Thompson Falls Hydroelectric Project
FERC Project No. 1869
NorthWestern Energy's Proposed Study Plan

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List of Abbreviations and Acronyms

2D	two-dimensional
3D	three-dimensional
APE	Area of Potential Effect
ARM	DEQ Administrative Rules of Montana
BO	Biological Opinion
°C	degrees Celsius
CAD	Computer Aided Design
CFD	computational fluid dynamics
cfs	cubic feet per second
DEM	digital elevation model
DEQ	Montana Department of Environmental Quality
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
flow	Project discharge
ft/hr	feet per hour
FWP	Montana Fish, Wildlife and Parks
FWS	U.S. Fish and Wildlife Service
GBT	gas bubble trauma
GIS	geographic information system
H-A&E	Historic Architectural and Engineering Properties
HAP	Historic Archaeological Properties
High Bridge	below the Main Channel Dam
ILP	FERC's Integrated Licensing Process
Licensee	NorthWestern Energy
LiDAR	Light Detecting and Ranging
MW	megawatt
n	number
National Register	National Register of Historic Places
NOAA	National Oceanic and Atmospheric Administration
NorthWestern	NorthWestern Energy
PAD	Pre-Application Document
Panel	Thompson Falls Scientific Review Panel
PAP	Prehistoric and Historic Archaeological Properties
pH	hydrogen ion concentration
PIT	passive integrated transponder
Project	Thompson Falls Hydroelectric Project
PSP	Proposed Study Plan
Relicensing Participants	local, state, and federal governmental agencies, Native American Tribes, local landowners, non-governmental organizations, and other interested parties.
RSP	Revised Study Plan
Scientific Panel	Thompson Falls Scientific Review Panel
SD1	Scoping Document 1
SHPO	Montana State Historic Preservation Office
SOI	Secretary of the Interior
TAC	Technical Advisory Committee
TCs	Terms and Conditions

TDG	total dissolved gas
TDG Plan	Total Dissolved Gas Control Plan
Thompson Falls Project	Thompson Falls Hydroelectric Project
TIN	Triangular Irregular Networks
U.S.	United States
USFS	United States Forest Service
ZOP	zone of passage

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1. Introduction

1.1 Project Background

The Thompson Falls Hydroelectric Project (Thompson Falls Project or Project) is located on the Clark Fork River in Sanders County, Montana. Preliminary development of the Thompson Falls Project began in June 1912, by the Thompson Falls Power Company. Construction commenced in May 1913 and the first generating unit was placed in service on July 1, 1915. The sixth generating unit was placed in service in May 1917. The Project has been operating continuously since 1915.

Non-federal hydropower projects in the United States (U.S.) are regulated by the Federal Energy Regulatory Commission (FERC) under the authority of the Federal Power Act. Montana Power Company acquired the Thompson Falls Project in 1929. The original license for the Thompson Falls Project was issued effective January 1, 1938 and expired on December 31, 1975. The current FERC License was issued to the Montana Power Company in 1979. The Project was purchased by (and FERC License transferred to) PPL Montana in 1999 and then purchased by (and FERC License transferred to) NorthWestern Corporation, a Delaware corporation, d/b/a NorthWestern Energy (NorthWestern or Licensee) in 2014. An order amending the License was issued in 1990 allowing for construction of an additional powerhouse and generating unit, which was subsequently completed in 1995. With the addition of this new (second) powerhouse, the Project has a total generating capacity of 92.6 megawatts (MW).

The current FERC License expires December 31, 2025. As required by the Federal Power Act and FERC's regulations, on July 1, 2020 NorthWestern filed a Notice of Intent to relicense the Thompson Falls Project using FERC's Integrated Licensing Process (ILP). Concurrently, NorthWestern filed a Pre-Application Document (PAD).

The ILP is FERC's default licensing process which evaluates effects of a project based on a nexus to continuing Project operations. In general, the purpose of the pre-filing stage of the ILP is to inform Relicensing Participants[1] about relicensing, to identify issues and study needs (based on a project nexus and established FERC criteria), to conduct those studies per specific FERC requirements which will be defined in the FERC Study Plan Determination, and to prepare the Final License Application.

[1] Local, state, and federal governmental agencies, Native American Tribes, local landowners, non-governmental organizations, and other interested parties.

1.2 Study Plan Development Process

Before filing a Final License Application with FERC, applicants conduct a pre-license application filing process that consists of 1) presenting the project to Relicensing Participants; 2) consulting with those Relicensing Participants; 3) identifying issues; and 4) conducting studies and gathering relevant information.

Under FERC regulations, NorthWestern is required to submit a PAD 5 to 5.5 years prior to the expiration of the current License (December 31, 2025). NorthWestern filed the PAD July 1, 2020.

On August 28, 2020, FERC issued Scoping Document 1 (SD1) which included a preliminary list of issues to be addressed in FERC's environmental analysis for its relicensing of the Project pursuant to the National Environmental Policy Act. In accordance with its ILP regulations, FERC also requested that Relicensing Participants identify studies that would provide pertinent information for the environmental assessment. The deadline for filing study requests was October 27, 2020.

As specified by 18 CFR § 5.9(b)(5) of FERC's ILP regulations, a study request must explain "…how the study results would inform the development of license requirements." NorthWestern has concluded that the studies in this Proposed Study Plan will provide information which will assist in assessing effects of the Project and inform potential future license conditions.

FERC will make the final determination on studies to be conducted. FERC's process and schedule for making that determination is described in **Table 1-1**.

Table 1-1: Thompson Falls anticipated Study Plan Determination schedule
(NorthWestern activities in white, FERC activities in green, Relicensing Participant participation opportunities in orange).

Activity	Comment	Date	Timeline
NorthWestern files Proposed Study Plan (PSP) incorporating Relicensing Participants input on PAD.	This document.	12/11/2020	45 days after comment deadline for SD1.
Study Plan Meetings.	For the purpose of discussing the PSP and any information gathering or study requests, and to resolve any outstanding issues with respect to the PSP.	Scheduled for 1/6/2021[2]	30 days after PSP filed.

[2] Must be held no later than 1/11/2021

Activity	Comment	Date	Timeline
Relicensing Participants Comments on PSP Due.	This filing must also include an explanation of any study plan concerns and any accommodations reached regarding those concerns.	3/11/2021	90 days after PSP filed.
NorthWestern Files Revised Study Plan (RSP) incorporating Relicensing Participants input on the PSP.	The RSP includes comments on the PSP and efforts made to resolve any differences over study requests. If NorthWestern does not adopt a requested study, an explanation is included in the RSP as to why the request was not adopted.	4/12/2021[3]	30 days after comment deadline on PSP.
Relicensing Participants Comments on RSP Due.	Comment period.	4/27/2021	15 days after RSP filed.
FERC Study Plan Determination[4].		5/12/2021	30 days after RSP filed.

FERC's Study Plan Determination will be based on the following seven study criteria (18 CFR § 5.9(b)), which must be met by the Licensee and Relicensing Participants in their proposed studies:

- The goals and objectives of each study proposal and the information to be obtained;
- The relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- Relevant public interest considerations in regard to the proposed study;
- Existing information concerning the subject of the study proposal, and the need for additional information;
- The nexus between project operations and effects on the resource to be studied, and how the study results would inform the development of license requirements;

[3] Deadline is 30 days after the comment period on the PSP, which is 4/10/2021, a Saturday. Therefore, the filing deadline moves to the next business day, 4/12/2021.

[4] Agencies and Tribes with mandatory conditioning authority may request the use of a formal dispute resolution process regarding FERC's Study Plan Determination. Within 20 days of the Study Plan Determination, any federal agency or Tribe with authority to include mandatory conditions in a license may file a notice of study dispute with respect to studies pertaining directly to the exercise of their authorities under sections 4(e) and 18 of the Federal Power Act or section 401 of the Clean Water Act.

- How any proposed study methodology (including any preferred data collection and analysis techniques), or objectively quantified information, and a schedule including appropriate field season(s) and the duration is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge, and;
- Considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

1.3 Proposed Study Plan

In the PAD, NorthWestern identified preliminary issues and studies for certain resources based on existing and relevant information, baseline conditions, and current and proposed future operations. NorthWestern identified eight studies in the PAD that NorthWestern is including in this Proposed Study Plan. In response to requests for studies submitted by the U.S. Forest Service (USFS) and Montana Fish, Wildlife and Parks (FWP), NorthWestern is proposing to add one additional study to the eight proposed in the PAD, a study of Westslope Cutthroat Trout Genetics.

The nine studies included in this Proposed Study Plan are:

- Operations Study: A study of operational scenarios to provide flexible capacity and the potential impact of those operational scenarios on Project resources in the Project reservoir and below the powerhouses.
- Total Dissolved Gas (TDG): A study of TDG in the Project reservoir, below the Main Channel Dam, and at the Birdland Bay Bridge.
- Water Quality: A study of water temperature, water chemistry, and turbidity in the Project reservoir, below the powerhouses, and at the Birdland Bay Bridge.
- Hydraulic Conditions: A hydraulics study to characterize a depth-averaged velocity field and water depths between the Main Channel Dam and the High Bridge (below the Main Channel Dam).
- Fish Behavior: Radio telemetry study of salmonids to evaluate movement paths/rates and behavior in response to hydraulic conditions, from downstream of the powerhouses to the Main Channel Dam.
- Downstream Transport of Bull Trout: A study to test collecting and transporting juvenile Bull Trout from the Thompson River to Lake Pend Oreille.
- Visitor Use Survey: A study surveying recreationists at the 10 recreation sites related to the Project on or near the reservoir and the Clark Fork River below the dams.
- Cultural Resources: A study to update the inventory of the Historic Architectural and Engineering Properties (H-A&E) and to identify areas where there is a high probability

for the occurrence of prehistoric or historic archaeological properties within the proposed Area of Potential Effect.

- Westslope Cutthroat Trout Genetics. A study to confirm visual identification of *Oncorhynchus* sp. and to assess the amount of hybridization of *Oncorhynchus* sp. collected in the fish passage facility.

Study Schedule

FERC's regulations specify certain milestones in the implementation of a FERC Study Plan Determination, as shown in **Table 1-2**.

Table 1-2: Thompson Falls anticipated study plan implementation schedule
(NorthWestern activities in white, FERC activities in green, Relicensing Participant participation opportunities in orange)**.**

Activity	Comment	Due Date	Timeline
FERC Issues Study Plan Determination	If no disputes are filed within 20 days of Study Plan Determination, the Study Plan Determination is considered final.	5/12/2021	Within 30 days from Filing Revised PSP
First Study Season	Studies required by the Study Plan Determination.	5/12/2021–5/12/2022	
Initial Study Report	NorthWestern prepares and files with FERC an Initial Study Report describing progress in implementing the study plan, data collected, and any variance from the study plan or schedule. The report must also include any modifications to ongoing studies or new studies proposed.	5/12/2022	No later than 1 year from Study Determination
Initial Study Report Meeting	Meeting with Relicensing Participants and FERC to discuss the study results and any proposals to modify the study plan.	5/27/2022	Within 15 days from Initial Study Report
Initial Study Report Meeting Summary	NorthWestern prepares and files a meeting summary, including any modifications to ongoing studies or new studies. Any proposal to modify an ongoing study or add a new study must be accompanied by a showing of good cause why the proposal should be approved.[5]	6/11/2022	Within 15 days from Study Meeting
Second Study Season	For those studies in the Study Plan Determination that require two study seasons.	5/12/2022–5/12/2023	2 years from Initial Study Determination

[5] Any participant or the FERC staff may file a disagreement concerning the applicant's meeting summary within 30 days, setting forth the basis for the disagreement. This filing must also include any modifications to ongoing studies or new studies proposed by FERC staff or other participant.

Activity	Comment	Due Date	Timeline
Updated Study Report Due	NorthWestern files an updated study report describing overall progress in implementing the study plan, data collected, including an explanation of any variance from the study plan and schedule. The report must also include any modifications to ongoing studies or new studies proposed by NorthWestern.	5/12/2023	2 years from Initial Study Determination
Updated Study Report Meeting	Same purpose as Initial Study Report Meeting	5/27/2023	Within 15 days from Updated Study Report
Updated Study Report Meeting Summary	Same purpose as Initial Study Report Meeting Summary[6]	6/12/2023	Within 15 days from Study Meeting

A study specific schedule is in **Table 1-3**. Details of the reporting schedule for each study are included in the study plans in Sections 2 through 10.

[6] The review, comment, and disagreement resolution provisions for the Initial Study Report apply to the Updated Study Report.

