickly close the bag, and set the trap down.
6. Remove any foreign objects that have fallen into the trap with the animal (e.g., bait, bedding, sticks).
7. Weigh the bag. If the scale is not pre-tared, subtract the weight of the bag from the weight of the bag and the animal.
8. Record the weight.
9. Live animals in pitfalls should be removed by personnel wearing heavy leather gloves to avoid being bitten.
10. Removing larger animals in Tomahawk and Havahart traps requires particular caution. Tip the trap up on its end, and carefully reach in a gloved hand to grasp the animal. Alternatively, lock the door open and shake the animal out of the trap into a cloth holding bag (e.g., a pillow-case type of bag).

Small Mammal Asphyxiation

Small mammals caught in live traps will be euthanized by asphyxiation using a cooler and a CO_2 bottle connected via plastic tubing to the cooler's drain spout.

1. Place the bagged animal (or the trap used with the animal inside) into the cooler and close the lid tightly.
2. Turn on the CO_2 tank for approximately 60 seconds and wait 5 minutes for the specimen to asphyxiate before removing from the cooler for processing.
3. Ensure the specimen is dead before further handling and removal by gently shaking the cooler and listening for movement, or by visual inspection.

Small Mammal Processing

Small mammal samples will be transported to the field processing area to be weighed (in grams) and recorded. Individuals will be observed for any morphological abnormalities, which will be recorded on field laboratory processing sheets. If insufficient mass is captured at a given sampling station, all samples will nevertheless be shipped to laboratory, and the laboratory will be directed to aggregate samples with those from adjacent monitoring stations

to ensure sufficient mass for analytical requirements, or to abandon selected analyses, as directed by the project manager.

Composite small mammal samples from each station will be placed in glass sample jars. Each sample jar will be clearly labeled with the project name, sample/composite identification, type of analysis to be performed, date and time, and initials of person(s) preparing the sample, and the words "potentially infectious substance."

Composite small mammal sample jars will be bagged and then stored in dedicated sample storage coolers on dry ice maintained at approximately –20°C. No other samples should be stored with the small mammal samples. These coolers will be labeled with the words "Contains potentially infectious substance," and all staff will be made aware of the hazards posed by rodent samples. Small mammals will be prepared for shipment to the analytical laboratory as described in the SAP.

Other Measurements

Measurements in addition to weight can be helpful if the identification of the animal is in question. Measurements that are often used for identification are total length (including the tail), tail length, hind foot length, and ear length. These measurements require use of a specific method to ensure proper identification. Refer to the field sampling plan, field guides, or mammalogy laboratory books for the proper method.

Identification of Sex of Animals

Sexing small mammals becomes easier with experience. Males and females may be differentiated by using the following guidelines:

- Males—Check for the presence of testes (only visible during periods of reproductive activity). The penis is directed anteriorly and may be covered with a sheath. The distance between the papillae and the anus is greater in males than in females.
- Females—Check for the presence of mammae, a vaginal opening, and a clitoral sheath. The distance between the papillae and the anus is shorter than in males.

Record sex information if necessary.

Identification of Age of Animals

The most accurate and cost-efficient method of aging small mammals currently in practice is the use of eye-lens weights, as described in Rowley et al. (1983) and Thomas and Bellis (1980). An approximation of age can be made in the field by using details of pelage coloration, body weight, and meristic measurements (i.e., length of hind foot or tail length). Local keys or field guides are moderately useful in aging animals. A good source for age characteristics, if

available, is a small mammal collection maintained at a college, university, or natural history museum.

Decontamination and Disposal of Small Mammal Sampling Material and Wastes

Due to the prevalence of hantavirus in small mammal populations across the country, any traps that have been used should be treated as if they contain hantavirus. Risk of hantavirus is greatest in closed air environments. Therefore, traps should be transported in an open-air vehicle such as the back of a pickup truck or a trailer. If this is not possible, the traps should be double-bagged prior to transporting in a vehicle, and care should be taken not to tear the bags while placing the traps in the vehicle. Alternatively, traps can be washed in the field provided a means of transporting wastewater is available.

All coolers, counters, equipment, and other surfaces or items that come into contact with rodents, rodent excreta, or otherwise potentially contaminated items (including vehicles and boots) must be washed with a detergent and thoroughly disinfected using a bleach solution, alcohol, or a commercial disinfectant such as Lysol®. Contaminated reusable clothing should be double-bagged for laundering using a detergent. After decontamination of surfaces, warning labels or signs should be removed, indicating that the area is clean. In the event of skin contact with potentially infected materials, the field person must immediately wash the affected skin with soap and water and then wipe the area with alcohol. All personnel wearing potentially contaminated gloves must wash and disinfect those gloves with a bleach solution of commercial disinfectant prior to removing them.

Once traps are transported to an area for washing, all traps should be washed with soap (e.g., Alconox) and water, decontaminated with bleach, and rinsed thoroughly regardless of whether traps were used in a treated (i.e., contaminated) or an untreated area. Traps should then be allowed to air dry before they are packed away or discarded. The SHSP contains further information on precautions regarding hantavirus and small mammal handling.

All potentially infectious wastes (including animal tissue, gloves, and paper towels) must be separated from noninfectious trash for disposal. The potentially infectious trash should be double-bagged and labeled as "potentially infectious materials." Actual disposal will depend on local regulations. Alternatives include contracting with a service providing incineration of infectious wastes or thoroughly wetting waste materials with disinfectant prior to disposing the materials as solid waste. Potentially infectious materials must not be placed into a dumpster or other receptacle for collection by municipal waste haulers. These materials must be properly disposed of by a licensed hazardous waste hauler.

Communication of Hazards to Subcontractors and Outside Laboratories

The project manager must provide all available information regarding hantavirus (and any additional information as it becomes available) to the outside laboratory manager prior to the shipment of any samples. All samples sent to the laboratory must be packaged in accordance with the procedures detailed above. All sample coolers must be labeled as described below. Similarly, the project manager must notify any subcontractor of the hazards described above prior to allowing their participation in mouse or rodent collection or processing.

Shipment of Samples to Outside Laboratories

Samples shipped via common carrier (i.e., UPS or Federal Express) do not require shipment as restricted articles (items must be declared "infectious substances" if they are known to be infectious or if they are being shipped to a laboratory to determine if they are infectious substances). However, all samples must be placed in sealed glass containers within sealed plastic bags, with the individual packages labeled as potentially infectious. A warning label or sign must be included inside the cooler to warn laboratory personnel about the contents. The warning labels are available commercially.

All small mammal samples will be shipped on dry ice to an intermediary laboratory that will decontaminate these samples. The intermediary will then ship all small mammal samples on dry ice to the appropriate laboratory for chemical analysis. Samples shipped on dry ice are subject to special shipping procedures and regulations. Procedures may vary based on the carrier. For example, Federal Express follows international air cargo regulations, which require that special dry ice labels be placed on the package and the shipper provide additional information on the regular (i.e., not restricted article) air bill.

Medical Attention in the Event of Illness

According to the Centers for Disease Control, any field person who becomes ill or develops symptoms identified with hantavirus (including fever, coughing, muscle ache and pain) or who develops a respiratory illness within 45 days of their last potential exposure to deer mice or other suspected hantavirus carrier species should seek immediate medical attention. The field person must notify the physician of the potential exposure to hantavirus. The physician should be advised to alert local health authorities if hantaviral pulmonary syndrome is suspected. A blood sample should be obtained from the patient and be forwarded to the Centers for Disease Control through the local health department for hantavirus antibody testing.

Because the symptoms of hantaviral pulmonary syndrome are similar to those of influenza, field personnel with minor health complaints or symptoms may be reluctant to contact their physician. Personnel who exhibit the following symptoms will be referred to a doctor specializing in infectious diseases:

- Fever
- Pulmonary infiltrate (as diagnosed by a chest x-ray)
- Exposure to deer mice (or other suspected hantavirus carrier species)
- Shortness of breath.

It is Integral policy that any person who develops the symptoms described above immediately contact his or her occupational physician for additional information. Any exposures or evidence of hantaviral pulmonary syndrome must be immediately reported to the site safety officer and the corporate health and safety manager.

REFERENCES AND OTHER SOURCES

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Reference Pictures—Small Mammals

White-footed mouse

Short-tailed shrew

Meadow vole

Reference Pictures—Traps

Snap trap

Pitfall trap

Sherman trap

Tomahawk trap

SOP-3

SAMPLE NOMENCLATURE, DOCUMENTATION, AND CHAIN-OF CUSTODY PROCEDURES

When completing sampling it is critical that the process used to label and transport samples to the laboratory for analysis is sufficient to demonstrate with confidence that the samples were collected from the location indicated, and that during transport to the lab no actions were taken to potentially alter the integrity of the samples. Without following strict sample labeling and chain-of-custody procedures, analytical data collected at a site has little to no value.

Purpose

To identify the specific requirements for labeling and documenting sample collection

Goal and Objective

To increase the confidence in sample locations and to submit samples to the laboratory without risk of integrity loss

SAMPLE Identifiers

Samples are labeled in such a way to allow a person unfamiliar with the site to understand where the samples were collected. Samples should be labeled sequentially beginning where previous investigations left off. The sample label would be ordered as follows:

> Sample **media type,** sequential location number - general location designation - sample **media sub-type** - composite designation (if needed).

For example, the thirtieth sediment sample (SE) collected in the CFR from subaqueous sediments (SA) would be labeled SE30-CFR-SA. Discrete samples are assumed. If the sample is a composite then the label will include a "c" at the end, ie: SE30-CFR-SA-c.

The surface water sample from the same location would be given the designation (SW) ie: SW30-CFR. The surface water sample sequential number should always match that of the sediment number if the samples are collocated. The same process is followed for pore water sample designation.

For additional reference, sample IDs are provided in the FSP location maps and analytical checklists.

SAMPLE DOCUMENTATION

In addition to the chain-of-custody forms discussed below, field person will keep a list of samples collected in the field in the field log book and on appropriate field sampling forms. Upon returning to the office, the field log book and forms will be scanned and electronic files will be put in the project file. Hard copies will be maintained in the project file and copies sent to the laboratory, or other designated parties, as needed.

Each person in the field is responsible for entering information into the field log and sampling forms. All entries on the log book and field sampling forms must be made in indelible ink.

Table SOP-3.1.

Sampling Acronym			
Media Type		**Media Sub-Type**	
AA	Ambient Air		
BH	Borehole		
DW	Domestic Well		
EB	Equipment Blank		
FB	Field Blank		
FW	Flood Way (Floodplain)		
GW	Groundwater Sample		
IW	Injection Well		
MW	Monitoring Well		
OB	Observation Well		
PA	Pond Area		
PW	Pore Water		
SB	Subsurface Soil Sample		
SE	Sediments	FF	Flood Fringe (Floodplain)
		SA	Subaqueous
SPR	Spring		
SR	Surface Runoff		
SS	Surface Soil Sample		
SUMP	Sump (Water sample)		
SW	Surface Water		
TB	Trip Blank		
TI	Tissue	BMI	Benthic Macroinvertebrate
		LD	Longnose dace
		SM	Small mammal
TP	Excavated Test Pit		
UST	Underground Storage Tank		
VE	Vapor Extraction		

CHAIN OF CUSTODY PROCEDURES

A chain-of-custody form must be generated for all samples collected in the field for laboratory analysis. Samples from more than one project should not be included on the same chain of custody; however, multiple samples from a specific project can be included on the same custody form.

Copies of the chain-of-custody form should be maintained in the project file. The sampler may use a NewFields' chain-of-custody form or a chain- of-custody form provided by the laboratory. Sample custody records must be maintained from the time of sample collection until the time of sample delivery to the analytical laboratory and should accompany the sample through analysis and final disposition. The information to be included on the chain-of-custody form will include, but is not limited to:

- Project number/site name

- Sampler's name and signature
- Date and time of sample collection
- Unique sample identification number or name
- Number of containers
- Sample media (e.g., soil, water, vapor, etc.)
- Sample preservative (if applicable)
- Requested analysis
- Comments or special instructions to the laboratory

Each sample must be assigned a unique sample identification number as described above. The information on the chain-of-custody form, including the sample identification number, must correspond to the information recorded by the sampler on the field forms and field log book and the label on the sample container.

A sample is considered under a person's control when it is in their possession. When custody of a sample is relinquished by the sampler, the sampler will sign and date the chain-of-custody form and note the time that custody was relinquished. The person receiving custody of the sample will also sign and date the form and note the time that the sample was accepted into custody. The goal is to provide a complete record of control of the samples. Should the chain be broken (signed by the relinquished but not receiver or vice versa), the integrity of the sample is lost and the resulting analytical data suspect. Samples must be shipped to the analytical laboratory following the procedures described in in SOP-4. If an overnight shipping service is used to transport the samples to the laboratory, custody of the samples must be relinquished to the shipping service. If possible, have the shipping service sign the chain-of-custody form prior to placing the chain of custody in the sample cooler. If this is not possible (i.e. form placed in the sealed cooler), a note should be included on the chain of custody that the shipping company has received the samples with the chain of custody inside the cooler.