Table 1-3: Study Plan Schedule

Activity	1-Operations Study	2-Total Dissolved Gas	3-Water Quality	4- Hydraulic Conditions	5- Fish Behavior	6-Downstream Transport of Bull Trout	7-Visitor Use Survey	8-Cultural Resources Inventory, Evaluation, and Examination of Potential Effects	9-Westslope Cutthroat Trout Genetics
Preparatory Work	Baseline Shoreline Condition Assessment, fall 2020	Set up of monitoring equipment, spring 2021	March 2021 sampling	None anticipated	Planning, acquiring equipment, testing equipment and procedures Jan - May 2021	Operation of currently installed PIT tag antenna arrays	Finalize survey schedule, survey technician training, April–May 2021	None anticipated	Samples taken at fish ladder in 2021
FERC Study Plan Determination anticipated May 12, 2021.									
First Study Season	Test and monitor operational scenarios, July–Sept 2021	High flow TDG monitoring, May–June 2021	Quarterly sampling, June, Sept and Dec, 2021	Bathymetry and Phase 1, 2D Modeling Aug–Nov 2021, Phase 2 modeling Jan–April 2022	Brown Trout radio telemetry, June–Nov 2021	July through Aug: PIT tagging Bull Trout; Oct through Nov: juvenile Bull Trout capture and transport	Conduct survey, May 2021–Sept 2021	Inventory H-A&E properties. Development of archeological model, June–Sept 2021	Samples taken at fish ladder during the 2021 season
Interim Reporting	None anticipated	None anticipated	None anticipated	Phase 1 Modeling Report and Phase 2 Modeling Plan Nov 2021	None anticipated	None anticipated	None anticipated	Archeological model report Nov, 2021	None anticipated
Initial (or Final) Study Report, 1 year after FERC Study Plan Determination (assumed to be May 12, 2022)	Results of operations study	Results of 2021 monitoring	Results of 2021 sampling	Phase 1 and 2 modeling results	Results of radio tracking to-date	Results of study to-date	Results of data collected in 2021, and comparison to previous surveys	Results of reinventory of H-A&E properties	Results of 2021 sampling
Study Report Meeting, 15 days after Initial Study Report									
Study Report Meeting Summary, 15 days after Initial Study Report Meeting									

Activity	1-Operations Study	2-Total Dissolved Gas	3-Water Quality	4- Hydraulic Conditions	5- Fish Behavior	6-Downstream Transport of Bull Trout	7-Visitor Use Survey	8-Cultural Resources Inventory, Evaluation, and Examination of Potential Effects	9-Westslope Cutthroat Trout Genetics
Second Study Season	None anticipated	TDG monitoring during high flows, May–June 2022	Quarterly sampling March, June, Sept, and Dec, 2022	None anticipated	Rainbow Trout radio telemetry, March to July 2022	July–Aug: PIT tagging Bull Trout; Oct–Nov: West Fork Thompson River, Fishtrap Creek juvenile Bull Trout capture and transport.	None anticipated	Inventory phase of Prehistoric and Historic Archaeological Properties (PAP and HAP) identification	None anticipated
Revised Study Report, 2 years after FERC Study Plan Determination	None anticipated	Results of TDG monitoring	Results of water quality sampling	None anticipated	Final report on Rainbow and Brown Trout radio telemetry and literature review of fish swimming capabilities.	Final report on tagging and transport.	None anticipated	Results of PAP and HAP inventory	None anticipated
Study Report Meeting, 15 days after Revised Study Report									
Study Report Meeting Summary, 15 days after Revised Study Report Meeting									

1.4 Proposed Study Plan Meeting

Pursuant to 18 CFR § 5.11(e), NorthWestern Energy is hosting a meeting to discuss the studies NorthWestern is proposing as part of the relicensing of the Project. Due to FERC travel restrictions and health and safety concerns related to COVID-19, the meeting will be held virtually on the ZOOM platform on January 6, 2021 beginning at 9:00 am MST. For those unable to attend during the day, NorthWestern is also offering an evening meeting starting at 6:00 pm MST. Relicensing Participants are welcome to join either meeting for some or all of the discussion. NorthWestern will present the studies and provide opportunities for participants to make comments and ask questions. Representatives from FERC will attend the daytime meeting only. The evening meeting will include the same content as the daytime meeting on an abbreviated schedule.

Directions for joining the meeting via Zoom

Join by Computer for Visual and Audio:

1. Click the link: https://zoom.us/j/91979519428
2. Join with Computer Audio (**highly recommended**)
    a. If your computer does not have audio capability, please join the audio by phone. To join the audio by phone, click **Join by Phone**. **Dial (669) 900 6833** after using the number and participant ID that appears on the prompt after clicking the link.
    b. **Meeting ID: 919 7951 9428; Password: 209133**.

Join by iPad or Tablet for Visual and Audio:

1. To join the visual and audio components of the meeting by tablet, download the Zoom app first. The app is free. Links to download the app are here: (Amazon Fire; iPad; Google Play).
2. Once the app has downloaded, click the link and follow the prompts: https://zoom.us/j/91979519428
3. Join with Tablet Audio (**highly recommended**)
    a. If your tablet does not have audio capability, please join the audio by phone. To join the audio by phone, click **Join by Phone**. **Dial (669) 900 6833** after using the number and participant ID that appears on the prompt after clicking the link.
    b. **Meeting ID: 919 7951 9428; Password: 209133**.

Join by Smartphone for Visual and Audio:

1. To join the visual and audio components of the meeting by smartphone, download the Zoom app first. The app is free. Links to download the app are here: (iPhone; Google Play).
2. Once the app has downloaded, click the link and follow the prompts to join both the audio and visual: https://zoom.us/j/91979519428

Join by Phone for Audio Only:

1. You do not need to download the app to participate in the meeting for audio-only. **Dial (669) 900 6833; Meeting ID: 919 7951 9428; Password: 209133**.

Daytime Meeting Agenda January 6, 2021

Start Time	Topic
9:00 AM	Introduction and Zoom tips, Overview of the FERC Process
9:25 AM	Operations Study
10:25 AM	BREAK (10 minutes)
10:35 AM	Tailrace Fish Behavior and Hydraulic Conditions Studies
11:35 AM	Downstream Transport of Bull Trout Study
12:05 PM	Westslope Cutthroat Trout Genetics
12:25 PM	BREAK (30 minutes)
12:55 PM	Water Quality and Total Dissolved Gas
1:25 PM	Visitor Use Survey
1:45 PM	Cultural Resources Study
2:00 PM	Adjourn

Evening Meeting Agenda January 6, 2021

Start Time	Topic
6:00 PM	Introduction and Zoom tips
6:45 PM	Tailrace Fish Behavior and Hydraulic Conditions Studies
6:55 PM	Downstream Transport of Bull Trout Study & Westslope Cutthroat Study
7:15 PM	Water Quality and Total Dissolved Gas
7:30 PM	Visitor Use Survey
7:45 PM	Cultural Resources Study
8:00 PM	Adjourn

2. Proposed Study 1 Operations Study

The Project is operated to provide baseload and flexible generation within the reservoir elevation and minimum flow requirements of the License issued by FERC. During flexible generation operations, the Licensee may use the top 4 feet of the reservoir while maintaining minimum flows.

NorthWestern is proposing that the Project continue to provide the baseload generation and flexible capacity needs required by NorthWestern's electric system and further proposes using the top 2.5 feet of the reservoir to meet these requirements. While an authorized use of 2.5 feet is substantially less than the current authorized use of 4 feet, it will provide flexibility needed.

NorthWestern is proposing a study of project operations, including evaluating generation changes at multiple reservoir elevations for multiple durations, allowing the resulting reservoir fluctuations to be observed and studied for potential impacts on Project resources. Operational scenarios for the study will be within the 2.5 feet of flexible reservoir elevation while maintaining minimum flows.

2.1 Goals and Objectives of Study

The goal of the study is to understand the effects of Project operations authorized under the current license and to evaluate possible impacts on project resources.

The following resource areas will be monitored during the study and evaluated as part of development of the Final License Application, with these specific objectives:

Operations: The study will simulate operational scenarios of flexible capacity that could be implemented at the Project. Objectives are to evaluate flexible operational scenarios to determine plant generation outputs, rate, and degree of reservoir elevation changes that may result from these flexible operations.

Shoreline Stability: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on shoreline stability around the reservoir. The objective of the monitoring is to identify any specific locations where Project-induced erosion may occur.

Fisheries: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on fish populations, fish access to tributary streams, and to the operation of the Project's fish passage facility.

Recreation and Aesthetics: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on public and private boat launches and docks within the Project boundary, and the aesthetic qualities of the reservoir.

Public Safety: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on the Project's public safety including changing water levels in the Project reservoir and below the powerhouse.

Water Quality: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on water quality in the Project reservoir, below the powerhouses and downstream at Birdland Bay Bridge.

Wetland/Riparian Habitats: Data collected during this study will be evaluated to determine what if any effects the study's operational scenarios have on wetland and riparian areas within and adjacent to the Project boundary.

Cultural: Data collected during this study will be evaluated to determine what, if any, effects the study's operational scenarios have on three previously recorded cultural properties located in the reservoir fluctuation zone[7] and exposed in shoreline embankments at the face of the backshore zone.[8]

2.2 Study Description

The Operations Study will simulate operational scenarios of flexible capacity at the Project. The study will be implemented in three phases, each with different levels of generation and corresponding raising and lowering of the reservoir. Changes in operations for the purposes of the study will occur within the top 2.5 feet of the reservoir and will maintain a minimum flow of 6,000 cubic feet per second (cfs) downstream of the Project. The three phases of study will be scheduled when flows would typically allow for flexible operations at the Project. This will facilitate observation of resource impacts during the season when they would most likely occur.

Methods

The Operations Study will be implemented in three phases, each with differing magnitudes of operational changes in generation. Reservoir elevation will be reduced, increased, and held stable relative to the operational scenario being tested. By the end of the three-phase study, the reservoir will have been held static at every half foot elevation for the top 2.5 feet for extended observation (**Figures 2-1 – 2-3**). During each of the three study phases change in reservoir elevation will be observed and recorded. The public will be notified of the study dates prior to the study.

Methods for each resource area to be studied are described below.

[7] Fluctuation Zone refers to lands exposed by any reservoir drawdown.
[8] Backshore Zone refers to the lands lying beyond the full reservoir contour of a reservoir.

Operations

Each phase will consist of multiple daily operations for a continuous week (7 days). A minimum of 2 weeks will be spaced between phases to reestablish a baseline condition in preparation for the subsequent phase of testing.

For each 7-day phase of the study, two to four specific operations, randomly ordered, will be conducted each day between 7 am and 5 pm (MST). Discrete operations of short-term generational changes that may be implemented to simulate flexible generation for each phase of the study are described below. The discrete operations described for each phase will be mixed over the 7 days to simulate NorthWestern's needs for transmission grid regulation. A minimum of two 0.5-foot static hold elevations will be maintained for a minimum of 4 hours within each phase.

The following operations will be used for the purposes of this study:

Phase 1 – 20 MW Generation change

20 MW increase in generation for 30 minutes

20 MW increase in generation for 90 minutes

20 MW decrease in generation for 30 minutes

20 MW decrease in generation for 90 minutes

Phase 2 – 40 MW Generation change

40 MW increase in generation for 30 minutes

40 MW increase in generation for 90 minutes

40 MW decrease in generation for 30 minutes

40 MW decrease in generation for 90 minutes

Phase 3 – Maximum[9] Generation Capacity change

Maximum available increase in generation for 30 minutes

Maximum available increase in generation for 90 minutes

Maximum available decrease in generation for 30 minutes

[9] Maximum capacity change will be determined at the time of the test based on available units in the plant and river baseflow.

Maximum available decrease in generation for 90 minutes

The following graphs are a simulation of what reservoir elevations may be during the three phases of the Operations Study. These graphs illustrate the random schedule of increasing and decreasing generation, combined with static holds to evaluate conditions at varying reservoir elevations.

Figure 2-1. Example of potential reservoir elevations during Phase 1 of Operations Study.

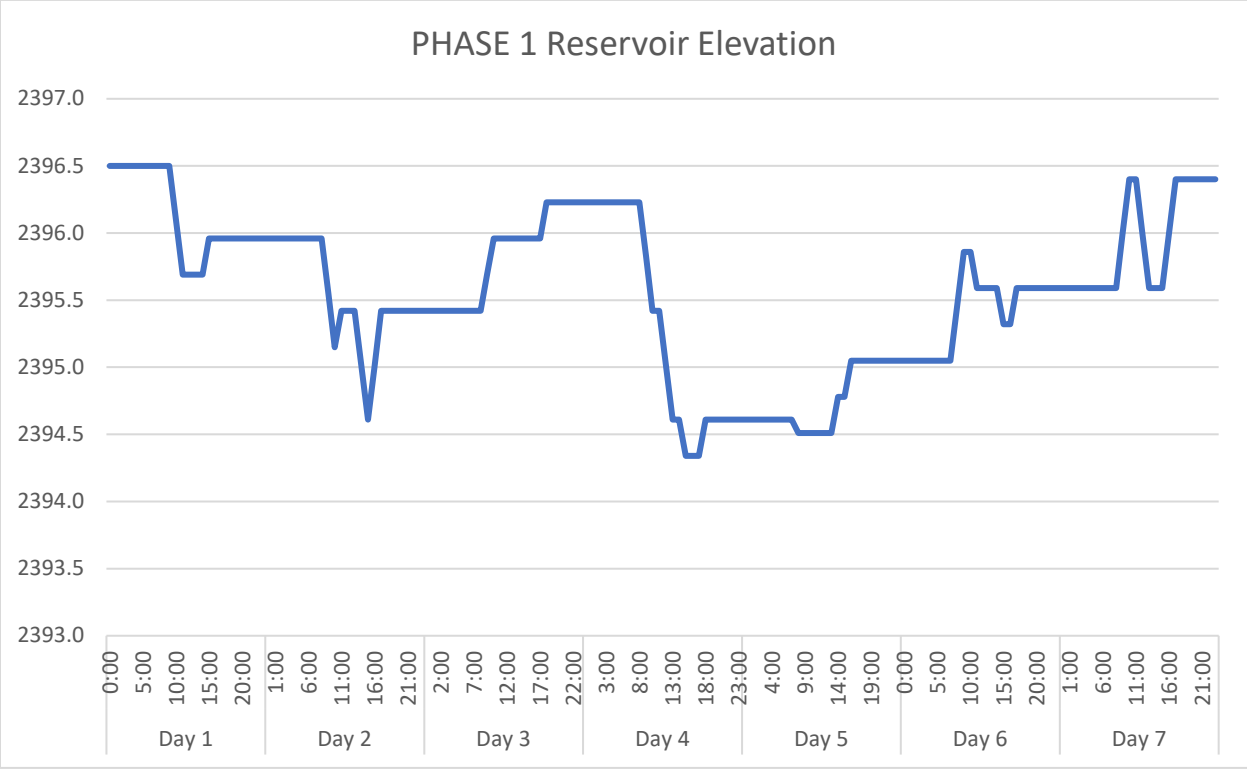


Figure 2-2. Example of potential reservoir elevations during Phase 2 of Operations Study.

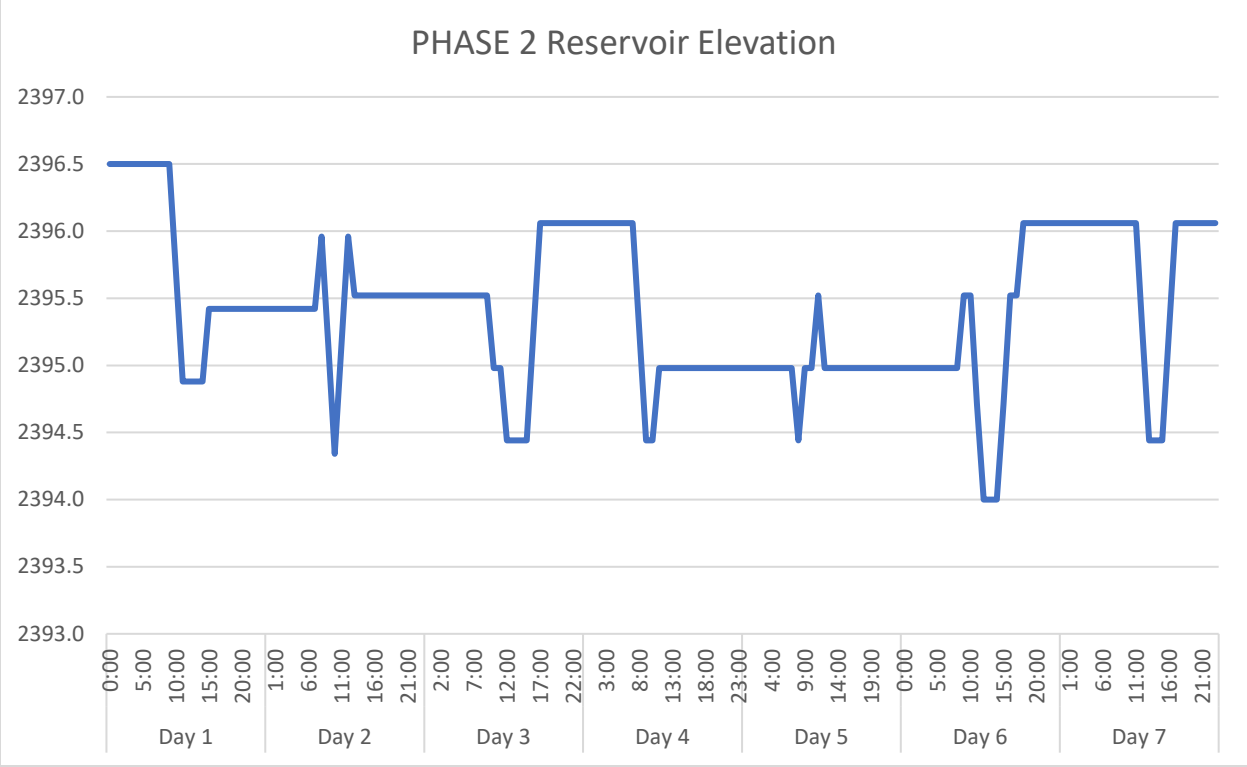
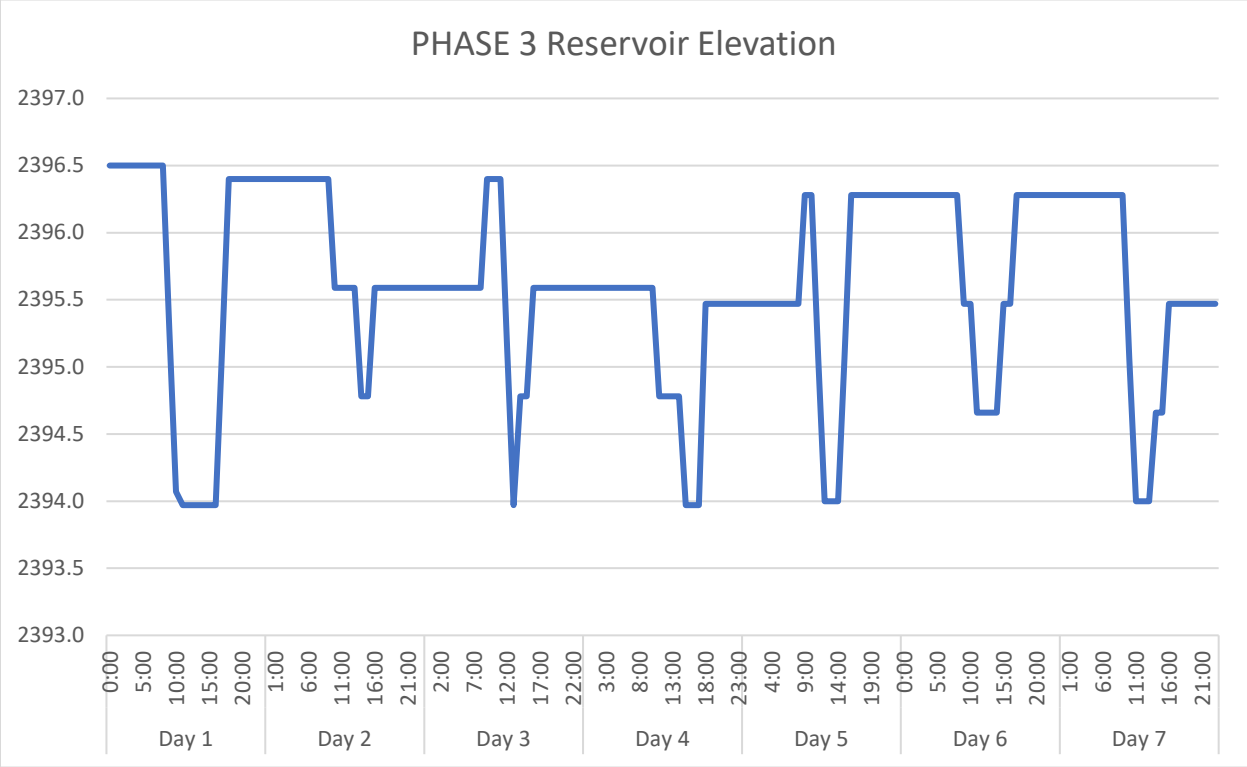


Figure 2-3. Example of potential reservoir elevations during Phase 3 of Operations Study.



The raising and lowering of the reservoir will be controlled by increasing or decreasing generation . Actual reservoir elevation changes will be dependent on the inflows to the Project at the time each phase is implemented.

Shoreline Stability

Study Area

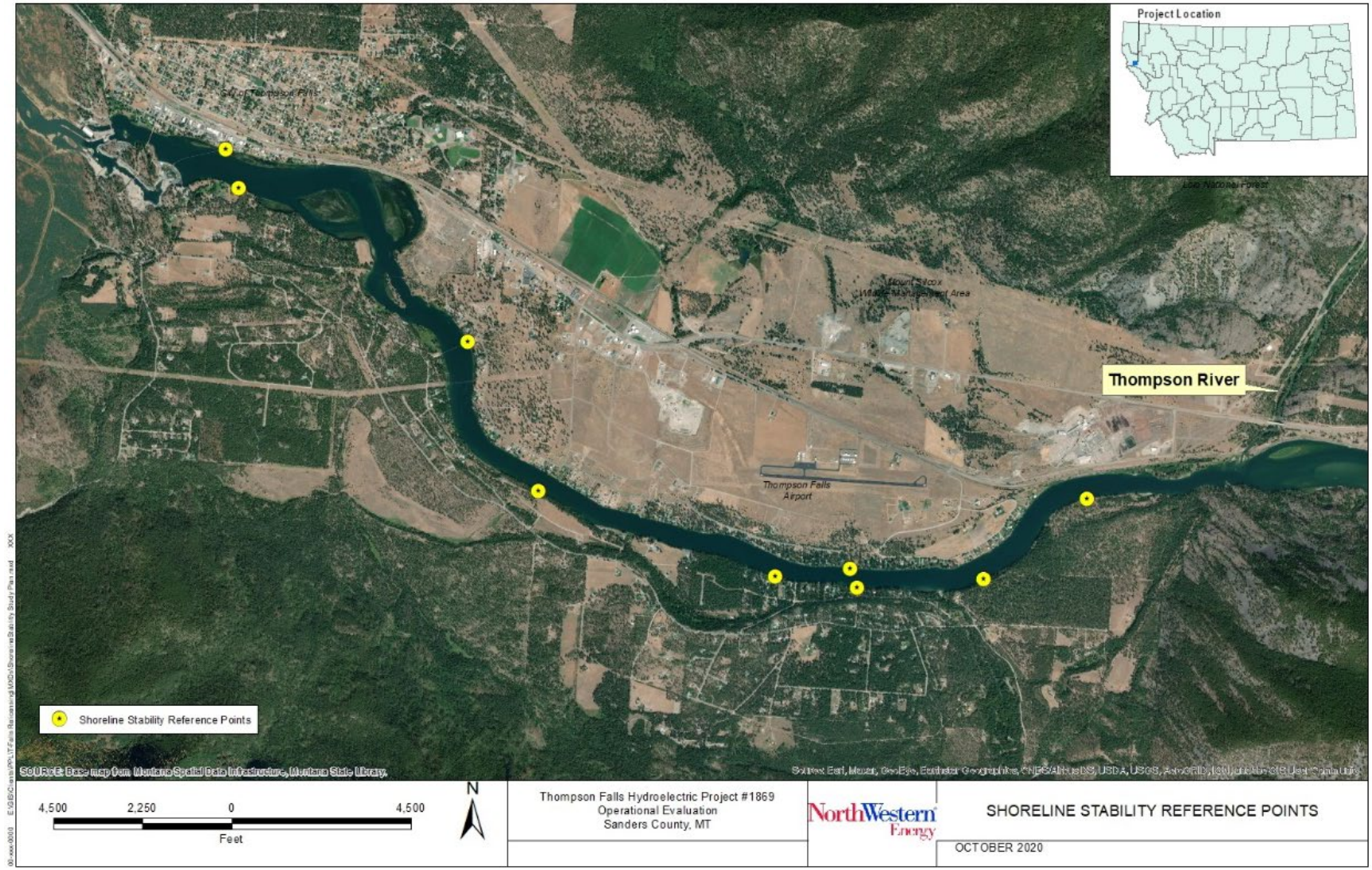
As part of the Operations Study, NorthWestern will assess shoreline stability. The assessment will include reservoir shorelines extending from the dams upstream to the mouth of the Thompson River (**Figure 2-4**). This area captures the vast majority of developed lands that are potentially affected by Project-induced bank erosion. Above the Thompson River, the reservoir becomes more riverine with higher current velocities, increased presence of bedrock, and larger substrate, and thus more resilient to erosion. Below the dams, the river is bedrock-controlled, and shoreline erosion is not a concern.

Study Methods

Nine reference points have been established along the reservoir shoreline. **Figure 2-4** is a map showing the location of the reference points. Each reference point will be a 300-foot reach of shoreline. The reference points represent a diversity of soil types, slope, aspect, vegetation and land use that in turn represent the variability in shoreline stability along the reservoir. The reference points will be monitored a number of times as discussed in Section 2.2 – Study Description, by making visual observations of the shoreline describing parameters such as presence or absence of erosion, type of erosion, magnitude of erosion, soil type, land management activities and shoreline erosion control measures (if any). The observations will be recorded electronically and entered into a database. Five photos will be taken at each reference point with three capturing the shoreline of the entire 300-foot reach and two photos taken from the mid-point of the reach, one facing upstream and the other facing downstream.