SOP-13

MANAGEMENT OF INVESTIGATIVE-DERIVED WASTE

Prior to the field sampling event, review the Sampling and Analysis Plan to understand how wastes generated during the investigation should be handled. This standard operating procedure is applicable to non-hazardous wastes. If hazardous wastes may be generated, please consult with the project manager and the Field Sampling Plan (FSP).

SEDIMENT

Care will be taken to collect the volume of sediment needed for chemical analysis and avoid excess material. Any excess sediment that is collected will be placed back at the sampling location.

RINSEATE WATER ORIGINATING FROM DECONTAMINATION

All source water for sampling equipment decontamination purposes will be distilled water. Decontamination will be conducted in a specified area that limits the spread of decontamination water. Decontamination water will be discharged to the ground in the vicinity of the source of dirt and mud to evaporate and infiltrate.

DISPOSABLE EQUIPMENT

Any equipment not intended for reuse will be placed in contractor bags and disposed of in an appropriate waste bin.

Purpose

To outline the procedure for handling wastes generated during site investigation

Goal and Objective

To employ a method for appropriate handling investigative-derived wastes that limits contamination of the environment

Equipment Needs

Field Forms and field book

Contractor bags

ATTACHMENT B2

FIELD FORMS

LIST OF FIELD FORMS

Tissue Collection Form

Small Mammal Collection Form Notes

Small Fish Collection Form Notes

Length-Weight Form

Length-Weight Form Notes

Chain of Custody

Field Change Request

Corrective Action Record

integral consulting inc.

Tissue Collection Form

Site Name: Smurfit-Stone/Frenchtown Mill Project Number: _____ Page: _____

Station ID: _____ Collection Date (DD/MM/YYYY): Start _____ End _____

Weather: _____ Crew: _____

Sample Type (circle one): Small Fish Benthic Macroinvertebrates Small Mammals

Gear Details (circle one):

☐	KN = Kick Net	Net	1	2	3	4	5	6	_____
☐	ES = Electroshocker	Run	1	2	3	4	5	6	_____
☐	BG = Benthic Grab	Grab	1	2	3	4	5	6	_____
☐	MT = Mammal Trap	Trap	1	2	3	4	5	6	_____

Sampling Information

Start Time: _____

Start Location:

Latitude (deg., min., sec.): _____ Longitude (deg., min., sec.): _____

End Time: _____

End Location:

Latitude (deg., min., sec.): _____ Longitude (deg., min., sec.): _____

Sampling Depth (m): _____ Water Depth (m): _____

Notes:

Crew Information

Collectors' Names (print): _____

Field Team Leader (print and sign): _____

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Small Mammal Collection Form Notes

Site Name: Smurfit-Stone/Frenchtown Mill

Project Number: _____

Page: _____

Station ID: _____

Mammal No.	**Species:** Individual Mammal Sample Number	**Species:** Individual Mammal Sample Number	**Species:** Individual Mammal Sample Number	**Species:** Individual Mammal Sample Number	Species: Individual Mammal Sample Number	Date Collected/ Time
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

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Small Fish Collection Form Notes

Site Name: Smurfit-Stone/Frenchtown Mill

Project Number: _____

Page: _____

Station ID: _____

Fish No.	**Species:** Individual Fish Sample Number	**Species:** Individual Fish Sample Number	**Species:** Individual Fish Sample Number	**Species:** Individual Fish Sample Number	Species: Individual Fish Sample Number	Date Collected/ Time
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

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Length-Weight Form

Project Name: Smurfit-Stone/Frenchtown Mill Project Number: _____ Page: _____

Station ID: _____ Tissue/Species: _____

Organism No.	Individual Sample Number	Total Length (mm)*	Weight (g)	Date	Time
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

Minimum size / Maximum size x100 _____ ≥75% Composite mean size _____ mm

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Length-Weight Form Notes

Notes:

CHAIN OF CUSTODY FORM

Project: _____

Samplers: _____

Integral Contact:
Phone

Ship to:
Lab Name
Address
Contact
Phone

integral consulting inc.

Sample No.	Tag #	Date	Time	Matrix	ANALYSES REQUESTED								Extra Container	Archive	Comments

Analysis Turn Time: **Normal** **Rush** **Rush Results Needed By:**

Shipped by: **Shipping Tracking No.**

Condition of Samples Upon Receipt: **Custody Seal Intact?**

Matrix Code:
GW - Groundwater
SL - Soil
SW - Surface water
SD -Sediment
Other:

Relinquished by: _____ **Date/Time:** _____ **Received by:** _____ **Date/Time:**_____
(signature) *(signature)*

Relinquished by: _____ **Date/Time:** _____ **Received by:** _____ **Date/Time:**_____
(signature) *(signature)*

Special Instructions:

	FIELD CHANGE REQUEST	Project Number:

Field Change No.
Page _____ to

Project Number:
Project Name:

CHANGE REQUEST
Applicable Reference:
Description of Change:

Reason for Change:

Impact on Present and Completed Work:

Requested by:
Date: ____/____/

(Field Scientist)

Acknowledged by:
Date: ____/____/

(Field Task Leader)

FIELD OPERATIONS MANAGER RECOMMENDATION

Recommended Disposition:

Recommendation by:
Date: ____/____/

(Sampling and Analysis Coordinator)

PROJECT MANAGER APPROVAL

Final Deposition:

Approved/Disapproved by:
Date: ____/____/

(Project Coordinator)

CORRECTIVE ACTION RECORD

Page ___ of

Audit Report No. :_____ Date:

Report Originator:

Person Responsible for Response:

DESCRIPTION OF PROBLEM:

Date and Time Problem Recognized: _____ By:

Date of Actual Occurrence: _____ By:

Analyte: _____ Analytical Method:

Cause of Problem:

CORRECTIVE ACTION PLANNED:

Person Responsible for Corrective Action:

Date of Corrective Action:

Corrective Action Plan Approval: _____ Date:

DESCRIPTION OF FOLLOW-UP ACTIVITIES:

Person Responsible for Follow-up Activities:

Date of Follow-up Activity:

Final Corrective Action Approval: _____ Date:

ATTACHMENT B3

TISSUE SAMPLING HEALTH AND SAFETY PLAN ADDENDUM

ATTACHMENT B3
ADDENDUM 1 TO THE OVERALL HEALTH AND SAFETY PLAN

Prepared for

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DRAFT
July 2018

CERTIFICATION PAGE

This is Addendum 1 to the overall Health and Safety Plan (HASP; NewFields 2015) for the Smurfit Stone/Former Frenchtown Mill site and Clark Fork River (the Site). It has been reviewed and approved by Integral Consulting Inc. (Integral) for the 2018 biological tissue study at the Site in support of the Supplemental Sampling, Baseline Ecological Risk Assessment (BERA) for the Site.

Jennifer Sampson Project Manager Integral Consulting Inc.	Stefan Wodzicki Field Lead Integral Consulting Inc.
Date: _____	Date: _____

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT FORM

Project Name: Smurfit-Stone/Frenchtown Mill

Addendum 1 to the overall HASP (NewFields 2015) is approved by Integral for use at the Smurfit-Stone/Frenchtown Mill site (the Site). The overall HASP and Addendum 1 are the minimum health and safety standard for the Site and will be strictly enforced for Integral personnel and other consulting personnel including subcontractors where applicable.

I have reviewed Addendum 1, dated July 2018, to the overall HASP for the project. I have had an opportunity to ask any questions I may have and have been provided with satisfactory responses. I understand the purpose of the plan, and I consent to adhere to its policies, procedures, and guidelines while an employee of Integral, or its subcontractors.

Date	Name (print)	Signature	Company

Date	Name (print)	Signature	Company

SITE EMERGENCY PROCEDURES

Emergency Contact Information

Table A
Site Emergency Form and Emergency Phone Numbers

Category	Information	
Chemicals of Potential Concern	dioxins/furans, PCBs, antimony, barium cadmium, mercury	
Minimum Level of Protection	Level D	
Site(s) Location Address	14377 Pulp Mill Road Missoula, Montana Coordinates [46° 57'51.71" N, 114° 12' 00.02"W]	
Emergency Phone Numbers		
Ambulance	911	
Fire	911	
Police	911	
Poison Control	911 and then 1-800-222-1212, if appropriate	
Dr. Peter Greaney (WorkCare)	800-455-2219	
Incident Intervention (WorkCare)	888-449-7787	
Project-Specific Health and Safety Officers' Phone Numbers		
Integral Field Lead and Integral Site Safety Officer (SSO)	Stefan Wodzicki	Cell: (360) 259-2518
Integral Corporate Health and Safety Manager (CHSM)	Matthew Behum	Office: (410) 573-1982 ext. 512 Cell: (443) 454-1615
Integral Project Manager	Jennifer Sampson	Office: (206) 957-0351 Cell: (360) 286-7552
NewFields Project Manager	David Tooke	Office: (406) 549-8270 Cell: (406) 240-8360
NewFields Field Manager	Dan Hoffman	Office: (406) 203-9960 Cell: (406) 240-7804
NewFields Site Health and Safety Manager	Heather Grotbo	Office: (406) 218-2576 Cell: (406) 465-7661
NewFields Corporate Health and Safety Manager	Rich Leferink	Office: (406) 443-3556 Cell: (406) 475-1655
Client Contact – M2Green Redevelopment LLC	Ray Stillwell	Office: (618) 910-2580

Table A
Site Emergency Form and Emergency Phone Numbers

Category	**Information**	
Client Contact – International Paper Company	Brent Sasser	Office: (901) 419-4447 Cell: (901) 413-6890
Client Contact – WestRock CP LLC	Steve Hamilton	Office: (770) 326-8136 Cell: (404) 307-2865
Reporting Oil and Chemical Spills		
National Response Center	1-800-424-8802	
State Emergency Response System	(512) 424-2138	
EPA Environmental Response Team	(201) 321-6600	

Note: In the event of any emergency, contact both the Integral and NewFields project managers and field leads.

Table B
Hospital Information

Category	Information
Hospital Name	Providence St. Patrick Hospital
Address	500 West Broadway
City, State	Missoula, Montana 59802
Phone	(406) 543-7271 (general)
Emergency Phone	911