The reference points were monitored on October 8, 2020 to gather baseline information. Another monitoring event will occur in spring of 2021 (specific date to be determined based on flows) to gather additional baseline information before Phase 1 of the Operations Study. A third monitoring event will occur between Phases 1 and 2 of the Operations Study, and the final monitoring event will occur in October of 2021 after Phase 3. Results from each monitoring event will be compared to identify changes in shoreline stability, and whether or not the changes were related to the operational evaluation, or baseline conditions, or a combination of both. Results will be presented in the Initial Study Report which will include data in geographic information system (GIS) format.

Figure 2-4. Shoreline stability reference points.



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Fisheries

The assessment of effects of operational fluctuations on fisheries will include evaluating the potential for fish stranding, habitat changes at the mouths of Cherry Creek and Thompson River, and impacts to the fish passage facility.

Study Area

In Thompson Falls Reservoir, below the confluence with Cherry Creek, and near the islands above the Thompson River, fish stranding will be monitored on exposed island areas, and along exposed shoreline habitats (*see* **Figure 2-5** for these study areas). In addition, photo points will be established at the confluences of Cherry Creek and Thompson River. Conditions in the fish ladder will also be evaluated during this study.

Study Methods

Transects will be established to observe and measure fish stranding during different operational scenarios in the reservoir. Shallow habitats that are less than 2.5 feet deep at full pool will be the focus since these are areas where fish stranding is most likely with the fluctuating reservoir level. In the reservoir below Cherry Creek, three 200-foot-long transects will be surveyed on exposed mid-channel island areas, and three transects will be surveyed along exposed shoreline habitats. The reservoir near the islands above Thompson River will also be sampled with the same methodology, including three transects on exposed island areas and three along shoreline habitats. The transects are intended to capture the range of habitat characteristics where there is the potential for fish stranding. Observers will walk the transect and record species, total length, and weight of any fish observed within 30 feet (15 feet either side) of the transect line. If fish are observed trapped in small pools along the transect, they will be counted by species, and lengths estimated.

Cherry Creek and Thompson River are important spawning and rearing habitats for salmonids. Different reservoir elevations have the potential to modify the areas at the tributary/reservoir confluence and potentially modify or impede the migration of salmonids into and out of these streams. Photo points will be established during the Operations Study at the confluence and 500 feet upstream to visually capture any changes to habitats at different reservoir elevations. Level loggers will also be employed to measure elevation changes near the tributary confluences, and a cross sectional area of the tributary will be measured.

During the Operations Study the fish passage facility will be operated as normal, including flow in the step pools of the ladder and in the high velocity attraction jet. Operation of the workstation pumps will be assessed. Observations of water levels in the fish ladder will be made and corresponding reservoir elevations recorded.

Recreation and Aesthetics

The effects of the study's operational fluctuations on public recreation facilities and privately-owned improvements used for recreation as well as aesthetic qualities will be observed during the study.

Study Area

Assessment of effects on recreation facilities will include facilities along the reservoir shoreline, from the dams upstream to the mouth of the Thompson River (*see* **Figure 8-1)**. This area includes the two publicly available boat launches at Wild Goose Landing Park and Cherry Creek Boat Launch, as well as facilities associated with private properties and subdivisions. There are no developed recreation facilities above the Thompson River or below the dams. However, there is dispersed recreation below the dams at Sandy Beach. This site will also be monitored for effects to accessibility when flows change.

Study Methods

Reference points will be established to monitor recreational access. These points will include a subset of docks that is representative of all docks located along reservoir shorelines and will include the two public boat launch sites (Wild Goose Landing Park and Cherry Creek Boat Launch), as well as the Salish Shores community subdivision boat launch. To establish the subset of monitoring locations, the reservoir will be divided into four segments:

1. From the boat barrier upstream to the upper end of Steamboat Island
2. From the upper end of Steamboat Island upstream to the Salish Shore boat launch
3. From the Salish Shores boat launch upstream to the Cherry Creek boat launch
4. From the Cherry Creek boat launch upstream to Thompson River

Due to the shallow and highly varied nature of shoreline access in the reservoir just above the dams, it is anticipated that docks closest to the dams would bear more impact than docks in the upper region of the reservoir, which is much deeper and more uniform. Therefore, all docks between the boat barrier and the upper end of Steamboat Island (approximately 10 docks) will be monitored. Upstream of Steamboat Island, 25 percent of docks (i.e., every fourth dock) will be monitored in each of the three segments, distributed between the North and South shorelines according to the distribution of all docks that exist at the time of the study. Monitoring every fourth dock in these three segments will result in the monitoring of approximately 30 docks in the upper sections and approximately 40 docks on the reservoir overall. These established reference points will each be evaluated one time when the reservoir is at the lowest elevation to observe any impacts to facilities that result from operational fluctuations. In addition, the Sandy Beach dispersed recreation site immediately downstream of the original powerhouse will be monitored during each phase of the Operations Study to determine the impact of changing water levels at that location.

At the public boat launch sites, reference points will include existing docks and the end of the boat ramps as well as established shoreline access points, if any, within the public recreation sites. These points will be photo-inventoried and measurements will be taken during each half-foot static hold to describe the depth of the water at the end of the boat ramps, the length of the submerged portion of the ramps, impacts to dock use, and the amount of exposed shoreline at shoreline access points before and during the operational change. Since all phases of the Operations Study will result in the same maximum reservoir elevation change, it will only be necessary to measure the impacts to these public boat launch site reference points during one phase of the study.

The Salish Shores community subdivision boat ramp is a gravel ramp and determining the overall length of the ramp (and thus, where the ramp ends) is not feasible. Therefore, a distance of up to 20 feet extending from the upland edge of the concrete barriers alongside the ramp will be designated as the end of the gravel boat ramp. Assessments conducted at the public boat launches will be replicated at the community ramp.

Established reference points of privately-owned docks will be a representative sample of all existing docks and will include photo documentation and description of the impacts to the docks and gangways resulting from the Operations Study. These impacts, along with any other observed impacts, will be documented and photographed for each reference point at the lowest reservoir elevation of the study. In addition, measurements of the amount of exposed shoreline at the mid-point of each shoreline in each segment will be recorded. As with public and private boat launches, these impacts will be measured once since all phases of the Operations Study will result in the same water elevations.

Below the dams, water elevation changes will be monitored for any impacts to public recreation. Reference points along the upstream edge of Sandy Beach and adjacent to the natural pool at the beach will be established to monitor and observe the variation in water level and the rate at which those variations occur. Since each phase of the study employs different magnitudes of operational changes, it will be necessary to evaluate the water elevation at Sandy Beach for all three phases of the study.

Effects on aesthetic qualities of the Project reservoir will be documented in much the same way. Reference points will be established and evaluated through photo documentation, observations and descriptions of influences from operational fluctuations. Reference points at common public viewing areas including the upper end of Island and Wild Goose Landing parks, the Canada Goose Rearing Area, and the Salish Shores and Cherry Creek boat launches will be established and photo inventories and descriptions of any changes to aesthetic qualities will be documented. These reference points are anticipated to provide a representative sample of viewpoints along reservoir shorelines that will approximate views from public and privately-owned properties.

Public Safety

Impacts to public safety related to water elevation changes will be evaluated and monitored during the Operations Study.

Study Area

Water level changes at Sandy Beach (*see* **Figure 8-1**), below the original powerhouse, and high-traffic areas in Thompson Falls Reservoir, will be monitored for potential impacts relative to public safety.

Study Methods

In-water obstacles may become more or less apparent and may become more or less hazardous as water conditions change. To better understand the effect of changing reservoir elevations on in-water obstacles, Sandy Beach (below the original powerhouse) and high-traffic areas in Thompson Falls Reservoir will be monitored during the static hold times of the Operations Study. In general, these assessments aim to determine the extent of public safety risk, if any, associated with changing water levels at these locations. Areas of potential shallow water will be the areas of focus.

Water Quality

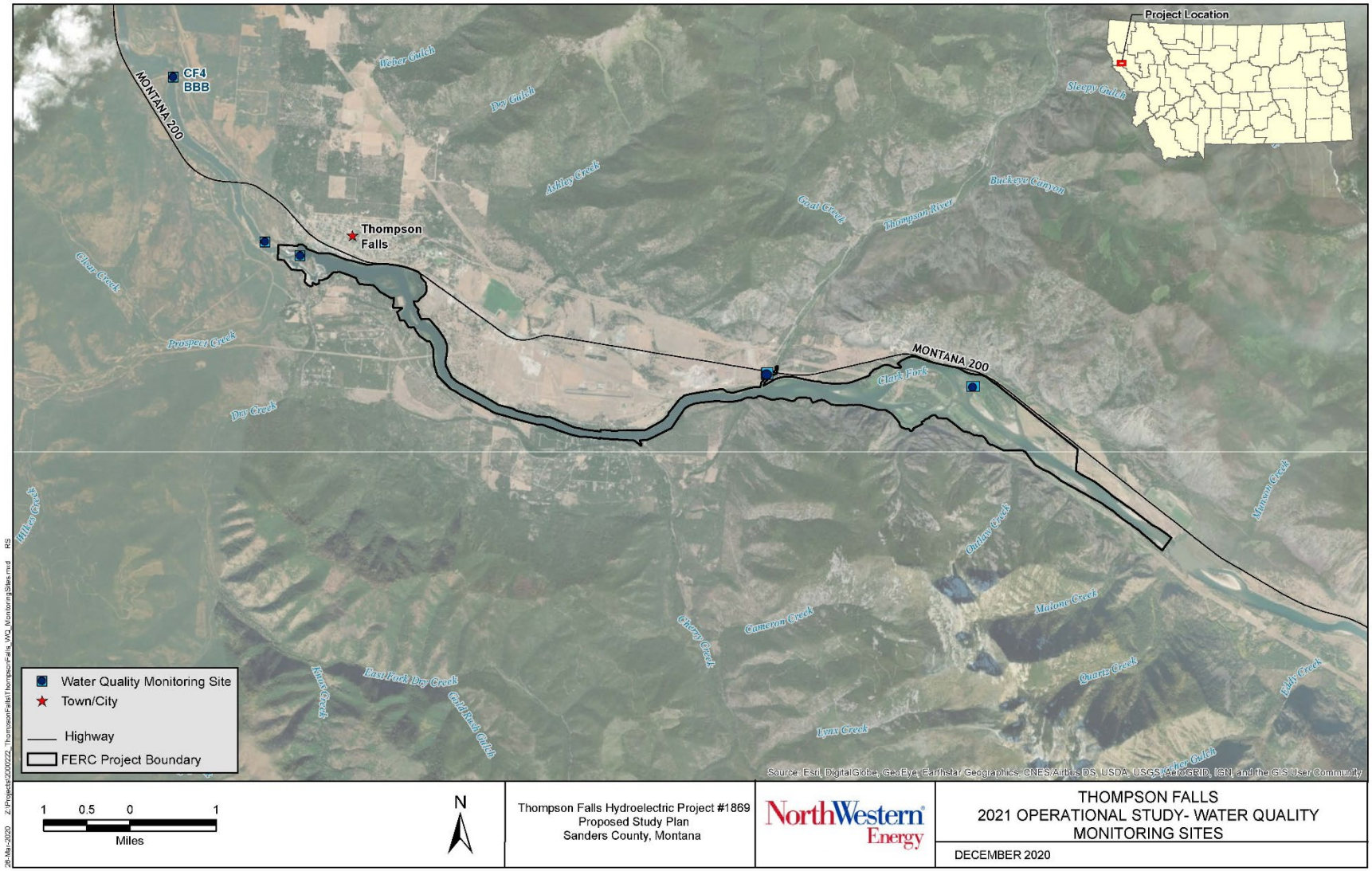
Water quality will be monitored during the Operations Study by measuring changes in water level stage, turbidity, and other water quality field parameters upstream and downstream of the Project's facilities. As reservoir levels decrease, the rate at which they decrease in conjunction with the reservoir pool level may have an effect on downstream turbidity.

Study Area

Water quality instruments will be deployed on the upstream face of the Dry Channel Dam, and downstream of the Project at Birdland Bay Bridge.

Onset water level recording instruments will be installed downstream of the powerhouse, at the mouth of the Thompson River, and at the island complex on the upstream end of the reservoir. These sites were chosen to be consistent with the data collected during the 2019 operational testing period (**Figure 2-5**). These sites were originally chosen to provide a spatial distribution across the reservoir and to see how different areas of the reservoir respond to changes in pond elevation.

Figure 2-5. Water Quality Sampling Locations for the Operational Study.



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Study Methods

Onset logging instruments will be programmed to record reservoir level in 5-minute intervals to provide data on how different parts of the reservoir respond to the lowering of the reservoir elevation. Reservoir inflows affect level changes, so by studying level changes at different inflows, reservoir level dynamics under different conditions can be better understood.

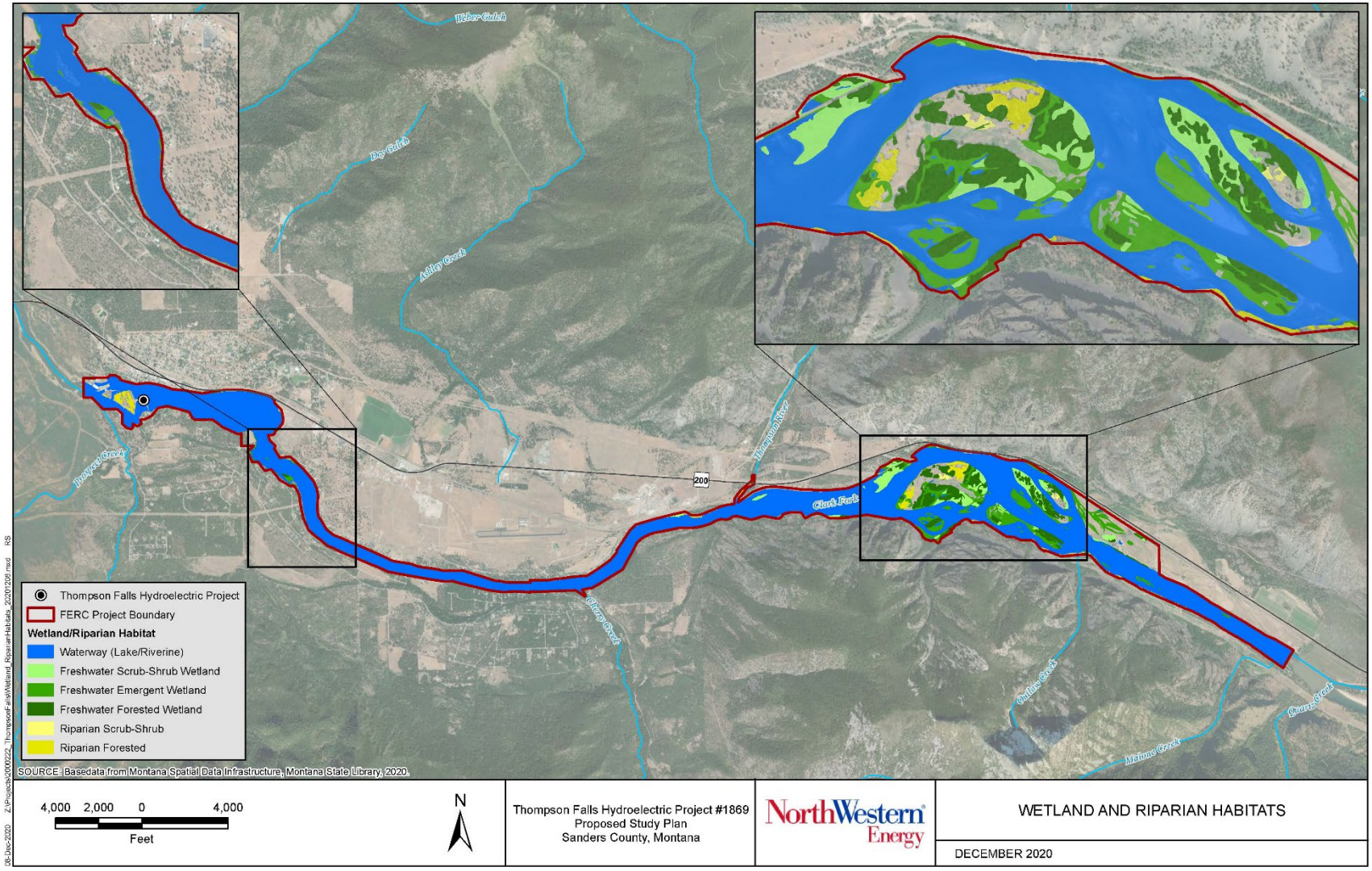
To evaluate turbidity, Hach Hydrolab water quality instruments will be deployed. The upstream instrument will track changes in turbidity coming from reservoir sediments being re-suspended, while the downstream instrument will track the ultimate fate of that turbidity as well as any increased turbidity that may be caused by altering the powerhouse discharges. These instruments will be set to record turbidity at fifteen-minute intervals and will track changes in water quality. Additional water quality parameters to be measured by the instruments are pH, specific conductivity, dissolved oxygen, temperature, and depth. The water quality data collected in this study will supplement water quality data to be collected in a separate water quality study proposed by NorthWestern which is described in further detail in Section 4 – Study 3 Water Quality.

Wetland/Riparian Habitats

Study Area

The Wetland/Riparian habitat study will be conducted along the shoreline of Thompson Falls Reservoir (**Figure 2-6**). Sites will be selected in the lower (adjacent to and downstream of Steamboat Island) and upper (upstream of the Thompson River confluence) portions of the reservoir where the majority of the wetland habitat exists.

Figure 2-6. Wetland/Riparian Habitat Study Areas.



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Study Methods

Wetlands and riparian habitats will be monitored during the Operations Study by measuring changes in water level and conducting visual observations of identified wetland and riparian areas. As the level of the reservoir decreases, the hydrological connection with adjacent wetlands and riparian areas has the potential to be altered.

Wetland and riparian areas will be identified using the Montana Spatial Data Infrastructure Wetlands Framework (2020). This information will be utilized to locate the approximate location of identified wetlands, and the type and extent of these areas adjacent to the reservoir. The risk to each wetland and riparian area altered hydrological connection due to reservoir fluctuations will be ranked as high, medium, or low. Risk will be determined by multiple factors including the surface water connection, soil type, slope, and distance from the ordinary high-water mark of the reservoir. Ground-truthing will be used to validate the results of the mapping stratification.

Prior to the Operations Study, level loggers and/or piezometers will be deployed at various locations around the reservoir to track water level changes in these areas throughout the duration of the study. Visual observations will be used to identify any areas that become disconnected from the reservoir. Data collected will be analyzed to determine any potential operational impacts on wetland and riparian areas.

Cultural

Study Area

The study area consists of the locations of known archaeological properties that lay at or near the reservoir high water line. These properties are Salish House (24SA0130), for which the specific location is suspected but not verified, a prehistoric and historic artifact scatter (24SA0291), and a Chinese railroad encampment (24SA0593).

Study Methods

Effects of reservoir level changes at the three locations will be observed to the extent possible and recorded. Observations will be documented on site monitoring forms based on Project Archaeology's Montana Site Stewardship Program Site Monitoring Form[10].

Schedule

Preparatory Work

In order to evaluate the potential resource effects of Project operations within the ILP timeframe, NorthWestern is planning to voluntarily conduct limited work prior to the FERC Study Plan Determination. These efforts include identifying the baseline condition to enable the comparison

[10] Project Archaeology, Montana Site Stewardship Program, 2020. https://projectarchaeology.org/about/montana-site-stewardship-program.

of before and after conditions, establishing reference points for observation, identifying sampling sites, and preparing maps.

First Study Season

The availability of flexible capacity at the Project is based upon the seasonal snowmelt runoff dominated hydrograph of the Clark Fork River. Flexible generation is available when the flows are below the Project's generation capacity of 23,000 cfs and above minimum flows of 6,000 cfs. All three phases of study will be scheduled in this flow window and during the recreation season so that potential recreation impacts can be evaluated, between July 1 and September 30. Each phase of the study will be implemented in coordination with the other seven proposed studies. A prescribed daily schedule for each phase has been developed based on randomly selected operations that dictate the sequence of plant operations and resulting estimated reservoir elevations.

Second Study Season

None, as this study will be completed during the first study season.

Reporting Plan

NorthWestern will complete a Final Study Report which will include data summaries, assessments of observations, photo documentation, and conclusions from resource evaluations as part of the study. The Final Study Report will be filed on or before May 12, 2022.

2.3 Resource Management Goals

Section 4(e) and 10(a) of the Federal Power Act require FERC to consider multiple public uses and give equal consideration to all uses of the water on which a project is located. When reviewing a proposed action, FERC will consider the environmental, recreational, fish and wildlife, and other non-developmental values of the project, as well as power and developmental values. This study will provide information on the potential impacts of Project operations on shoreline stability, fisheries, recreation, aesthetics, public safety, water quality, wetland and riparian habitat, and cultural resources. This information will assist the Licensee in development of a License Application which balances both developmental and non-developmental aspects of the Project.

2.4 Existing Information and Need for Additional Information

2019 Operations Test

In October 2019, NorthWestern conducted an operations test to assess the potential impacts of operating the Project within the 4-foot range authorized by the License. During the test, the reservoir elevation was lowered from normal full operating level down 4 feet, then raised in 1-foot increments. The plant was increased to full generation output to lower the reservoir. Level loggers were deployed in multiple locations to record water elevation changes. A time-lapse camera was

deployed at a key location to capture visual changes at the mouth of the Thompson River. Resource professionals visited different locations to photograph conditions and make visual observations during active drawdown and at each elevation level for the test. Observations were made on:

- Operations – quantification of the flexible capacity available with the reservoir volume
- Shoreline Erosion – bank stability and erosion
- Fisheries – fish stranding, migration corridors to tributaries, and fish passage facility operations
- Recreation – effects to recreation site amenities including boat launches, boat docks and aesthetic conditions
- Public Safety – navigation hazards in the reservoir, rate of water elevation changes
- Water Quality – changes in water chemistry and/or physical properties
- Wetland/Riparian Habitats – available habitat relative to water level changes, duration of dewatering

Results of 2019 Operations Test

Reservoir level fluctuations during the test were relatively consistent throughout the reservoir. The location at the upstream islands was the only exception where change in water level was reduced relative to downstream sites above the dam. During the test, reservoir levels observed at the dam and upstream to the Thompson River area were close to 4 feet, whereas the water level at the upstream islands was about 3 feet.

During refill of the reservoir, all the sites upstream of the dam showed a very similar rise during the 4-foot test and little difference in elevation was observed between the sites.

Below the dam, the difference observed between the two monitored locations was larger than upstream. During the drawdown portion of the test, the difference between the locations was approximately 1.5 feet. This is most likely due to the characteristics of the monitoring site, where the channel is confined from the rest of the river by a retaining wall. The channel volume in this location is much reduced compared to the entire Clark Fork River channel. The magnitude and rate of change at this location would be expected to be greater due to this difference. During reservoir refill, the difference in elevation between the two sites was minimal.

Water surface elevation rates of change during the test were evaluated both above and below the dam. The rate of change upstream of the dam was the greatest at the dam location and was attenuated upstream at Thompson River and the islands. Maximum observed elevation rates of change were similar throughout the test and ranged from 1.2 feet per hour (ft/hr) at the dam, 1 ft/hr at the Thompson River, and 0.85 ft/hr at the islands.

Rate of change below the dam was very quick at the start of the test but was significantly reduced after approximately 1 hour. This is most likely a function of filling the channel capacity with the

increased discharge through the powerhouse during the test. Once the channel capacity and elevation reached an inflection point, the water spilled over and was conveyed down river. Differences in rates observed between the two monitoring locations were observed during the initial hour and then were very similar during the remainder of the test.

Baseload generation prior to the test was 49 MW. Maximum full head output of the plant is rated at 92.6 MW and decreases as the elevation of the reservoir drops. The differential between the maximum capacity and the baseload generation dictates the flexible generation capacity of the plant and the rate of reservoir elevation change. The test showed a total availability of 147 MW-hours of flexible capacity provided with the full 4 feet of reservoir elevation. Additionally, no operational issues were found with any of the units that would prevent future normal operations in this manner.

Resource Impacts Observed During 2019 Operations Test

Observations concerning fishery resources during the October 2019 operations test included observations of the fish passage facility, reservoir habitats, and tributary connections. Little influence was seen on operation of the fish passage facility when pool elevations were within 0.5--foot of normal full operating level. As forebay elevations decreased below 0.5-foot, the fish passage facility was still operating and functioning , but outside of flow design standards. As forebay elevation neared 2 feet below normal full operating level the fish passage facility sampling loop became inoperable, pool to pool flow lacked sufficient water for effective capture, and the High Velocity Jet flow diminished considerably.

A variety of reservoir fish species were stranded during the operations test when the reservoir was drafted 4 feet. These included Largemouth Bass, Smallmouth Bass, Northern Pike, Pumpkinseed, Yellow Perch, Redside Shiner, Northern Pikeminnow, Black Bullhead, Yellow Bullhead, and Largescale Sucker. Most fish were less than 3 inches in total length but a few Northern Pike up to 10 inches were observed.

Water quality impacts were categorized into two main categories: shoreline erosion and water chemistry. When the elevation of the reservoir was lowered 4 feet from normal full operating level, some erosion occurred in areas of exposed un-vegetated reservoir sediment deposits and shoreline areas that became unstable due to previous manual removal of native vegetation. This operational regime did not result in significant changes in water chemistry at the downstream end of the reservoir, however at a reservoir elevation of 4 feet below normal full operating level, there was a slight increase in turbidity, total suspended solids, and total phosphorous.