Figure A
Site Location Map

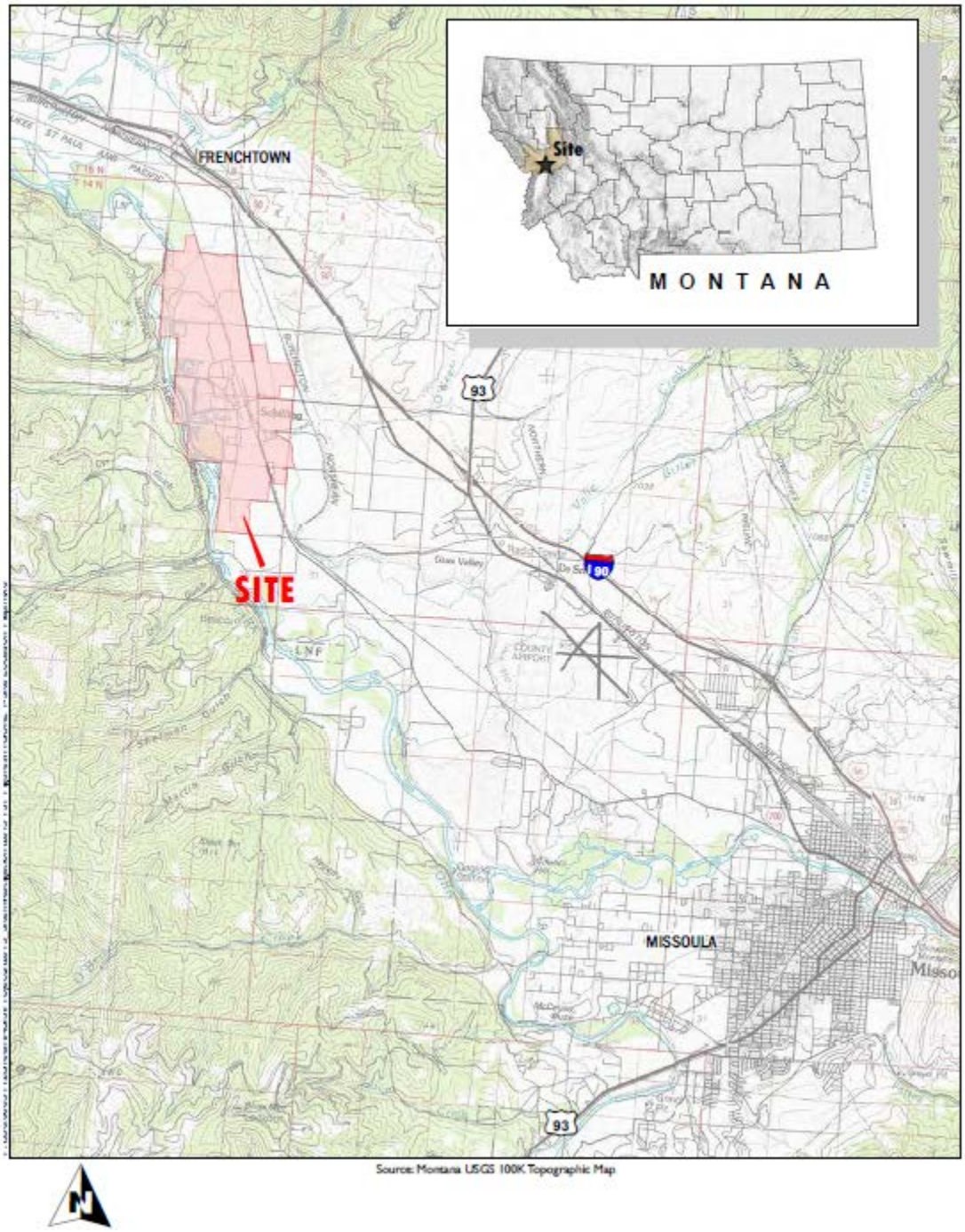


Figure B
Hospital Route Map from Site

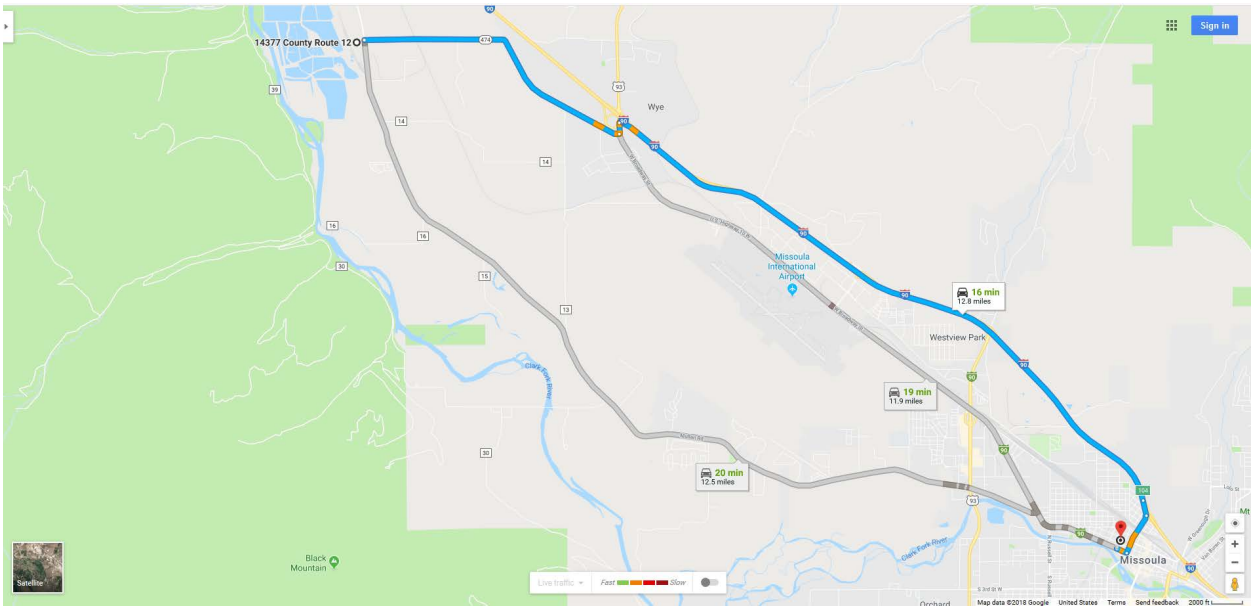
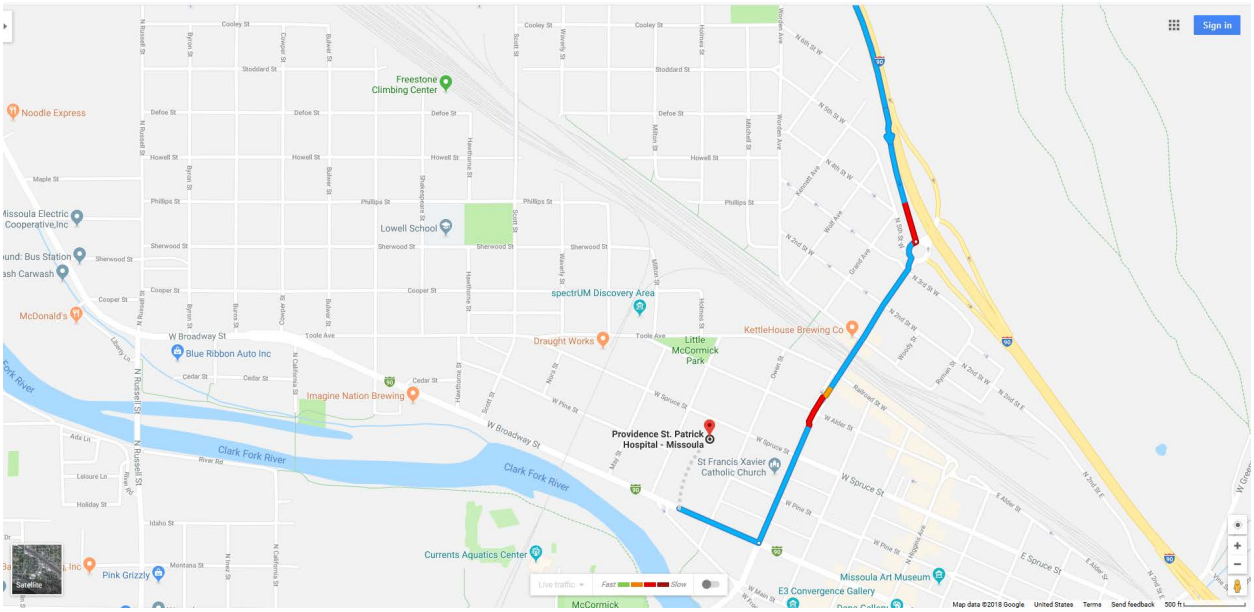
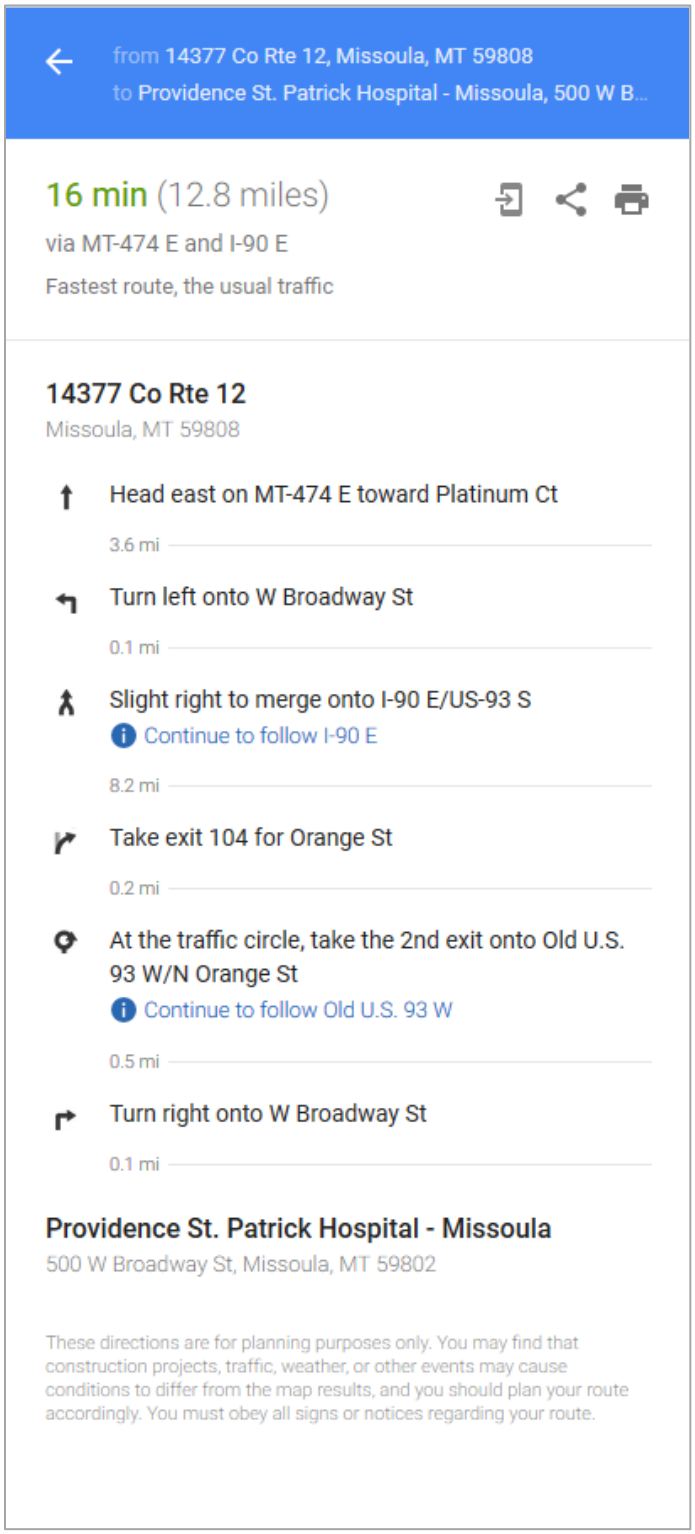


Figure C
Path to Hospital from I-90



Driving Directions from Site to Hospital



EMERGENCY RESPONSE PROCEDURES

In the event of an emergency, refer to the procedures in the Former Frenchtown Mill Site Site-Specific Health and Safety Plan SHASP (NewFields 2015).

A copy of this addendum must be included with the overall HASP, and both copies must be available in the field at all times during fieldwork.

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
AWG	American wire gauge
BMI	benthic macroinvertebrate
CDC	U.S. Centers for Disease Control and Prevention
CHSM	corporate health and safety manager
COPC	chemical of potential concern
CRZ	contamination reduction zone
EPA	U.S. Environmental Protection Agency
FSP	field sampling plan
HASP	Health and Safety Plan
IDHL	immediately dangerous to life or health
Integral	Integral Consulting Inc.
IPC	International Paper Company
JHA	Job Hazard Analysis
mg/m^3	milligrams per cubic meter
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Act or Administration
PEL	permissible exposure limit
PFD	personal flotation device
PPE	personal protective equipment
ppm	parts per million
SDS	safety data sheets
SSO	site safety officer
STEL	short-term exposure limit
TLV	threshold limit values
TWA	time-weighted average

1 INTRODUCTION

Integral Consulting Inc. (Integral) has prepared Addendum 1 to the Former Frenchtown Mill Site (the Site) overall Site-Specific Health and Safety Plan (HASP; NewFields 2015). This addendum provides study-specific information and health and safety provisions to protect workers from potential hazards during fish tissue sampling and small mammal tissue sampling activities at locations in the Site and within the Clark Fork and the Bitterroot rivers. Site background information and general health and safety provisions to protect workers from potential hazards during work at the Site are presented in the overall HASP.

The provisions of this biological tissue sampling HASP are mandatory for all Integral, NewFields, and any contractor personnel assigned to the project. Other contractors that will be working at the Site and the Clark Fork River are also expected to follow the provisions of this biological tissue sampling HASP unless they have their own HASP that covers their specific activities related to this study and such HASPs have been approved by Integral. Any other contractor HASPs must include the requirements set forth in this biological tissue sampling HASP and the overall HASP (NewFields 2015), at a minimum. All visitors to the work Site, including U.S. Environmental Protection Agency (EPA) personnel; state and local government personnel; and employees, representatives, or contractors of M2Green Redevelopment LLC, WestRock CP LLC, and International Paper Company (IPC) must also abide by the requirements of this biological tissue sampling HASP and will attend a pre-work briefing where the contents of this biological tissue sampling HASP and the overall HASP (NewFields 2015) will be presented and discussed.

It is Integral's policy to provide a safe and healthful work environment. No aspect of the work is more important than protecting the health and safety of all workers.

Integral cannot guarantee the health or safety of any person entering the Site and Clark Fork River. Because of the potentially hazardous nature of the Site and the activity occurring thereon, it is not possible to regulate personal diligence or to discover, evaluate, and provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein and in the overall HASP (NewFields 2015) will reduce, but not eliminate, the potential for injury and illness at the Site. The health and safety guidelines in this plan were prepared specifically for the Site and should not be used on any other site without prior evaluation by trained health and safety personnel.

A copy of this biological tissue sampling HASP Addendum and the overall HASP (NewFields 2015) must be in the custody of the field crew during field activities. All individuals performing fieldwork must read, understand, and comply with these plans before undertaking field activities. Once the information has been read and understood, the individual must sign the Site Health and Safety Acknowledgment Form provided with this biological tissue sampling

HASP Addendum. The signed form will become part of Integral and NewFields project files (as applicable to each company).

This HASP Addendum may be modified at any time based on the judgment of either Integral's or NewFields' site safety officer (SSO) in consultation with Integral's or NewFields' corporate health and safety manager (CHSM) and project manager or designee. Any modification will be presented to the onsite team during a safety briefing and will be recorded in the field notebook.