Observations of recreation, aesthetic and land use impacts found that elevations at 3 and 4 feet below normal full operating level may limit or prevent some uses of public and private recreation facilities (i.e., docks) and waterway access. In addition, there was an odor associated with the exposed mud flats and gravel bars when the reservoir was drafted 4 feet.

Observations of two areas of the reservoir shoreline that were impacted by a 2018 deep drawdown (to crest elevation, a drawdown of 18 feet) were made in order to quantify if the locations experienced movement in response to a 4 feet drawdown. Evidence of previous slope movement at the respective sites was noted. No slope movement in response to the 2019 operations test was observed.

Impacts to shoreline areas and recreation facilities were not uniform throughout the Project, since the north shoreline tends to be a steep bank with rocky substrate, while the south shoreline tends to be more gradual slopes of looser, more erodible soil. Observations of shorelines during this test revealed a few isolated areas of shoreline erosion where the majority of changes consisted of the movement of recent sediment deposits in the near-shore area.

The observations of shoreline and near-shore bed stability during this one-time rapid lowering of the reservoir were valuable, but most likely do not reflect actual long-term (attenuated) effects of flexible operations. It is anticipated that some of the erosion of near-shore sediment deposits and shorelines would, over time, resolve into stabilized shorelines with less impact during elevation changes.

Evaluation of 2019 Operations Test Results

Based on the results of the October 2019 test, NorthWestern concluded that drafting Thompson Falls Reservoir the full 4 feet as described by the current License on a regular and frequent basis would have an unacceptable level of impact to resources including recreation, shoreline residents, fisheries and the community. Consequently, NorthWestern is proposing that Thompson Falls continue to provide baseload generation and flexible capacity needs using 2.5 feet of the reservoir. During normal operations, the reservoir would be maintained between 2396.5 feet and 2394.0 feet.

Existing information to frame the study method and additional data needs are described below for each resource area.

Shoreline Stability

A geological evaluation of Thompson Falls Reservoir states that the various soil units along the reservoir display various degrees of erosional stability (Montana Power Company, 1989). It also states that some erosion occurs due to seasonal high flows and normal water and wave action. Only a small amount of shoreline erosion is occurring, principally in fine-grained alluvial soils which are predominantly on the south shore and on the islands upstream of the mouth of the Thompson River. Where erosion does occur, it can result in steep and sometimes undercut banks, generally less than 10 feet tall. The report states that erosion to date (as of 1989) has not caused significant changes to the reservoir shoreline or islands. Comparison of maps and aerial photos from 1964, 1980, 1988, and 1989 indicates only minor changes. The report also states that no shoreline erosion problems have been reported by landowners adjacent to the reservoir. In addition, the report states that not all erosion has been caused by reservoir/river processes, and that some erosion has been caused by snowmelt and high precipitation events which saturate the soils and result in caving of

the steep banks. The report also states the greatest erosion potential is during periods of high velocity flows which occur in the spring and early summer when reservoir levels typically do not fluctuate.

NorthWestern recently collaborated with Green Mountain Conservation District on a shoreline stabilization pilot study, "Thompson Falls Reservoir Bank Stabilization Pilot Project" (Northwestern 2020), the results of which inform the Operations Study. The pilot study tested a bioengineering approach on the Thompson Falls Reservoir. The key components of this approach were to: 1) reshape parts of the shoreline to a less steep and less erosive slope; 2) incorporate woody debris at the toe of the slope to protect against erosion from flowing water, wave action, etc.; and 3) establish native vegetation from cuttings, bareroot, and containerized plantings. Results from the pilot study may be incorporated into the design recommendations during the permitting of any future similar projects around Thompson Falls Reservoir. The shoreline stabilization project for this pilot study was completed in the fall of 2019 on an eroding shoreline on the south shore a short distance downstream of Cherry Creek, and monitoring is currently in progress. This shoreline stabilization project is also within one of the shoreline stability reference points described in Section 2.2 – Study Description. Information from the pilot study in the form of a color brochure is currently available at: https://www.northwesternenergy.com/environment/thompson-falls-project/thompson-falls-other-reference-material. Additional evaluation of shoreline erosion will occur at the pilot study location as part of the Operations Study's shoreline erosion monitoring. Success and viability of the vegetation (plantings and cuttings) will be evaluated in 2021 after plants have had time to take root and grow for at least one growing season.

Wetland/Riparian Habitats

Existing mapping and survey information is available from the Montana State Library as part of the Montana Spatial Data Infrastructure (2020) to provide the initial stratification and risk assessment of the Project's wetland and riparian resources. More information is needed to determine if the operational scenarios being studied will have an effect on these areas, and the Operations Study intends to answer that question.

Cultural

Cultural observations were not included during the October 2019 operations test.

2.5 Nexus Between Project Operation and Effects

NorthWestern utilizes numerous operation modes to manage water at the Project. These include spilling at either the main or dry channel dams, increasing generation, decreasing generation, or holding generation steady. Different combinations of these operations amount to changes in water use through the Project resulting in conveyance of variable volumes of water downstream. If the total volume of water leaving the Project is different than the volume of inflow to the Project, the reservoir elevation will either increase or decrease in response.

Providing both baseload generation and flexible capacity with reservoir storage is essential and core to the value of the Project for NorthWestern customers and our obligations as a Transmission Balancing Authority, and it will continue to be in the future. An increasing need for flexible generation on the NorthWestern electric system is being driven primarily by the addition of new renewable and intermittent energy sources to the system.

2.6 Study Methodology Consistency with Generally Accepted Practice

Operations

The methodology proposed for plant operations was developed to closely simulate the unpredictable provision of flexible capacity from the Project. The transmission grid is very dynamic with constantly changing generation and load which requires flexible capacity needs. While no published methodology exists to test flexible capacity operations, the proposed methodology for this study will replicate the random nature of actual operations.

Shoreline Stability

The methodology proposed is common to other study plans for shoreline erosion that have been approved by FERC, such as the "Proposed Study Plan - Boundary Hydroelectric Project (FERC No. 2122)" by Seattle City Light, the "Shoreline & Bypass Reach Erosion Control Study Plan – Lake Chelan Hydroelectric Project – FERC Project No. 637" by Chelan Public Utility District and "Reservoir Shoreline Erosion Study Plan – Toledo Bend Relicensing Project – FERC Project No. 2305" by Sabine River Authority.

Fisheries

The methodology for study is consistent with other research for systematically evaluating stranding of fish, water level fluctuations at key migration points, and observations of fish passage facility functionality (Dauwalter et al. 2012, Bell et al. 2008, Saltveit et al. 2001).

Recreation and Aesthetics

Assessment of the changes in access to public recreation facilities during the Operations Study will most accurately be completed using a set of measurable parameters (water depth, amount of exposed sediment, slope of dock gangways, etc.) rather than prediction models that characterize acceptability. Since the composition and profile of the shoreline varies throughout the reservoir, documenting impacts to a sample of public and private facilities throughout the Project during the Operations Study will reveal the worst-case impacts that may be endured as a result of elevation fluctuations. Measuring the depth of the water at boat ramps, for instance, will reveal their functionality under the operational scenarios parameters, and monitoring the change in slope of dock gangways will determine at what elevation public and private docks will remain usable at the lowest proposed reservoir elevation.

Aesthetics, on the other hand, is far more qualitative and subjective since aesthetic characteristics are tied to human senses. While Visual Quality Objectives adopted by the USFS are commonly utilized to describe and document aesthetic qualities of surrounding areas (Southern California Edison 2007), the Thompson Falls Project is located adjacent to the city of Thompson Falls, Montana Highway 200, a major railroad, and residential development. Therefore, descriptions of the changes to aesthetic qualities (sight, sound, and smell primarily) from the status quo during the Operations Study will be descriptive in nature regarding any perceived impacts to aesthetics by project operations.

Public Safety

The size of this Project makes it possible to identify areas where in-water reservoir hazards may become more problematic under changing conditions. Based on the characteristics and size of the waterway, documenting these areas during the Operations Study is a precise and cost-effective assessment of public safety since the assessment will describe conditions that are improved and conditions that are worsened under different water elevations. Similarly, documenting how flows and elevations change at areas downstream of the powerhouse will provide a model of predictable conditions during project operations and evaluation of potential impacts to public safety.

Water Quality

The sampling methodology for this assessment conforms to the most current standard operating procedures used by the Montana Department of Environmental Quality (DEQ) (DEQ 2012).

Wetland/Riparian Habitats

The methodology for this assessment conforms to generally accepted evaluations of wetland and riparian habitats. Site specific methods will be determined based on the physical characteristics at each wetland study site. A combination of piezometers and temperature/level monitors may be used to measure the connectivity and relationship of these riparian wetlands, shallow groundwater, and surface water (Anibas et. al 2011).

Cultural

The identification of previously identified cultural sites during opportunistic Project conditions is standard practice at hydropower reservoirs throughout the country[11]. The proposed methods for Thompson Falls follow the standard practice and are appropriate given the small number of known sites at or near the reservoir edge.

[11] *See* for example: Corcoran, Maureen K., Lawson M. Smith, and Paul R. Nickens, Columbia River System Operation Review, Final Environmental Impact Statement, Appendix D Exhibits, Exhibit A, Development of Geomorphology Based Framework for Cultural Resources Management, Dworshak Reservoir, Idaho, 1995. Bonneville Power Administration and U.S. Army Corps of Engineers.

Level of Effort and Cost

The approximate cost to implement the Operations Study is $146,000

3. Proposed Study 2 Total Dissolved Gas

NorthWestern is proposing a study to collect TDG data at the Project. These data will help characterize the current TDG contributions of the Project under different discharge scenarios.

3.1 Goals and Objectives of Study

The goal of this study is to gather data on TDG concentrations upstream and downstream of the Project throughout the spring runoff season to gain a better understanding of TDG concentrations in various discharge scenarios. The main objective is to collect additional information on whether and how the Project's new radial gates affect TDG concentrations downstream of the dams and powerhouses.

3.2 Study Description

Background

The prior Licensee developed a TDG Control Plan in 2010 in consultation with the DEQ. The TDG Control Plan outlines operational practices used during the spring runoff period to minimize TDG concentrations in the Clark Fork River downstream of the Thompson Falls Project. The TDG Plan has been implemented annually.

In late 2018, construction was completed on two new radial spill gates, resulting in a total of four radial gates on the Main Channel Dam. These new radial gates are a change from the spill panels that were previously in use, so the effect on TDG from these radial gates is not yet fully understood. Data collection occurred in 2019 and 2020, and additional data will result in a further understanding of TDG concentrations at a wider range of discharge levels.

Study Area

Hach Hydrolab instruments will be deployed at three locations to capture TDG concentrations above the dam (site AD), below the Main Channel Dam at the High Bridge (site HB), and downstream of the Project at Birdland Bay Bridge (site BBB). **Table 3-1** provides the locations of each of these monitoring sites.

Table 3-1: Descriptions and latitude and longitude of TDG monitoring sites.

Site Description	Latitude	Longitude
Above Dam (AD) – Upstream face of the Dry Channel Dam	47.593131	-115.356904
High Bridge (HB) – Downstream of the Main Channel Dam	47.590720	-115.354920
Birdland Bay Bridge (BBB) – Clark Fork River downstream of Project at Birdland Bay Bridge	47.621436	-115.391592

The monitoring locations were chosen to represent the TDG concentrations of incoming water upstream of the Project, TDG concentrations of the spill water downstream of the Main Channel Dam, and TDG concentrations leaving the Project which captures a mixture of water from the powerhouse discharge and the spillway discharge.

Figure 3-1. Total Dissolved Gas Sampling Locations.

Methods

The TDG study will consist of monitoring TDG concentrations during spring runoff season at multiple locations around the Project's facilities under different discharge scenarios. This study will use methods currently being used for TDG evaluation at the Project.

TDG data will be collected throughout the spring runoff season to capture the variability of TDG entrainment in relation to flow rate in the Clark Fork River. During this time, operators of the Thompson Falls Project will test various configurations of spill through the Main Channel Dam using different combinations of the four radial gates. Each gate spill configuration will be held for approximately 4 hours to allow the downstream TDG levels to stabilize. This methodology is consistent with testing conducted in 2019 and 2020 and will be used to supplement the existing dataset. NorthWestern will analyze the data in developing the Final License Application.

Schedule

Preparatory Work

Hach Hydrolab instruments will be deployed at the start of runoff season as spill at the Project commences. The deployment schedule depends on weather and flow conditions but generally starts in the late April time period which is prior to the FERC Study Plan Determination.

First Study Season

TDG concentrations are highest during the spring runoff season, so data collection will occur during the spring runoff period, which usually occurs from early May through late June of each year.

Second Study Season

This study will be conducted during both study seasons, which will allow NorthWestern to capture data during a greater variety of discharge conditions.

Reporting Plan

The Initial Study Report will be filed on or before May 12, 2022 and will include the results of data collection during the 2021 season. The Final Study Report, including the 2021 and 2022 data, will be filed on or before May 12, 2023.

3.3 Resource Management Goals

Montana's Surface Water Quality Standards and Procedures includes language specific to dams. Administrative Rules of Montana (ARM) 17.30.602 defines "naturally occurring" as "conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Conditions resulting from the reasonable operation of dams in existence as of July 1, 1971, are natural." ARM 17.30.636 (1) states that owners and operators of water impoundments that cause conditions harmful to prescribed beneficial uses of state water shall demonstrate to the satisfaction of the department that continued operations will be done in the best practicable manner to minimize harmful effects.

Water quality standards developed by the DEQ (Circular DEQ-7, 2019) sets a standard of 110 percent of saturation for TDG. This water quality standard was developed to protect fish from high levels of TDG, which may cause gas bubble trauma (GBT). GBT can cause injury and, in severe cases, death to fish.

3.4 Existing Information and Need for Additional Information

NorthWestern and the prior Licensee frequently monitored TDG in the Clark Fork River during the 2003 to 2020 time period. These data have helped to inform NorthWestern on the optimal

operations scenario to minimize TDG concentrations. Two years of data have been collected when the new radial gates were operating, which were installed in the fall of 2018 Additional data is needed at higher discharges above 80,000 cfs where TDG concentrations are typically at their highest. This study will help to fill data gaps that are missing in recent TDG data.

3.5 Nexus Between Project Operation and Effects

There is a nexus to project operations and downstream water quality. Water that is either discharged through the powerhouse or through the spillway will have varying concentrations of TDG, and this study will help provide information on the downstream concentrations of TDG during spring runoff events.

3.6 Study Methodology Consistency with Generally Accepted Practice

This study maintains consistency with the prior TDG monitoring efforts at the Thompson Falls Project in that it uses the same monitoring locations and methodologies that have been used under the current TDG Control Plan. The TDG Control Plan was developed in consultation with DEQ and uses methodologies that are commonly accepted as standard monitoring procedures. By using the same monitoring locations and methodologies, NorthWestern will be able to compare data collected from this study with historical data.

3.7 Level of Effort and Cost

The approximate cost to implement proposed Study 2 – Total Dissolved Gas Monitoring is $50,600.

4. Proposed Study 3 Water Quality

NorthWestern is proposing a water quality study to collect data on waters directly affected by the Project and allow analysis of any Project-related effects on water quality.

4.1 Goals and Objectives of Study

The goal of this study is to gather data needed to evaluate the influence the Project has on water quality. Objectives of this study are to quantify Project-induced water quality changes, if any, and determine the source of those changes.

4.2 Study Description

The study will characterize the current water quality of the Project. This will facilitate the identification of water quality trends and provide useful information as to the effects that Project operations may have on water quality.

Background

In 2019 and 2020, NorthWestern Energy conducted water quality monitoring at multiple locations across the Project. This initial data collection effort was intended to refine a list of monitoring locations and parameters to be collected at each location to best inform study design. Data collected in 2019 and 2020 will supplement the data collected in this study to help provide an assessment of the water quality at the Project over a range of seasons and flows.

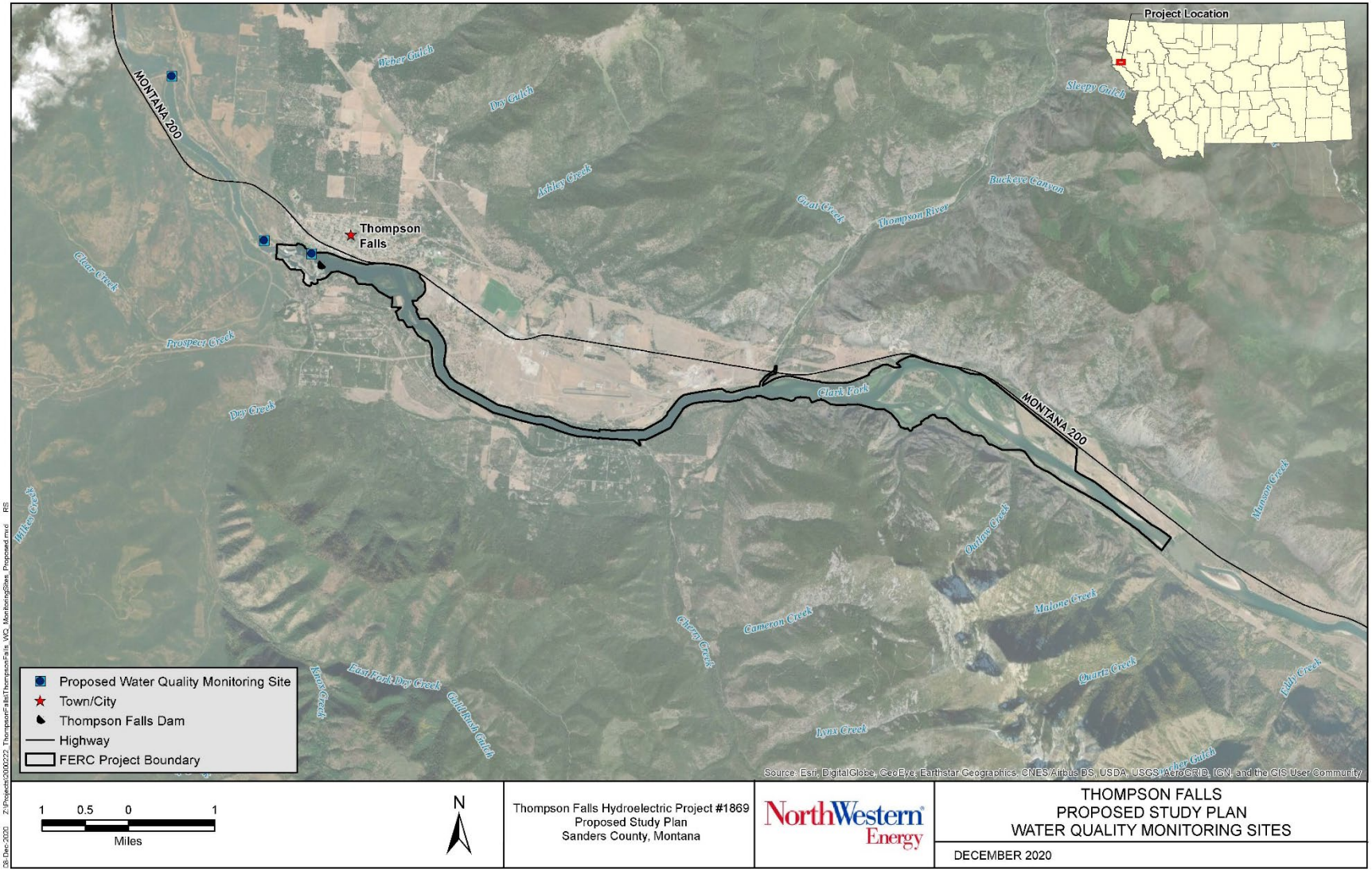
Study Area

Sampling will consist of multiple monitoring sites around the Project to characterize the incoming water quality from the Clark Fork River and the outgoing water quality downstream of Thompson Falls Dam to Birdland Bay Bridge. Three monitoring sites, identified in **Table 4-1** and on **Figure 4-1**, have been strategically chosen to capture the above-mentioned objectives.

Table 4-1: Descriptions and latitude and longitude of water quality monitoring sites.

Site Description	Sample Collection Method	Latitude	Longitude
Clark Fork River upstream of powerhouse in Thompson Falls Reservoir	Equal width increment depth integrated composite sample	47.593502	-115.353699
Clark Fork River downstream of powerhouse	Single point grab sample	47.595148	-115.365710
Clark Fork River downstream of Project at Birdland Bay Bridge	Equal width increment depth integrated composite sample	47.621436	-115.391592

Figure 4-1. Water Quality Sampling Locations.



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Study Methods

Sites will be sampled quarterly to understand the seasonality of water quality in the Project. Parameter groups to be analyzed include nutrients, metals, inorganics, and physical properties. Field parameters collected in-situ will also be measured as part of this sampling effort.

The water quality sampling will consist of collecting either single point depth integrated samples (at the Clark Fork River downstream of the powerhouse), or depth integrated equal width increment composites (at the other two monitoring locations). Grab samples will be collected from the bank in a well-mixed portion of the river, or from a bridge at equal width increments and composites. Sample bottles will be rinsed three times with native water (or filtered native water) prior to sampling. Samples will be taken in the upstream direction to avoid entrainment of sediment disturbed by wading. During sampling, the sampling device will be drawn through the water column once, carefully avoiding any disturbance of bottom sediments.

Samples will be transferred to a decontaminated Teflon churn splitter and sealed in a secure container until processing. Processing and splitting of sample aliquots into sample bottles will occur at the end of each day in a clean location. Filtration with a 0.45 micrometer filter for dissolved parameters will be done as a batch process within 8 hours of sampling. All sample bottles will be virgin polyethylene bottles. Samples will be clearly labeled with a waterproof marker or preprinted labels. Label information will include the site identification, date and time, sample type, preservative, and sampler's initials. Field notes will be collected at each location and completion of appropriate chain-of-custody forms. All samples will be immediately placed in a cooler chilled to 4 degrees Celsius (°C) for transport to the lab.

Quality control samples will also be analyzed for water quality parameters. These samples consist of one replicate sample and one equipment blank for each sampling event. The replicate is a sequential sample taken at one of the locations as a control measure of both field variability, sample processing procedures, and laboratory methodology. The equipment blank is a deionized water sample run through the sampling apparatus after standard decontamination procedures and analyzed for the full suite of water quality parameters. The blank primarily represents a quality control measure of lab methodology, but also integrates procedural aspects such as decontamination and sample handling.

Field parameters will be collected at each sampling site using a laboratory calibrated Hydrolab HL7 instrument. After 1 minute of stabilization, five measurements will be collected at 10-second intervals. The mean of these five measurements will be used as the value for that site. This file is saved electronically, as well as recorded in the field notebook.

Schedule

Preparatory Work

All monitoring sites will be sampled in March 2021 to contribute to the baseline data.

First Study Season

All monitoring sites will be sampled once per quarter after the FERC Study Plan Determination is issued (June, September, December) in 2021, and each monitoring event will consist of collecting a sample and measuring field parameters at each site.

Second Study Season

All monitoring sites will be sampled once per quarter in 2022 (March, June, September, December), and each monitoring event will consist of collecting a sample and measuring field parameters at each site.

Reporting Plan

An Initial Study Report will be filed by no later than May 12, 2022 and will include the 2021 sampling data. The Final Study Report, including the 2021 and 2022 data, will be filed no later than May 12, 2023.

4.3 Resource Management Goals

Montana's Surface Water Quality Standards and Procedures includes language specific to dams. ARM 17.30.602 defines "naturally occurring" as "conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Conditions resulting from the reasonable operation of dams in existence as of July 1, 1971, are natural." ARM 17.30.636 (1) states that owners and operators of water impoundments that cause conditions harmful to prescribed beneficial uses of state water shall demonstrate to the satisfaction of the DEQ that continued operations will be done in the best practicable manner to minimize harmful effects.

The Clark Fork River at the Thompson Falls Project is classified as B-1 in ARM 17.30.607, implemented by the DEQ. Waters classified B-1 are to be maintained suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

4.4 Existing Information and Need for Additional Information

Water quality data currently exists for the Thompson Falls Project at these sites from 2019 and 2020. This study will provide additional data to the existing water quality dataset to capture a broader range of environmental conditions and account for variability from year to year.

NorthWestern collected water quality data in 2019 in Thompson Falls Reservoir at the upstream end of the project boundary. No significant difference in water quality was found between the upstream end of the Reservoir and directly upstream of the powerhouse. Therefore, NorthWestern proposes to use the monitoring site just upstream of the powerhouse in this study.

4.5 Nexus Between Project Operation and Effects

Proposed Project operations and routine operation and maintenance may affect water quality in the Project reservoir and downstream of the dams and powerhouses.

4.6 Study Methodology Consistency with Generally Accepted Practice

The sampling methodology for this study conforms to current standard operating procedures used by the DEQ (2012). Proposed sampling methods are consistent with sampling conducted in 2019 and 2020 at the Project and are similar to water quality monitoring conducted and approved by DEQ at other NorthWestern hydropower projects.

Data quality assurance and quality control (QA/QC) will be accomplished under this plan using methods described in the standard operating procedures used by the DEQ (2012).

4.7 Level of Effort and Cost

The approximate cost to implement proposed Study 3 – Water Quality is $57,400.

5. Proposed Study 4 Hydraulic Conditions

NorthWestern is proposing to model hydraulic conditions downstream of the Main Channel Dam (site of the fish passage facility) to assess whether there are seasonal or site-specific velocity barriers to upstream fish passage impacted by Project operation.

5.1 Goals and Objectives of Study

The goal of the proposed hydraulic modeling study is to assess the velocity field downstream of the fish passage facility to understand if the flow field created by discharge from the fish passage facility provides a sufficient behavioral cue (attraction flow) to Bull Trout and other species, and whether velocities are low enough as to not fatigue fish attempting to approach the fish passage facility entrance. The hydraulic model will provide velocity fields that can be used as indirect indicators of effectiveness of the fish passage facility.