2 SCOPE OF WORK

To perform the fieldwork required for the 2018 biological tissue study, two field sampling teams will be deployed by Integral. The following tasks will be performed by the teams using this biological tissue sampling HASP Addendum and the overall HASP (NewFields 2015):

- Benthic macroinvertebrate (BMI) tissue samples from 10 locations in Lavalle and O'Keefe creeks and 12 locations in ponds within the Site
- Small fish at 14 locations in the Clark Fork River and one sample in the Bitterroot River targeting the longnose dace (*Rhinichthys cataractae*)
- Small mammals from 10 upland or floodplain locations within the Site boundary.

BMI samples from the Lavalle and O'Keefe creeks will be collected using a D-framed kick net. A benthic grab sampler, deployed from a small skiff, will be used in ponds located at the Site. Sediment and detritus material collected in the kick nets and/or benthic grabs will be washed with site water through a sieve. Material that remains on the sieve will be removed and placed into laboratory provided containers. Samples submitted to the laboratory will be analyzed for dioxin and furans, methylmercury, total metals, and percent lipids.

Small fish will be collected along the margins in the Clark Fork River at 14 locations and one sample in the Bitterroot River. The primary method for fish collection will be to use a kick net, unless that method proves unsuccessful, in which case, a backpack electrofisher (Smith Root - LR24) will be used. Transport between sample locations on the Clark Fork and Bitterroot rivers may involve the use of a motorized vessel. Samples submitted to the laboratory will be analyzed for dioxins and furans, methylmercury, total metals, and percent lipids.

Small mammals will be collected using baited live animal traps at 10 locations within the Site boundary. Samples submitted to the laboratory will be analyzed for dioxins and furans, methylmercury, total metals, and percent lipids.

3 AUTHORITY AND RESPONSIBILITIES OF KEY PERSONNEL

This section describes the authority and responsibilities of key Integral project personnel.

To maintain adequate Site control, the SSO will have the authority to enforce the rules of the overall HASP and this addendum to any individual present at the Site, whether that individual is an employee or an outside contractor who is working with his or her team.

Because there is more than one HASP (i.e., overall HASP [NewFields 2015] and this addendum), the Occupational Safety and Health Administration (OSHA) (OSHA 1997) considers it essential that the plans be integrated and enforced consistently to ensure that onsite personnel have a clear understanding of health and safety expectations, lines of authority, and emergency response actions.

The names and contact information for key safety personnel are listed in the "Emergency Site Procedures" section at the beginning of this HASP (Table A). If key site personnel change during the course of the project, a new list will be established and given immediately to the field teams. The emergency phone number for the Site is **911**, and should be used for all medical, fire, and police emergencies.

Stefan Wodzicki (proposed Integral field lead and SSO) has oversight responsibility for all health and safety activities and the authority to discontinue or modify site operations when unsafe conditions are observed. The field lead will be in direct contact with his respective CHSM (Matthew Behum) and project manager (Jennifer Sampson).

The project manager will be in regular contact with the field lead/SSO and CHSM to ensure that appropriate health and safety procedures are implemented during the surface water study.

Subcontractors who will provide a boat for in-water work will be identified at a later date, and their names and contact information will be distributed with an updated contact list table to all participants.

4 JOB HAZARD ANALYSIS

The OSHA standard (29 CFR 1910.120) mandates that site safety and health programs require that task- and operation-specific hazard analyses be conducted at the Site. These analyses are intended to ensure a comprehensive and systematic approach to hazard anticipation, recognition, and evaluation at hazardous waste sites.

The kinds of potential hazards associated with surface water sampling are summarized in the Job Hazard Analysis (JHA) that is provided in Table C (located at the end of this section of the Addendum) for the biological tissue sampling tasks. In addition, task specific JHA assessment forms are included in Exhibit 3. The JHA lists a task or operation required during site activity and the location(s) where that task or operation is performed. A single JHA may be used for a task performed in multiple locations if the hazards, potential exposures, and controls are the same in each location.

The JHA lists the chemical hazards associated with that task and their known or anticipated airborne concentrations during performance of the task. Each JHA also identifies anticipated physical and biological hazards and potential exposure levels or the likelihood of exposure. The final section of each JHA lists the control measures implemented to protect employees from exposure to the identified hazards. The information provided here is designed to satisfy OSHA's hazardous waste operations and emergency response JHA requirements of 1910.120(b)(4)(ii)(A) and the workplace hazard assessment requirements of 1910.132(d).

Health hazard information for all chemicals of potential concern (COPCs) identified in site JHAs appears in the safety data sheets (SDSs, previously MSDSs) of the overall HASP (NewFields 2015).

Integral's field lead will modify the study-specific JHA when:

- The scope of work is changed by adding, eliminating, or modifying tasks
- New methods of performing study tasks are selected
- Observation of the performance of study tasks results in a revised characterization of the hazards
- New chemical, biological, or physical hazards are identified
- Exposure data indicate changes in the concentration and/or likelihood of exposure
- New/different control measures are selected.

If the JHA is modified, then related provisions in other sections of this addendum will also be modified as needed.

The overall hazard level associated with the activities described in Section 2 is low. Hazards encountered during these sampling programs are due to physical safety hazards associated with the field operations, exposure to chemicals used to decontaminate sampling gear and preserve samples and biological hazards in the handling of small mammals, and potential exposure to hazardous materials present within the surface water and sediments. Potential hazards while working at the Site include, but are not limited to, the following:

- Exposure to toxic and/or hazardous chemicals
- Physical hazards from use of sampling equipment and operations on a vessel and on land areas
- Physical hazards from working conditions (e.g., hypothermia, slips/trips/falls, electrocution, or drowning).
- Biological hazards from collecting and processing of small mammal tissue samples (e.g., bites, scratches, or hantavirus)

As described below, protective equipment and safe working procedures will help prevent accidents caused by these hazards. All workers are required to use the buddy system, and no one will be allowed to work alone.

4.1 DEFINITIONS

Chemical hazards are defined by the following terms:

Time-Weighted Average (TWA): The recommended exposure limits for a hazardous chemical in the workplace, typically during an 8-hour work day over a 40-hour work week. TWAs are recommended by the National Institute for Occupational Safety and Health (NIOSH) under the authority of OSHA.

Permissible Exposure Limit (PEL): The legal maximum air concentration of a hazardous chemical to which workers may be exposed on an 8-hour basis as established by OSHA. The PEL is a time-weighted average value (PEL-TWA), and for all chemicals discussed below, the corresponding PEL-TWA is the same for OSHA.

Threshold Limit Value (TLV): The recommended maximum air concentration of a hazardous chemical to which workers may be exposed on an 8-hour basis. TLVs are time-weighted average values (TLV-TWA) and are recommended by the American Conference of Governmental Industrial Hygienists (ACGIH).

Short-Term Exposure Limit (STEL): A 15-minute TWA exposure that should not be exceeded at any time during a workday.

Ceiling Limit: Employee's exposure, which should not be exceeded during any part of the workday.

Immediately Dangerous to Life or Health (IDLH): Exposure to airborne contaminants that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.

Buddy System: "Buddy system" means that an employee is designated to be observed by at least one other employee in the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

4.2 CHEMICAL HAZARDS

Table 2 in the overall HASP (NewFields 2015) presents a detailed summary of health-based chemical exposure information for the primary COPCs that are known or suspected to be present at the Site.

4.3 PHYSICAL HAZARDS

As stated in Section 2 above, it will be necessary to use a vessel to access some of the proposed biological tissue sampling locations in the Clark Fork and Bitterroot rivers and ponds. The sections below provide safety guidelines for using a backpack electrofisher, sampling for BMI, setting small mammal traps and processing small mammal tissue samples, and operating small craft and vehicles. The different physical hazard that may be associated with each of these operations is discussed below.

4.3.1 Backpack Electrofishing

All field team members must be trained in electrofishing safety precautions and unit operation procedures as identified by the backpack elctrofishing unit manufacturer (e.g., Smith Root LR-24).

4.3.1.1 Field Procedures

The following minimum procedures have been adopted for personnel working with a backpack electrofisher. It is essential that all personnel abide by these procedures. Detailed field collection procedures are included in the field sampling plan (FSP), Section 2.3.8.3 (Integral 2018).

4.3.1.2 General Procedures

The field team will consist of at least two personnel. The backpack electrofishing unit will consist of one hand-held anode and a trailing cathode. The operator of the electrofishing units will hold the anode in one hand and have the second hand free for use of a dip net. The remaining field personnel will aid in netting of fish and in addition are responsible for fish transport in buckets or live wells. The following steps outline the general procedure for electrofishing and documenting fish species:

1. Record the coordinates of the target sample location.
2. Collect conductivity measurements using a multi-parameter water quality probe.
3. Apply output current once all field staff are in a safe and grounded positions. Adjust pulse rate and width periodically depending on conductivity, fish species present and fish behavior.
4. Collect all stunned fish using fiberglass dip nets and placed in buckets containing river water.
5. Once the target number of fish have been captured, process them as described in the FSP, Section 2.3.8.4 (Integral 2018).
6. Decontaminate all buckets and dip nets between stations, following procedures outlined in the FSP, Section 2.3.2 (Integral 2018).

4.3.1.3 Personal Protection

All field personnel involved in backpack electrofishing operations must be insulated from the water and the electrodes, therefore chest waders and class 0 rubber insulating gloves are required. At least two field personnel will be certified in CPR. The electrode and dip net handles must be constructed of insulating materials (e.g., fiberglass). In addition all field staff are required to wear a personal flotation device (PFD) and polarized sunglasses. Field team members must not reach into the water unless the electrodes have been removed from the water or the electrofishing unit has been disengaged or turned off. Boots with steel inserts will not be worn during electrofishing.

4.3.2 Benthic Macroinvertebrate Sampling

The following minimum procedures have been adopted for personnel working in the collection of benthic macroinvertebrates. It is essential that all personnel abide by these procedures. Detailed field collection procedures are included in the FSP, Section 2.3.7.2 (Integral 2018).

4.3.2.1 General Procedures

BMI tissue samples will be collected at on-Site ponds and in O'Keefe and Lavalle creeks. Tissue samples will be collected using a benthic grab sampler in on-site ponds, deployed from a small craft. Material collected in the grab sampler will be washed through sieves. Sampling in creeks will be conducted with a kick net sampler and the collected material will be washed through a sieve. For each type of tissue sample collection the remaining material after sieving is completed, will be placed in sample containers.

4.3.2.2 Personal Protection

Tissue samples collected onsite will require the use of a small skiff. All field personnel working from the skiff are required to wear a PFD. Samples collected within the creeks, field personnel are required to wear chest waders, appropriate skid resistant boots and PFDs.

4.3.3 Small Mammal Sampling

The objective of this field safety guideline is to ensure the safety of Integral and subcontractor personnel when collecting and sampling mice and other rodent species. Because of the acute hazard posed by hantavirus, all Integral and subcontractor personnel must exercise extreme caution when handling deer mice or other rodents. More detailed information on hantavirus is included in Exhibit 4.

4.3.3.1 Background Information

Hantavirus is a rodent-borne virus that causes acute respiratory illness, which has been named the Hantaviral Pulmonary Syndrome. The virus has traditionally been associated with hemorrhagic fever, which causes internal bleeding and kidney failure, and was believed to be limited to Asia and parts of Europe (there are reported to be 200,000 hantavirus cases each year in China, and the disease affected United Nations troops during the Korean War). However, a new strain of the virus that causes the flooding of the patient's lungs with blood plasma appears to have developed or emerged in North America; the disease was found to be responsible for several deaths in the Four Corners area of the American Southwest in the spring and summer of 1993.

According to the U.S. Centers for Disease Control and Prevention (CDC), 560 hantavirus cases have been reported in the United States through December 15, 2010. Thirty-six of these cases resulted in death. Cases have been reported in 32 states, including the majority of the western half of the United States. Additional information on Hantavirus statistics can be found at http://www.cdc.gov/hantavirus/surveillance/index.html.

The disease is characterized by the onset of fever and other flu symptoms, including headache, backache, muscle pains, and vomiting. In later stages, the victims encounter shortness of breath

as fluid enters their lungs. Recent cases of hantavirus in the United States were characterized by the rapid onset of symptoms. In some cases, the victim reportedly died within a few days after first exhibiting symptoms of respiratory illness.

Deer mice (*Peromyscus meniculatus*) have been identified as the reservoir hosts for hantavirus in the Southwest, although other species of mice have been found to carry the virus, including *Peromyscus truei* and *Peromyscus boylii*. The infected rodents shed the virus in saliva, urine, and feces. The virus does not appear to affect the mice. Human infection occurs when infected mouse saliva, urine, or excreta are inhaled as aerosols, contact broken skin (i.e., animal bites), are ingested in contaminated food or water, or are introduced to the mucus membranes. Infection can reportedly occur after only a few minutes of exposure. Several exposures reportedly occurred when the victim disturbed mouse excreta by sweeping or cleaning a rodent-infested area. Several of the victims who lived in states outside the original epidemic zone appeared to have become infected while traveling in the Four Corners area. A victim in Montana reportedly did not visit the Four Corners area, but kept wild mice in cages in his home. Health officials found hantavirus in mice near other victims' homes in Oregon and Idaho.

The virus is susceptible to most disinfectants, including bleach solutions, detergents, 70 percent ethyl alcohol, and general-purpose household disinfectants.

4.3.3.2 Field Procedures

The following minimum procedures have been adopted for personnel handling rodents and rodent samples in support of an ecological risk assessment. It is essential that all personnel abide by these procedures. Detailed field collection procedures are described in the FSP, Section 2.3.9 (Integral 2018).

4.3.3.3 General Procedures

Wherever possible, Integral and subcontractor personnel must avoid contact with rodents and rodent excreta while conducting field operations. Only designated trained and properly equipped personnel may handle small animal traps or collect rodents. All field personnel, regardless of their assignment, must take care to avoid unnecessarily disturbing rodent nests or disturbing excreta in rodent-infested areas.

Although the deer mouse is the species most often identified with hantavirus, personnel must take precautions when handling any mouse or rodent species. Rodents are carriers of other diseases, other species of mice have been found to carry hantavirus, and traps set for other species may also catch deer mice.

4.3.3.4 Personal Protection for Field Personnel

Field personnel involved in any aspect of the collection or handling of deer mice are required to wear a half-face dust mask, Tyvek® coveralls, disposable chemical-resistant gloves, and eye protection (preferably goggles as long as they do not interfere with respirator fit; field personnel must pass a respirator fit test and complete instruction in respirator use). Sleeves should be taped to gloves. Field personnel are required to prevent the spread of excreta by wearing removable boot covers or by decontaminating boots with a bleach solution or commercial disinfectant spray (such as Lysol®) prior to getting into a vehicle. In addition to wearing personal protective equipment (PPE), all field personnel must practice good hygiene (i.e., washing hands thoroughly after handling mice and before eating, drinking, or smoking) and avoid contact with all rodent and rodent excreta to the greatest extent possible. All personnel wearing potentially contaminated gloves must wash and disinfect those gloves with a bleach solution of commercial disinfectant prior to removing them.

4.3.3.5 Packaging Small Mammals in the Field

The following procedures have been developed to control exposure of potentially infectious materials while collecting samples of mice. All mice samples must be stored in plastic bags in the field using the following procedures:

- Each animal-trapping team should consist of two persons, each with the following roles:
  - The primary handler (field person 1) opens the traps and handles the mice. This person is equipped with impermeable gloves, coveralls, full-face respirator, and chemical-resistant boots.
  - The assistant (field person 2) provides support to the primary handler, but does not handle traps or mice unless the traps or mice have been disinfected or containerized.
- The mice will be placed in a sealable plastic bag by field person 1. Field person 1 will inspect the outside of the plastic bag for evidence of gross contamination and clean the outside of it with a disinfectant, if necessary.
- Field person 2, wearing clean gloves (defined as fresh, new gloves from the box), will hold open a 1-gallon bag allowing field person 1 to drop the plastic bag in a larger bag. Bags should be pre-labeled with the sample number and the words "potentially infectious substance." All resealable bags must be at least 2 mm thick; field person 1 may not touch or handle the outside of the inner bag.
- The bag is sealed and placed in the cooler for shipment by field person 2.

The bag and clean cooler must not come into contact with potentially contaminated gloves or other potentially infectious substances or equipment. This will ensure that the outside of all samples and the coolers are contamination-free. All resealable bags must be at least 2 mils

(0.002 inch) thick (e.g., freezer Ziploc® bags). The goal of this procedure is that any person opening the cooler or placing the samples in the freezer for storage will not come in contact with infectious substances.

4.3.3.6 Storage of Mice Samples

Mice or rodent samples must be stored in a dedicated sample storage freezer. No other samples should be stored with the mice. This freezer must be clearly labeled as containing potentially infectious substances, and all staff must be made aware of the hazards posed by the mice sample. All personnel involved in the processing (e.g., packaging, handling, shipping, storing, dissecting) of the samples must be trained in the procedures for handling potentially infectious substances. Training will consist of an in-house review of the procedures discussed herein. Packages should be protected from damage so that the non-contaminated outer packages remain intact.

4.3.3.7 Decontamination of Field and Laboratory Equipment

All coolers, counters, equipment, and other surfaces or items that come into contact with rodents, rodent excreta, or otherwise potentially contaminated items (including vehicles and boots) must be washed with a detergent and thoroughly disinfected using a bleach solution, alcohol, or a commercial disinfectant such as Lysol®. Contaminated reusable clothing should be double-bagged for laundering using a detergent. After decontamination of surfaces, warning labels or signs should be removed, indicating that the area is clean. In the event of skin contact with potentially infected materials, the field person must immediately wash the affected skin with soap and water and then wipe the area with alcohol. All personnel wearing potentially contaminated gloves must wash and disinfect those gloves with a bleach solution of commercial disinfectant prior to removing them.

To prevent the spread of contaminants, traps or other contaminated items must be thoroughly decontaminated (including the use of disinfectant) in the field prior to being placed into a building or vehicle. Uncleaned traps must be double-bagged prior to transporting in a vehicle (i.e., to a new sample location). Any wastes generated during the decontamination of traps (such as paper towels) must be double-bagged and segregated for appropriate disposal (see "Disposal of Wastes" below).

4.3.3.8 Disposal of Wastes

All potentially infectious wastes (including animal tissue, gloves, and paper towels) must be separated from noninfectious trash for disposal. The potentially infectious trash should be double-bagged and labeled as potentially infectious materials. Actual disposal will depend on local regulations. Alternatives include contracting with a service providing incineration of infectious wastes or thoroughly wetting waste materials with disinfectant prior to disposing the

materials as solid waste. Potentially infectious materials must not be placed into a dumpster or other receptacle for collection by municipal waste haulers. These materials must be properly disposed of by a licensed hazardous waste hauler.

4.3.3.9 Communication of Hazards to Subcontractors and Outside Laboratories

The project manager must provide all available information regarding hantavirus (and any additional information as it becomes available) to the outside laboratory manager prior to the shipment of any samples. All samples sent to the laboratory must be packaged in accordance with the procedures detailed above. All sample coolers must be labeled as described below. Similarly, the project manager must notify any subcontractor of the hazards described above prior to allowing their participation in mouse or rodent collection or processing.

4.3.3.10 Shipment of Samples to Outside Laboratories

Samples shipped via common carrier (i.e., UPS or Federal Express) do not require shipment as restricted articles (items must be declared "infectious substances" if they are known to be infectious or if they are being shipped to a laboratory to determine if they are infectious substances). However, all samples must be placed in sealed glass containers within sealed plastic bags, with the individual packages labeled as potentially infectious. A warning label or sign must be included inside the cooler to warn laboratory personnel about the contents. The warning labels are available commercially.

All small mammal samples will be shipped on dry ice to an intermediary laboratory that will decontaminate these samples. The intermediary will then ship all small mammal samples on dry ice to the appropriate laboratory for chemical analysis. Samples shipped on dry ice are subject to special shipping procedures and regulations. Procedures may vary based on the carrier. For example, Federal Express follows international air cargo regulations, which require that special dry ice labels be placed on the package and the shipper provide additional information on the regular (i.e., not restricted article) air bill.

4.3.3.11 Seeking Medical Attention

According to the CDC, any field person who becomes ill or develops symptoms identified with hantavirus (including fever, coughing, muscle ache, and pain) or who develops a respiratory illness within 45 days of his or her last potential exposure to deer mice or other suspected hantavirus carrier species should seek immediate medical attention. The field person must notify the physician of the potential exposure to hantavirus. The physician should be advised to alert local health authorities if Hantaviral Pulmonary Syndrome is suspected. A blood sample should be obtained from the patient and be forwarded to the CDC through the local health department for hantavirus antibody testing.

Because the symptoms of Hantaviral Pulmonary Syndrome are similar to those for influenza, field personnel with minor health complaints or symptoms may be reluctant to contact their physician. Personnel who exhibit the following symptoms will be referred to a doctor specializing in infectious diseases:

- Fever
- Pulmonary infiltrate (as diagnosed by a chest x-ray)
- Exposure to deer mice (or other suspected hantavirus carrier species)
- Shortness of breath.

It is Integral policy that any person who develops the symptoms described above should immediately contact their occupational physician for additional information. Any exposures or evidence of Hantaviral Pulmonary Syndrome must be immediately reported to the SSO and the CHSM.

4.3.4 Sampling Vessel Operations

It will be necessary to use a vessel to access some of the proposed fish tissue sampling locations in the Clark Fork River. When this occurs, Integral personnel will adhere to vessel safety protocols in the project Quality Assurance Project Plan (NewFields, 2015) Appendix F (HASP), Section 4.9. PFDs (i.e., life vests) will be provided for and worn by all personnel working on the deck, or as directed by the field lead/SSO or vessel operator. The vessel will also be equipped with throwable life rings, fire extinguishers, and warning horns, and each crew member will be briefed on their storage location. Additional details regarding working on vessels is provided in Section 4.9 of the overall HASP (NewFields 2015).

4.3.5 Small Craft Operation

Safety procedures on small boats (i.e., length of 20 ft or less) may necessitate an increased level of protection, depending on boat size and location in the river. Small-boat procedures will include all the requirements listed above. In addition, all personnel onboard will be required to wear PFDs at all times.

4.3.6 Man Overboard

Any time a team is working over water on the sampling vessel there is a potential for a man-overboard situation. The danger of this situation is increased if the water is flowing swiftly or if there is debris in the water. All personnel working over water will wear a PFD at all times.

If a man-overboard situation occurs, all vessel engines will be stopped immediately. Flotation devices (e.g., life rings) attached to lines will be thrown to the victim from the vessel. The

victim will then be brought aboard the sampling vessel; wet clothes will be removed and replaced with dry clothing. The victim may need to be treated for cold stress. No other person should enter the water unless the victim is unconscious or seriously injured. If rescuers enter the water, they must wear PFDs and be tethered to the sampling vessel or shore.

4.3.7 Motor Vehicle Operation

Motor vehicles will be used to transport field personnel, equipment, and supplies to the nearshore, intertidal sampling locations that will be accessed during low tide. Motor vehicles will also be used to transport field personnel, equipment, and supplies to the sampling vessels and sample processing/shipping locations. Only sampling team personnel with valid driver's licenses and liability insurance (per local state laws) will operate motor vehicles required for work activities. All field staff will use best professional judgment at all times to ensure safe operation of motor vehicles, including:

- Cell phone usage while driving is not allowed, including the use of hands-free devices. If it not feasible to wait to use the cell phone until arriving at the destination, drivers are to pull off the road and park in a safe location to use the cell phone. They are not to pull to the side of the road to use a cell phone because this significantly increases the risk of a rear-end collision.
- Operators are to practice defensive driving and drive in a courteous manner.
- Operators are to be aware of pedestrians and give them the right-of-way.
- All vehicles are to be operated in a safe manner and in compliance with statutory traffic regulations and ordinances.
- Operators are to verify that safety seat belts are in proper operating order.
- Seat belts are to be worn by the driver and all passengers whenever the vehicle is in motion.
- No persons are allowed to ride in the back of any vehicles, unless equipped with seat belts.
- Vehicles are to be driven in conformance with local speed limits.
- Operators are to avoid excessively long driving periods.
- Personnel who are impaired by fatigue, illness, alcohol, illegal or prescription drugs, or who are otherwise physically unfit, are not allowed to drive.
- Personnel are to avoid engaging in other distractions while driving.
- Motor vehicle accidents are to be reported to the responsible law enforcement agency, Integral's human resources manager, and Integral's CHSM.

4.3.8 Physical Exposure

Exposure to the elements and fatigue are two major causes of accidents while working outside. The individual task activities may include long work days and unpredictable weather. Working in cold, rough, or swift-moving waters can lead to fatigue, seasickness, and/or overexposure. The combination of vessel motion and fatigue increases the risk for a man-overboard situation.

To prevent fatigue and overexposure in adverse weather conditions, field personnel will take regular work breaks. Extra clothing will be brought to accommodate changes in weather. Cold stress can be manifested as hypothermia (discussed further in Section 5 of the overall HASP; NewFields 2015). Heat-related illnesses can occur at any time when protective clothing is worn. When air temperatures average between 70 and 75°F, the risk of heat-related illnesses increases. Heat stress can be manifested as both heat stroke and heat exhaustion (discussed further in Section 5 of the overall HASP; NewFields 2015).

Personnel should monitor their own conditions and capabilities and are responsible for taking appropriate measures to relieve fatigue, exposure, or heat stress. Because fatigue and extreme heat/cold stress may impair an individual's judgment, the field lead/SSO is also responsible for monitoring workers' apparent condition in relation to physical exposure. The field lead/SSO and vessel operator may direct any crew member to cease working if conditions indicate the potential for overexposure or if overexposure occurs.

4.3.9 Other Physical Hazards

Incorporating the following basic safety procedures can prevent many of the most common causes of injury or accident during field sampling:

- Implement good housekeeping practices, including immediate cleanup of spills and safe storage of all materials. All equipment or materials not in current use will be removed from the immediate work area.
- Use proper lifting and moving techniques to prevent back or muscle strain or injury. Any heavy equipment, boxes, coolers, or other items should be tested before lifting. If a piece of equipment is too heavy, the equipment should be broken into smaller components or assistance requested. Lifting should be done with the legs, not the back.
- Use extra caution when handling sharp tools or sampling devices and when possible, wear protective gloves.
- Use the following safety procedures when using the backpack electroshocker:
  - Always review the manufacturer's manual before using the unit. Before use, inspect entire unit and insuring that all connections are secure and no physical damage or corrosion is visible

- Backpack electroshockers will be equipped with a quick release hip belt and shoulder straps.
- All backpack electroshockers must be equipped with a tilt switch that opens the circuit in case the operator falls.
- The positive electrode (anode) will be equipped with a manually-operated, normally open pressure switch that breaks the electrical current upon release. Do not bypass the manual switches with hold-down mechanisms, such as tape.
- Electrode handles will be constructed of a nonconductive material and be long enough to avoid hand contact with the water.

4.4 EMPLOYEE NOTIFICATION OF HAZARDS AND OVERALL SITE INFORMATION PROGRAM

The information in the JHA and the SDSs will be made available to all employees who could be affected by it prior to the time they begin their work activities. Modifications to JHAs and the accompanying data sheets will be communicated during routine briefings.

Consistent with paragraph 1910.120 (i) of Hazardous Waste Operations and Emergency Response (HAZWOPER) (OSHA 1994), the field lead/SSO will also inform other contractors and subcontractors working on this study about the nature and level of hazardous substances at the Site, the likely degree of exposure to workers who participate in site operations, and any modifications to this addendum to other contractors and subcontractors working on this Site.

Daily safety briefings will take place before work begins. The daily briefing form provided in Exhibit 1 will be used to record the daily meetings.

Table C
Job Hazard Analysis for Biological Tissue Sampling – Types of Potential Hazards

Operational Phase: Smurfit-Stone/Former Frenchtown Mill	Location: Creek and Pond Area Sediments and Surface Water, Upland Area Soils and Clark Fork River Surface Water

Chemical Hazards (Detailed List included in overall HASP (NewFields 2015)						
Chemical of Potential Concern	**PEL - TWA[a] mg/m³**	**TLV - TWA[b] mg/m³**	**STEL mg/m³**	**IDLH mg/m³**	**Exposure Routes**	**Symptoms**
Alconox®	15	-	-	-	Inhalation	

Physical Hazards			
Name of Physical Hazard	**Source**	**Exposure Level/ Potential**	**Exposure Limit**
Boating operations	Boat deck	Likely	N/A
Electrofishing	Backpack electrofisher	Likely	N/A
Drowning	Boat/River/Creek/Pond	Likely	N/A
Heat (ambient)	Sun	Likely	N/A
Cold weather operations	River/Creek/Pond	Likely	N/A
Heavy manual lifting/moving	Boat deck and boat launch areas	Likely	N/A
Alconox – storage and use	Decontamination solution	None	N/A
Slips/trips/falls/person overboard	Boat deck, River, Creek, Pond, Upland	Likely	N/A
Inclement weather – rain, wind, thunderstorms	Boat deck, River, Creek, Pond, Upland	Likely	N/A
Sharp objects – box cutter	Opening boxes, cutting line	Likely	N/A
Sharp objects – broken glass	Sample containers	Likely	N/A
Overhead hazards	Trees, branches		
Uneven surface	River banks, upland		
Material handling	Tissue samples	Likely	N/A
Vehicular travel	Rental vehicle	Likely	N/A
Working over water	Boat deck area and wading in river and creeks	Likely	N/A

Table C
Job Hazard Analysis for Biological Tissue Sampling – Types of Potential Hazards

Biological Hazards			
Name of Biological Hazard	**Source**	**Exposure Level/Potential**	**Exposure Limit**
Hantavirus	Small mammals, upland areas	Likely	N/A
Giardia	River, creeks, ponds	Possible	N/A
Insect bites and stings	River, creeks, ponds, and upland site	Likely	N/A
Snake bites	River, creeks, ponds, and upland site	Likely	N/A
Operational Phase: Smurfit-Stone/Frenchtown Mill	Location: On water and upland Site area		
Control Measures Used			
Engineering Controls: Task specific JHAs in Exhibit 3 **In addition:** 1. Weights of coolers are such that two persons should lift the units to prevent back injuries. 2. To avoid insect bites, insect repellents may be applied. 3. To avoid ingestion of water with giardia, personnel should wash hands thoroughly and use a hand sanitizer before eating or drinking. 4. To avoid potential inhalation of dust containing hantavirus, personnel are required to wear a half-face dust mask and Tyvek suit. 5. To mitigate poisoning from a snake bite, a snake bite kit will be available on Site. 6. To avoid slipping in river and creek, staff will wear appropriate wading boots.			
Level of PPE for boat deck sampling: Modified D	PPE: Chemical-resistant steel-toed boots, safety glasses, nitrile gloves and PFDs.		
Level of PPE for wading in river and creeks: Modified D*	PPE: Bib waders and wading boots, polarized sunglasses, nitrile gloves, and PFDs.		
Level of PPE for small mammal sampling: C	Same as Level D with addition of Tyvek® coveralls and half-face dust mask.		
Level of PPE for offsite sampling handling: D	PPE: Chemical-resistant steel-toed boots, safety glasses, nitrile gloves.		

Table C
Job Hazard Analysis for Biological Tissue Sampling – Types of Potential Hazards

Work practices:	Change disposable nitrile gloves frequently. Wash hands and face with soap and water after each sampling event and before eating or drinking. Take shower at end of workday.

Notes:

[a] PEL-TWA values from NIOSH Pocket Guide to Chemical Hazards (1997).

[b] TLV-TWA values from American Conference of Governmental Industrial Hygienists (ACGIH 1996).

IDLH = Immediately dangerous to life or health

Inh = Inhalation, Abs = Absorption, Con = Contact, Ing = Ingestion

NA = Not applicable

NE = Not established

5 SITE CONTROL ZONES

The use of site control zones is designed to reduce the spread of hazardous substances from contaminated areas to clean areas, to identify and isolate contaminated areas of the Site, to facilitate emergency evacuation and medical care, to prevent unauthorized entry to the Site, and to deter vandalism and theft.

5.1 EXCLUSION ZONE

Exclusion zones will be established wherever biological tissue and sediment are handled.

Sampling Vessel: During intrusive sampling on a sampling vessel, the exclusion zone includes the area of the vessel in which sediment collected from the pond areas are handled. This part of the vessel is designated as the exclusion zone only when sediment samples are being handled on the vessel.

River and Creek: During tissue sampling in the river and creeks, the exclusion zone includes river/creek banks adjacent to the station location. An approximate 15-ft radius around the sample processing area will be the exclusion zone. Only properly equipped and trained personnel will be allowed in this area. These areas will be designated as the exclusion zone only when tissue samples are being handled.

Upland Areas: An approximate 15-ft radius around the sampling location will be the exclusion zone. Only properly equipped and trained personnel (i.e., level D protective clothing) will be allowed in this area.

5.2 CONTAMINATION REDUCTION ZONE

Contamination reduction zones (CRZs) will be established wherever decontamination of sampling equipment and personnel exposed to surface water, sediment or small mammals is conducted:

Sampling Vessel: The CRZ during on-water surface water handling is the same area on the vessel deck after intrusive sampling has occurred. Decontamination of both personnel and equipment will take place in this zone to prevent the transfer of COPCs to the support zone.

River and Creek: After sampling is complete at a station, the exclusion zone will become the contamination reduction zone.

Upland Areas: After sampling is complete at a station, the exclusion zone will become the contamination reduction zone.

5.3 SUPPORT ZONE

The support zone will be located wherever exposed contaminated surface waters are not present. In general, the support zone is where sample processing occurs after surface water samples have been sealed in sample jars and inserted into resealable plastic bags. It is also the area where chain-of-custody forms are completed, sample jar labels are prepared, and sample jars are packed for shipping.

Sampling Vessel: The support zone is the cabin area of the vessel or on the vessel deck where contaminated sediment are not present.

River and Creek: All areas outside the exclusion and contamination zones.

Upland Areas: All areas outside the exclusion and contamination zones.

6 PROJECT AIR MONITORING REQUIREMENTS

Air monitoring will not be conducted. However, field personnel who will be collecting and processing small mammal tissue samples will wear a half-face dust mask.

7 DECONTAMINATION OF SAMPLING EQUIPMENT

Decontamination of sampling equipment will follow procedures in Section 2.3.9.6 of the FSP for this study. All sampling equipment will be decontaminated prior to initiation of sampling and between sampling locations according to instructions for each specific sampling standard operating procedure. Equipment decontamination methods will at a minimum include the following:

- Rinse with tap or site water
- Scrub with Alconox detergent
- Tap or site water rinse
- Distilled water rinse (for sample handling equipment only).

To minimize or prevent personal exposure to hazardous materials, all personnel working in the exclusion zone and contaminant reduction zone will comply with the following decontamination procedures:

- PPE will be removed and placed in a garbage sack for proper disposal at a solid waste landfill.
- All gloves, Tyvek®, rain gear, and rubber boots will be removed prior to entering the field vehicle.

8 REFERENCES

ACGIH. 1996. Threshold Limit Values (TLV) for Chemical Substances and Physical Agents Biological Exposure Indices (BEIs). American Conference of Governmental Industrial Hygienists, Cincinnati, OH.

NewFields. 2015. Site-Specific Health and Safety Plan. Former Frenchtown Mill Site Frenchtown, Montana. NewFields, Missoula, MT.

NIOSH. 1997. National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards. Keller & Associates, Neenah, WI.

OSHA. 1994. 29 CFR Parts 1910 and 1926. Hazardous Waste Operations and Emergency Response. Department of Labor, Occupational Safety and Health Administration. Accessed web site on January 8, 2010. http://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1910

OSHA. 1997. EPA/Labor Superfund Health & Safety Task Force: OSHA Audits of Superfund Sites from 1993 to 1996. Department of Labor, Occupational Safety and Health Administration. August 25, 1997. Accessed web site on January 8, 2010. http://www.osha.gov/SLTC/hazardouswaste/sftaskrpt.html

EXHIBIT 1

DAILY FIELD SAFETY TAILGATE BRIEFING FORM

January 2018

FIELD SAFETY TAILGATE BRIEFING FORM

Corporate Health and Safety Manager:
Matthew Behum
(410) 573-1982 ext. 512

Date: _____ Project name: _____ Project number: _____

Meeting conductor: _____ Site safety officer: _____ Project manager: _____

Items discussed (check all that apply):

- ☐ HSP review and location
- ☐ Lines of authority
- ☐ Chemical hazards and exposure routes
- ☐ Flammable hazards
- ☐ Lifting techniques
- ☐ Buddy system
- ☐ Self and coworker monitoring
- ☐ Biological/plant/animal hazards
- ☐ Slips, trips, and falls
- ☐ Heat and cold stress
- ☐ Overhead hazards
- ☐ Vessel safety protocols
- ☐ Proper use of PPE
- ☐ Safety equipment location
- ☐ Proper safety equipment use
- ☐ Fire extinguisher location
- ☐ Eye wash station location
- ☐ Emergency procedures and evacuation route
- ☐ Directions to hospital
- ☐ Emergency decontamination procedures
- ☐ Site communication
- ☐ Work zones
- ☐ Vehicle safety and driving/road conditions
- ☐ Other: _____

Daily work scope: _____

Site-specific hazards: _____

Weather conditions: _____

Field staff health and safety concerns: _____

Attendees	
Printed Name	Signature

EXHIBIT 2

SAFETY DATA SHEET FOR
ALCONOX

ALCONOX MSDS

Section 1 : MANUFACTURER INFORMATION

Product name: Alconox

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/03/09

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE
497-19-8	7-13	SODIUM CARBONATE	NOT AVAILABLE	4090 MG/KG RAT ORAL 6600 MG/KG MOUSE ORAL	2300 MG/M3/2H RAT INHALATION 1200 MG/M3/2H MOUSE INHALATION
7722-88-5	10-30	TETRASODIUM PYROPHOSPHATE	5 MG/M3	4000 MG/KG RAT ORAL 2980 MG/KG MOUSE ORAL	NOT AVAILABLE
7758-29-4	10-30	SODIUM PHOSPHATE	NOT AVAILABLE	3120 MG/KG RAT ORAL 3100 MG/KG MOUSE ORAL >4640 MG/KG RABBIT DERMAL	NOT AVAILABLE

Section 2A : ADDITIONAL INGREDIENT INFORMATION

Note: (supplier).
CAS# 497-19-8: LD50 4020 mg/kg - rat oral.
CAS# 7758-29-4: LD50 3100 mg/kg - rat oral.

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Solid

Appearance & odor: Almost odourless.
White granular powder.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): Not applicable.

Vapour density (air=1): Not applicable.

By weight: Not available.

Evaporation rate (butyl acetate = 1): Not applicable.

Boiling point (°C): Not applicable.

Freezing point (°C): Not applicable.

pH: (1% aqueous solution).
9.5

Specific gravity @ 20 °C: (water = 1).
0.85 - 1.10

Solubility in water (%): 100 - > 10% w/w

Coefficient of water\oil dist.: Not available.

VOC: None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Not available.

Sensitivity to mechanical impact: Not applicable.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: None

Section 5 : REACTIVITY DATA

Chemical stability: Stable under normal conditions.

Conditions of instability: None known.

Hazardous polymerization: Will not occur.

Incompatible substances: Strong acids.
Strong oxidizers.

Hazardous decomposition products: See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Effects of Acute Exposure

Eye contact: May cause irritation.

Skin contact: Prolonged contact may cause irritation.

Inhalation: Airborne particles may cause irritation.

Ingestion: May cause vomiting and diarrhea.
May cause abdominal pain.
May cause gastric distress.

Effects of chronic exposure: Contains an ingredient which may be corrosive.

LD50 of product, species & route: > 5000 mg/kg rat oral.

LC50 of product, species & route: Not available for mixture, see the ingredients section.

Exposure limit of material: Not available for mixture, see the ingredients section.

Sensitization to product: Not available.

Carcinogenic effects: Not listed as a carcinogen.

Reproductive effects: Not available.

Teratogenicity: Not available.

Mutagenicity: Not available.

Synergistic materials: Not available.

Medical conditions aggravated by exposure: Not available.

First Aid

Skin contact: Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

Inhalation: Remove victim to fresh air.
Seek medical attention if symptoms persist.

Ingestion: Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.
Do not induce vomiting, seek immediate medical attention.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak/Spill: Contain the spill.
Recover uncontaminated material for re-use.
Wear appropriate protective equipment.
Contaminated material should be swept or shoveled into appropriate waste container for disposal.

Waste disposal: In accordance with municipal, provincial and federal regulations.

Handling procedures and equipment: Protect against physical damage.
Avoid breathing dust.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Launder contaminated clothing prior to reuse.

Storage requirements: Keep containers closed when not in use.
Store away from strong acids or oxidizers.
Store in a cool, dry and well ventilated area.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves/Type:

Neoprene or rubber gloves.

Respiratory/Type:

If exposure limit is exceeded, wear a NIOSH approved respirator.

Eye/Type:

Safety glasses with side-shields.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

EXHIBIT 3

JOB HAZARD ANALYSIS
ASSESSMENT FORMS

Job Hazard Analysis (JHA) Assessment Form

JHA Title: Smurfit-Stone/Frenchtown Mill - Biological Tissue Collection	**JHA Number: 2**	**Date:** June 13, 2018
Job Description: Benthic Macroinvertebrate Tissue Collection	**Project Number:** C1300-0501	
General Personal Protective Equipment (PPE) Required: Chest waders, wading boots (non-skid), PFD and nitrile glovee	**JHA Team Names:** Stefan Wodzicki, Jake Wilhelm and to be determined	**Approved by:**
Additional PPE Required: Sunscreen, rain gear and safety glasses		

Job Steps	Photographs	Hazard Type	Potential Hazards	Control Type	Existing Controls	SEV	OCC	EFF	HPN	Control Type	Recommended Controls	SEV	OCC	EFF	HPN
Transport to site and between sample locations		Phys	Traffic	Adm	Administrative control—Safe driving practices	2	2	0.25	**1**			2	2	0.25	**1**
		Phys	Ergonomics—Heavy lifting (material handling)	Adm	Ergonomics—Assisted lifts (>40 lb)										
		Phys	Slip/trip/fall—Same level	Adm	Slip/trip/fall protection—"Eyes on path"										
Macroinvertebrate sample collection using a benthic grab sampler in ponds. Gear deployed from small skiff.		Phys	Ergonomics—Heavy lifting (material handling)	Adm	Buddy system- staff will take turns lifting grab sampler	2	2	0.25	**1**			2	2	0.25	**1**
		Phys	Object or machine that may crush or pinch a body or body part	Adm	Crush/pinch/abrasion protection—"Body out of line of fire"										
		Phys	Overboard	PPE	PPE—PFD					PPE	Staff will wear PFDs				
		Phys	Drowning	PPE	PPE—PFD										
		Env	Environmental—Uneven terrain	Adm	Slip/trip/fall protection—"Eyes on path"										
		Env	Environmental—Adverse weather	Adm	Atmospheric monitoring, suspend work during storms.										
Macroinvertebrate sample collection using a D-Frame kick-net in creeks		Phys	Ergonomics—Highly repetitive musculoskeletal actions	Adm	Sprain/strain protection—Proper lifting techniques / body posture	2	2	0.25	**1**			2	2	0.25	**1**
		Env	Environmental—Uneven terrain	Adm	Slip/trip/fall protection—"Eyes on path"										
		Bio	Slips from algae	PPE	PPE—Non skid wading boots, felt lined and/or studded					PPE	Staff will wear PFDs				
		Phys	Physical—drowning	PPE	PPE—PFD										
		Env	Environmental—Adverse weather	Adm	Atmospheric monitoring, suspend work during storms										
Sample Processing, tissue samples will be shipped using dry ice.		Phys	Ergonomics—Heavy lifting (material handling)	Adm	Buddy system, two people for lifting heavy objects	2	2	0.25	**1**			2	2	0.25	**1**
		Chem	Chemical eye contact	PPE	PPE—Safety glasses, to protect from Alconox decon solution					PPE	Field staff will wear safety glasses and nitrile gloves				
		Env	Environmental—Uneven terrain	Adm	Slip/trip/fall protection—"Eyes on path"										
		Chem	Exposure to splashes or spills of cold material or cryogenic gases	PPE	Hand—Gloves (leather)										
		Phys	Slip/trip/fall—Same level	Adm	Slip/trip/fall protection—"Eyes on path"										

Job Hazard Analysis (JHA) Assessment Form

JHA Title: Smurfit-Stone/Frenchtown Mill - Biological Tissue Collection	**JHA Number:** 1	**Date:** June 13, 2018
Job Description: Fish Tissue Collection	**Project Number:** C1300-0501	
General Personal Protective Equipment (PPE) Required: Chest waders, wading boots (non-skid), PFD, rubber gloves, polarized sunglasses	**JHA Team Names:** Stefan Wodzicki, Jake Wilhelm and to be determined	**Approved by:**
Additional PPE Required: Nitrile gloves, sunscreen and rain gear		

Job Steps	Photographs	Hazard Type	Potential Hazards	Control Type	Existing Controls	SEV	OCC	EFF	HPN	Control Type	Recommended Controls	SEV	OCC	EFF	HPN
Transport to site and between station locations. Motorized vessel to be used for transport between station locations.		Phys	Traffic	Adm	Administrative control—Safe driving practices	2	2	0.25	**1**			2	2	0.25	**1**
		Phys	Overboard	PPE	PPE—PFD					PPE	Field staff will wear PFDs				
		Phys	Physical—Drowning	PPE	PPE—PFD					Adm	Field staff should maintain three points of conact when boat is in motion				
		Phys	Ergonomics—Heavy lifting (material handling)	Adm	Ergonomics—Assisted lifts (>40 lb)										
Backpack Electrofishing		Phys	Ergonomics—Highly repetitive musculoskeletal actions	Adm	Sprain/strain protection—Proper lifting techniques / body posture	3	2	0.25	**1.5**			3	2	0.25	**1.5**
		Env	Environmental—Uneven terrain	Adm	Slip/trip/fall protection—"Eyes on path"										
		Phys	Contact with energized electrical circuits	PPE	Electrical safety—Non-conductive rubber gloves, neoprene waders, non-conductive dip nets					Adm	Buddy system (2 or more including subcontractors)				
		Bio	Slips from algae	PPE	PPE—Non skid wading boots, felt lined and/or studded					PPE	Field staff will wear PFDs				
		Phys	Physical—Drowning	PPE	PPE—PFD					Adm	Pre-shift or use inspection. Backpack electrofishing unit will be inspected for visible damage, corrosion and loose connections				
		Env	Environmental—Adverse weather	Adm	Atmospheric monitoring, suspend work during storms										
Kick netting		Phys	Ergonomics—Highly repetitive musculoskeletal actions	Adm	Sprain/strain protection—Proper lifting techniques / body posture	2	2	0.25	**1**			2	2	0.25	**1**
		Env	Environmental—Uneven terrain	Adm	Slip/trip/fall protection—"Eyes on path"										
		Bio	Slips from algae	PPE	PPE—Non skid wading boots, felt lined and/or studded					PPE	Field staff will wear PFDs				
		Phys	Physical—Drowning	PPE	PPE—PFD										
		Env	Environmental—Adverse weather	Adm	Atmospheric monitoring, suspend work during storms										
Sample Processing and decontamination of equipment		Phys	Ergonomics—Heavy lifting (material handling)	Adm	Buddy system, two people for lifiting heavy objects	2	2	0.25	**1**			2	2	0.25	**1**
		Chem	Chemical eye contact	PPE	PPE—Safety glasses, to protect from Alconox decon solution					PPE	Field staff will wear safety glasses and nitrile gloves				
		Env	Environmental—Uneven terrain	Adm	Slip/trip/fall protection—"Eyes on path"										
		Chem	Exposure to splashes or spills of cold material or cryogenic gases	PPE	PPE—Leather gloves and safety glasses while handling dry ice										
		Phys	Slip/trip/fall—Same level	Adm	Slip/trip/fall protection—"Eyes on path"										

Job Hazard Analysis (JHA) Assessment Form

JHA Title: Smurfit-Stone/Frenchtown Mill - Biological Tissue Collection	**JHA Number:** 3	**Date:** June 13, 2018
Job Description: Small Mammal Tissue Collection	**Project Number:** C1300-0501	
General Personal Protective Equipment (PPE) Required: Safety glasses, half-face dust mask, tyvek suit and nitrile gloves	**JHA Team Names:** Jake Wilhelm and to be determined	**Approved by:**
Additional PPE Required: Steel toe boots and sunscreen		

Job Steps	Photographs	Hazard Type	Potential Hazards	Control Type	Existing Controls	SEV	OCC	EFF	HPN	Control Type	Recommended Controls	SEV	OCC	EFF	HPN
Transport to site and between station locations		Phys	Traffic	Adm	Administrative control—Safe driving practices	2	2	0.25	**1**			2	2	0.25	**1**
		Phys	Ergonomics—Heavy lifting (material handling)	Adm	Sprain/strain protection—Proper lifting techniques / body posture										
		Phys	Slip/trip/fall—Same level	Adm	Slip/trip/fall protection—"Eyes on path"										
		Env	Environmental—Uneven terrain	Adm	Slip/trip/fall protection—"Eyes on path"										
Small mammal tissue collection		Phys	Ergonomics—Awkward postures (static or transient)	Adm	Sprain/strain protection—Proper lifting techniques / body posture	3	2	0.25	**1.5**			3	2	0.25	**1.5**
		Phys	Ergonomics—Heavy lifting (material handling)	Adm	Ergonomics—Assisted lifts (>40 lb)										
		Chem	Exposure to airborne particulates	PPE	PPE—Staff will wear half face dust masks, tyvek suits and nitrile gloves					PPE	Staff will wear half face dust masks, tyvek suits and nitrile gloves				
		Bio	Animal attack/bite	PPE	Hand—Gloves (cut/puncture resistant)					Adm	Housekeeping. All disposable PPE will be placed in garbage bags.				
		Env	Environmental—Adverse weather	Adm	Atmospheric monitoring-suspend work during storms										
Sample processing and decontamination of equipment		Phys	Ergonomics—Heavy lifting (material handling)	Adm	Ergonomics—Assisted lifts (>40 lb)	2	2	0.25	**1**			2	2	0.25	**1**
		Chem	Chemical eye contact	PPE	Head/face—Safety glasses with side shields (ANSI Z71)										
		Chem	Exposure to splashes or spills of cold material or cryogenic gases	PPE	PPE—Leather gloves and safety glasses while handling dry ice.										
		Env	Environmental—Adverse weather	Adm	Atmospheric monitoring-suspend work during storms.										

EXHIBIT 4

HANTAVIRUS INFORMATION

Hantavirus Information

What is Hantavirus?

Hantavirus infects humans and causes a variety of illnesses, most of which are associated with capillary hemorrhaging and/or renal dysfunction. There are many different strains of hantavirus throughout the world. Outside of North America, the suite of diseases caused by hantavirus has been termed hemorrhagic fever with renal syndrome (HFRS). The Seoul Virus, one of the strains which caused HFRS in China and Korea, was probably introduced into United States port cities by the Norway rat (*Rattus norvegicus*). Another strain, Prospect Hill Virus (PHV), was isolated in the United States in the 1980's and was identified as the first autochthonous (indigenous) hantavirus in North America, although it has not yet been shown to cause human disease. In 1993, a mysterious outbreak of pulmonary illnesses and deaths in the southwestern United States was linked to another strain of hantavirus, which was later named Sin Nombre Virus (SNV). Since 1993, additional strains of hantavirus similar to SNV have been identified in North America. In humans, infection by SNV and related strains causes an often fatal disease called hantavirus pulmonary syndrome (HPS) (Mills *et al.* 1995). It is the SNV and related strains of hantavirus which are of primary concern when trapping, handling, and dissecting small mammals.

Hantavirus in the United States

Since the 1993 hantavirus outbreak in New Mexico, the disease has spread rapidly to other parts of the country. HPS was initially a concern primarily in the western states, but it has now been confirmed in many eastern states, including Louisiana, Florida, Indiana, West Virginia, Virginia, New York, Rhode Island, and Pennsylvania (Mills *et al.* 1995, Devlin 1997, Wlazelek 1998). Due to the rapid spread of the virus, it should be assumed that it may be present anywhere in the contiguous United States.

Prinicipal Hosts

The primary host of SNV is the deer mouse (*Peromyscus maniculatus*), which is found across most of the United States. Other hosts which have been confirmed as carriers of related strains of the virus, and which have been linked to HPS in North America, include the cotton rat (*Sigmodon hispidus*), and more recently, the white-footed mouse (*Peromyscus leucopus*) and the rice rat (*Orzomys palustris*). In addition, serological evidence of infection has been found in chipmunks (*Tamias* spp.), western harvest mice (*Reithrodontomys megalotis*), California voles (*Microtus californicus*), meadow voles (*M. pennsylvanicus*), pinon mice (*P. truei*), and brush mice (*P. boylii*) (Mills *et al.* 1995, CDCP 1996, CDCP 2000).

Hantavirus Information (cont)

Exposure Routes

Hantavirus can be transmitted through the urine, feces, saliva, and fresh organs of its rodent hosts. The primary exposure route for humans is via inhalation of aerosols or dusts contaminated with rodent urine, feces, saliva, or fresh tissue. However, the virus can also be introduced into the body via mucous membranes broken skin, and possibly by accidental ingestion with food or water. People may also be infected by being bitten by rodents (Mills *et al.* 1995).

Symptoms and Effects of Exposure

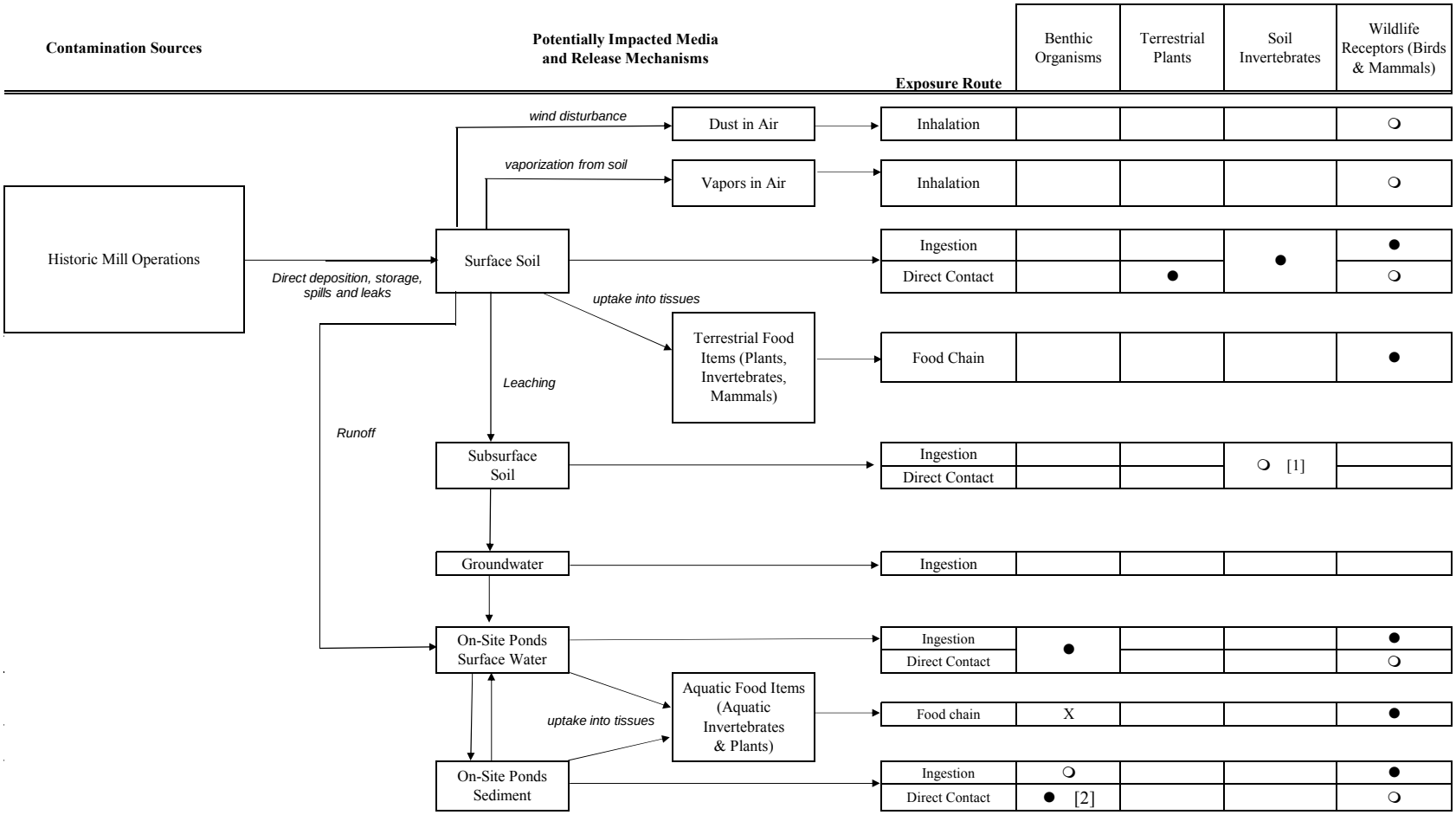
Although hantavirus appears harmless to its rodent hosts, it can cause severe illness and often death in humans who have been infected by it. People who are infected develop initial symptoms of HPS within 1to 6 weeks of initial exposure. Early symptoms often include a high fever (101 degrees Fahrenheit or above), muscle aches, headache, cough, abdominal pain, nausea, vomiting, and diarrhea. Symptoms do not include sore throat, runny nose, or watery eyes (Bradshaw 1994, Mills *et al.* 1995, Wlazelek 1998). Patients can also exhibit an increased heart rate and abnormal blood counts (Wlazelek 1998). Early symptoms are either accompanied or followed by shortness of breath, and, in approximately 50% of the cases, death ensues due to respiratory failure (Bradshaw 1994).

Respiratory failure is the result of leaking capillaries in the lungs causing the lungs to rapidly fill with blood. It can develop shortly after the onset of shortness of breath, sometimes in a matter of hours (Mandelbaum-Schmid 1993). Therefore, early detection of the disease, and thus early hospitalization, greatly increases the chances of survival. If a person who has been trapping, handling, dissecting, or otherwise coming in contact with small mammals' experiences symptoms within 45 days of potential exposure, they should seek medical attention immediately. The medical provider should be notified of the person's contact with small mammals and the possibility of hantavirus infection. Blood samples should be taken and sent through the state health department to the CDCP to be tested for the hantavirus antibody. If a person has difficulty breathing, he/she should be taken to the emergency room immediately and the hospital staff should be alerted of his/her potential exposure to hantavirus (CDCP 1996).

APPENDIX C

EPA'S CONCEPTUAL SITE MODELS OF ECOLOGICAL EXPOSURE PATHWAYS

Figure 4-1 Conceptual Site Model for Ecological Exposure at OU2



LEGEND

●	Pathway is complete and might be significant.
❍	Pathway is complete, but is relatively minor.
X	Pathway is complete and may be significant, but insufficient data (exposure or toxicity) are available for quantitative evalution.
	Pathway is not complete.

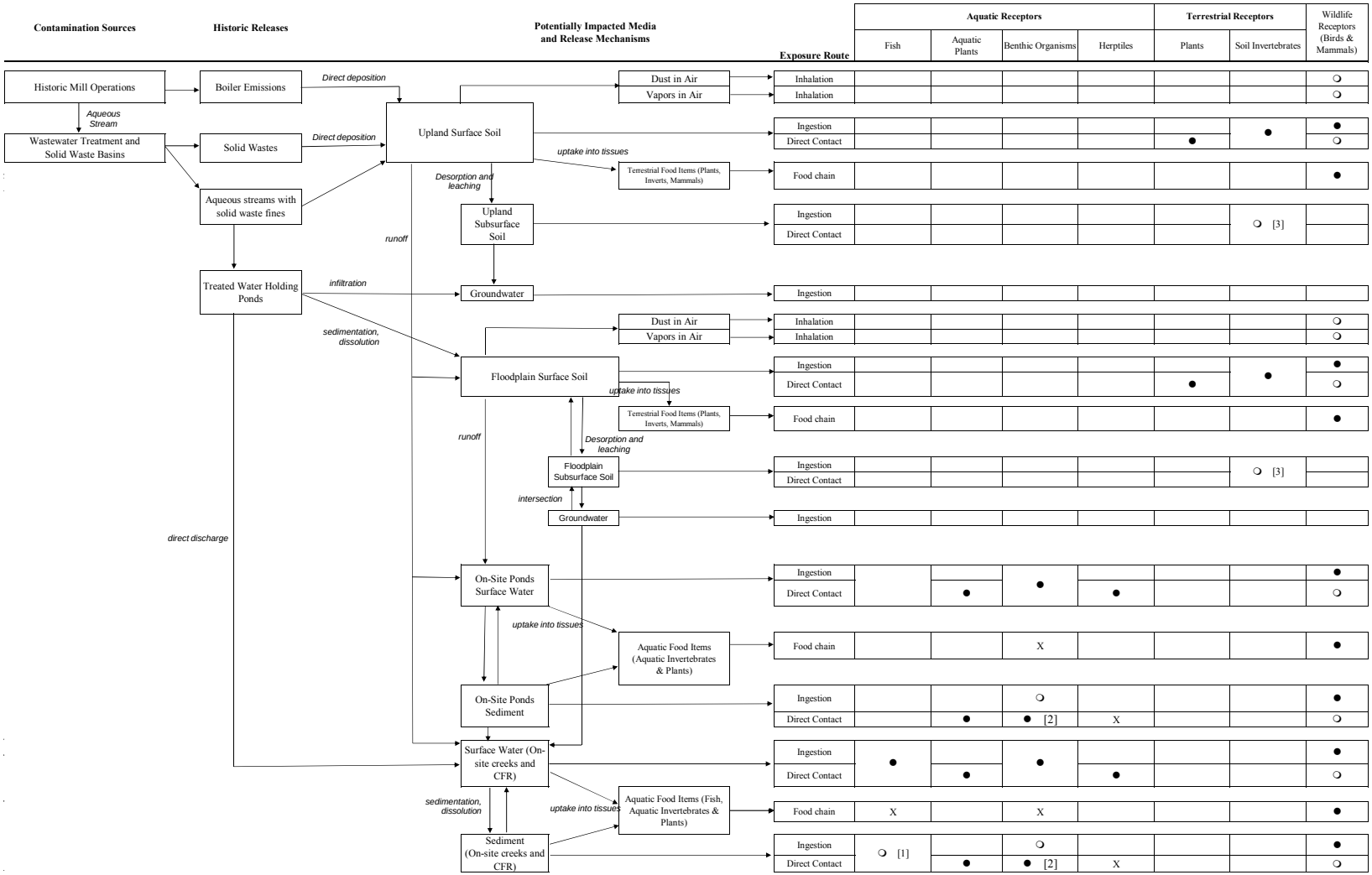
NOTES

Direct contact exposures include dermal contact, root uptake, respiration, and/or osmotic exchange.

[1] USEPA (2015) guidance recommends sampling to a depth of approximately 25-30 cm to capture the average biologically active zone (soil biota). Surface soil samples have been collected at 0-7 inches (0-18 cm). Subsurface samples have been collected at depths greater than 1 foot below ground surface. However, statistical testing has found that concentrations in surface soils are comparable or higher than concentrations in subsurface samples (alpha = 0.05). Thus, quantification of ecological exposures to surface soils is expected to be representative and/or protective of exposures to subsurface soils.

[2] In most cases, toxicity values for exposure of BMI to sediments likely include at least some contribution from the ingestion pathway, so direct contact and ingestion of benthic macroinvertebrates are usually evaluated together.

Figure 4-2. Conceptual Site Model for Ecological Exposures at OU3



LEGEND

●	Pathway is complete and might be significant; quantitative evaluation.
❍	Pathway is complete, but is relatively minor; semi-quantitative evaluation.
X	Pathway is or may be complete, however, data for quanitative evaluation may be lacking.
	Pathway is not complete; no evaluation required.

NOTES

Direct contact exposures include dermal contact, root uptake, respiration, and/or osmotic exchange.

[1] Believed to be a minor pathway compared to risks from direct contact with surface water, but may be important for contaminants that bioaccumulate.

[2] In most cases, toxicity values for exposure of BMI to sediments likely include at least some contribution from the ingestion pathway, so direct contact and ingestion of benthic macroinvertebrates are usually evaluated together.

[3] USEPA (2015) guidance recommends sampling to a depth of approximately 25-30 cm to capture the average biologically active zone (soil biota). Surface soil samples have been collected at 0-7 inches (0-18 cm). Subsurface samples have been collected at depths greater than 1 foot below ground surface. However, statistical testing has found that concentrations in surface soils are comparable or higher than concentrations in subsurface samples (alpha = 0.05). Thus, quantification of ecological exposures to surface soils is expected to be representative and/or protective of exposures to subsurface soils.