The study will involve comparing the swimming capabilities of Bull Trout and other species with the estimated velocity fields at or near the fish passage facility entrance to determine effectiveness. These data will be evaluated along with the data from the Fish Behavior Study (Study No. 5), to assess upstream fish passage effectiveness at the Project.

5.2 Study Description

Background

Bull Trout (*Salvelinus confluentus*) were federally listed as a threatened species under the Endangered Species Act (ESA) in 1998. The prior Licensee-prepared 2003 Biological Evaluation concluded that the Project was likely adversely affecting Bull Trout. On November 4, 2008, the U.S. Fish and Wildlife Service (FWS) filed a Biological Opinion (BO) (FWS 2008) with FERC, concluding that the Project is not likely to jeopardize Bull Trout and that the Licensee's proposed conservation measures would reduce, but not eliminate, adverse impacts of the Project.

The BO (FWS 2008) included a requirement for the Licensee to conduct BO-Phase 2 fish passage evaluation studies. At the end of the BO-Phase 2 evaluation period, the Licensee was required to prepare a comprehensive report for filing with FERC. The Comprehensive (BO) Phase 2 Fish Passage Report was prepared with guidance from the Thompson Falls Technical Advisory Committee (TAC)[12] and filed with FERC on December 20, 2019.

The BO (FWS 2008) also required that the Licensee conduct a scientific review to determine if the Thompson Falls fish passage facility is functioning as intended, and whether operational or structural modifications are needed. The scientific review convened in January 2020, with the

[12] The TAC includes, among others, the Licensee, FWS, FWP, Avista, DEQ, USFS, and the Confederated Salish and Kootenai Tribes.

formation of the Thompson Falls Scientific Review Panel (Scientific Panel). On March 27, 2020, the Scientific Panel issued a memo (Scientific Panel 2020) summarizing its evaluation of the fish passage facility and provided recommendations on how to better evaluate the facility in the future. The Scientific Panel suggested NorthWestern initiate two parallel studies to assist in the determination of the fish passage facility's attraction and entrance efficiency:

- Two-dimensional (2D) hydraulics study that incorporates measured or approximated bathymetry to determine, at a minimum, a depth-averaged velocity field and water depths in the near field downstream of the dam/project.
- Telemetry (radio-tag) study using sufficient sample sizes of surrogates to posit movement paths/rates and behavior in response to hydraulic conditions in the near field (areas immediately downstream of the Main Channel Dam, to approximately the High Bridge); the telemetry should be augmented by a literature review of the relative swimming capacities and behaviors of Rainbow, Westslope Cutthroat, Brown and Bull trout.

This study plan defines the proposed hydraulics study recommended by the Scientific Panel. The proposed radio telemetry study is described in Section 6 – Study Plan No. 5 Tailrace Fish Behavior.

Study Area

The study area includes the channel downstream of the Main Channel Dam to the High Bridge (*see* **Figure 6-1**).

Study Methods

Task 1 – Bathymetric Surveying

The initial task for developing an understanding of the hydraulic conditions downstream of the fish passage facility includes performing a bathymetric survey of the study area to combine with publicly available Light Detecting and Ranging (LiDAR) data to develop a digital elevation model (DEM) of the Main Channel Dam, downstream river channel and surrounding terrain.

Task 1 will be accomplished by establishing ground control points and conducting the bathymetric survey with a single beam echo-sounder that is configured with an RTK-GPS. This will provide data in XYZ format of riverbed elevations at accuracies limited by the equipment (e.g., 1-centimeter accuracy of echo-sounder and 3-centimeter accuracy of RTK-GPS). To efficiently capture a complete bathymetric coverage of the riverbed, the RTK-GPS equipped echo-sounder will be attached to a motorized boat that will circle the river channel at approximately 25-foot spacings at survey speed (i.e., 2-4 kilometers per hour). To ensure an accurate bathymetric survey, the echo-sounder data will be compared against multiple RTK-GPS depths taken from the traditional rod method. The final subtask will be combining the land and bathymetric surveys into a single DEM. This will be accomplished by merging the datasets into a single-point cloud, and creating a surface using a Triangular Irregular Networks (TIN) and breaklines (spillway structure,

water surface elevations, etc.). This TIN will then be converted into raster format (also known as geoTIFF) and 1-foot contours for use in this study.

Task 2 – Hydraulic Modeling

A computational fluid dynamics (CFD) model will be developed of the existing Thompson Falls Main Channel Dam and river downstream of the dam using Flow-3D software. Flow-3D can perform both Shallow Water methods (a sophisticated 2D modeling method) and highly resolved three-dimensional (3D) modeling of the river flow, using 3D topography, bathymetry, structures geometry and the surrounding terrain. Flow-3D can simulate fully 3D and transient flow to examine important parameters like velocity, mixing, pressure, turbulence intensity and dissipation, and free water surface profiles. NorthWestern proposes a two-phase approach to the hydraulic modeling. The first phase will be performed using 2D simulations to provide an overview of the river channel hydraulics and will evaluate a wider range of flow rates to identify areas in the river channel to focus and refine the hydraulic modeling and to identify the critical flow rates. Once there is a better understanding of the overall river channel hydraulics, 3D simulations will be performed at key identified flow rates to provide a comprehensive evaluation of the velocity's spatial and vertical variation in the water column.

Based on available project information and collected survey data, a 3D Computer Aided Design (CAD) model will be created of the spillway, downstream river channel and surrounding terrain. The downstream river channel will extend to just upstream of the High Bridge, or approximately 1,500 feet downstream of the dam. The 3D CAD model will be imported into the CFD model and a computational mesh will be developed to capture the relevant geometric features of the spillway and river channel configuration.

Phase 1 – The CFD model will be used to simulate 2D flow with depth averaged velocities. The simulations will be performed for up to four flow rates, which may include a low flow condition, two intermediate flow rates and the maximum flow rate at which the fish passage facility is operational. Model results will be reviewed and compared with available operational data to validate the model results with known flow rates and depths. Model adjustments may be performed to calibrate the model to observed conditions if needed. An evaluation will be conducted of the flow depths and depth average velocities at the approach of the fish passage facility and along the margins of the river to account for the Bull Trout's preference to move in lower velocity margins. These 2D depth and velocity raster results for each flow scenario will be combined with collected telemetry data to provide valuable insight into the effectiveness of the fish passage facility in both the far and near fields.

Phase 2 – Once the 2D CFD model is established, and results reviewed and validated, NorthWestern will perform 3D CFD modeling to provide a comprehensive evaluation of the flow conditions in the river channel. The 3D CFD modeling will be performed for two identified flow conditions to be determined after review of the 2D CFD modeling results. NorthWestern will refine the mesh in key areas of such as the fish passage facility entrance and the falls to identify the

vertical velocity distribution in the water column. This will identify particular depths that may influence the movement of the fish. Velocity and depth raster results and water surface profiles at key locations will be provided for the evaluated flow rates. These results will be compared to collected telemetry data to provide information on the effectiveness of the fish passage facility.

The hydraulic analyses and evaluations will be documented in an Initial Study Report with supporting figures and appendices.

Schedule

Preparatory Work

The hydraulic study will commence following the FERC Study Plan Determination anticipated by May 12, 2021.

First Study Season

Task 1: Bathymetric Survey will be conducted in the mid to late summer of 2021, when the river flows are low, and a small boat can access the area between the powerhouse and the majority of the reach below the spillway. These data will supplement the available LiDAR data. NorthWestern anticipates that bathymetry data collection will be complete by August 1, 2021 (**Table 5-1**).

Task 2: Phase 1 of the hydraulic modeling (2D) will be conducted from August 2021 to October 2021.

NorthWestern proposes to supplement the ILP reporting requirements for this study by issuing an Interim Report. The Interim Report will provide results from the 2D modeling and recommendations for the specific scenarios to model with the 3D modeling. The Interim Report will be completed by November 30, 2021 and distributed to Relicensing Participants for a 30-day review and comment period. The Interim Report will be revised based on comments received.

Phase 2 of the hydraulic modeling (3D) will be conducted between February 2022 and April 2022.

The Final Study Report will be filed by May 12, 2022.

Table 5-1: Summary of First Study Season Schedule.

Timing	Activity
July–Aug 2021	Bathymetric survey
Aug–Oct 2021	Phase 1 hydraulic modeling
Nov 30, 2021	Interim Report distributed to Relicensing Participants (2D)
Dec 30, 2021	Comments due to NorthWestern on Interim Report
Feb–April 2022	Phase 2 hydraulic modeling (3D)
May 12, 2022	Final Study Report distributed to Relicensing Participants

Second Study Season

None, as the study will be completed in the first study season.

Reporting Plan

NorthWestern proposes to supplement the ILP reporting requirements for this study by issuing an Interim Study Report that will document the results of the first phase of hydraulic modeling and make recommendations on scenarios for the second phase of hydraulic modeling.

NorthWestern will document the results of both phases of the hydraulic analyses and evaluations in a Final Study Report and will document the methodology, parameter selections, flow rate that was evaluated, and assumptions used for modeling. The Final Study Report will include figures to present the findings and appendices to support the analyses performed. The Final Study Report will be filed no later than May 12, 2022 (*refer to* **Table 5-1**).

5.3 Resource Management Goals

The FWS manages Bull Trout under the ESA. Within the FWS Bull Trout Recovery Plan (2015), the FWS calls for minimizing demographic threats to Bull Trout by restoring connectivity or populations to promote diverse life history strategies and conserve genetic diversity. The ultimate goal of the FWS recovery strategy is to manage threats and ensure sufficient distribution and abundance to improve the status of Bull Trout throughout their extant range in the coterminous U.S. so that protection under the ESA is no longer necessary.

FWP manages and monitors fish populations in Montana. The fisheries management direction for the Lower Clark Fork River Drainage is to conserve and monitor the Bull Trout population and engage in general fisheries management for all other species. The 2019 – 2027 Montana Statewide Fisheries Management Program and Guide prioritizes continued operation of the Thompson Falls fish passage facility and reestablishment of connectivity for Bull Trout.

The Thompson Falls TAC has defined the priorities for fish passage at the Thompson Falls fish passage facility as:

- Pass Bull Trout
- Pass native species
- Pass non-native salmonid sport fish, but not to the detriment to the first two objectives. (e.g., if Brown Trout expansion extends into Bull Trout systems)
- Overarching goal is volitional passage

While the overarching goal for the fish passage facility is volitional passage, volitional passage has not been approved by FWP and FWS at this time due to the presence of Walleye downstream of Thompson Falls Dam and the absence of an established Walleye population upstream.

This study will provide information on the ability of fish to locate the fish passage facility entrance under different flow conditions.

5.4 Existing Information and Need for Additional Information

In 2010, the prior Licensee developed a TDG Control Plan (TDG Plan) for the Project. The TDG Plan described a spillway opening schedule for the Project intended to maximize fish attraction to the upstream adult fish passage facility at discharge less than 48,000 cfs. At discharge in excess of 48,000 cfs, the spillway opening schedule was designed to minimize the level of TDG in the river downstream. The fish attraction spill schedule was developed based on observations of hydraulic conditions downstream of the Main Channel Dam. No hydraulic modeling was conducted. The TDG Plan has been implemented annually since 2011.

Topographic and bathymetric surveys will provide detailed information to prepare a digital elevation model for hydraulic modeling and a better understanding of the hydraulics of the river channel immediately downstream of the Project.

5.5 Nexus Between Project Operation and Effects

Operations of the Main Channel Dam modify hydraulic conditions downstream, potentially influencing the ability of fish to locate the entrance to the fish passage facility.

5.6 Study Methodology Consistency with Generally Accepted Practice

The study methodology will utilize the CFD modeling to understand the hydraulics of the river channel between the Main Channel Dam and the High Bridge. CFD modeling will be performed using Flow3D software, which is a widely used and accepted software platform for performing CFD modeling.

5.7 Level of Effort and Cost

The approximate cost to implement proposed Study 4 – Hydraulic Conditions is $78,000.

6. Proposed Study 5 Fish Behavior

The fish passage facility was designed and constructed to address upstream fish passage for the federally threatened Bull Trout. Other fishes also use and benefit from the fish passage facility.

The goals and objectives of the upstream fish passage facility are, in order of importance:

- Pass Bull Trout
- Pass native fish species
- Pass nonnative salmonid sport fish, but not to the detriment of the other two objectives

The fish passage facility was constructed with the overarching goal of volitional passage. Volitional passage is currently not feasible with the presence of Walleye (*Sander vitreus*) in the system downstream of Thompson Falls Dam, but not upstream of Thompson Falls Dam.

Upstream fish passage for federally threatened Bull Trout and other fishes is impacted by the Project and effectiveness of the fish passage facility. From 2011 through 2019, the fish passage facility has provided upstream fish passage to over 34,000 fish representing 14 species (plus 3 hybrids), including 18 Bull Trout.

This study proposal provides a quantitative approach to evaluating the effectiveness of upstream fish passage at the Project (**Figure 6-1**). Due to the rarity of Bull Trout in the Project area, NorthWestern is proposing to monitor the movement of surrogate species, Brown Trout (*Salmo trutta*) and Rainbow Trout (*Oncorhynchus mykiss*), using radio telemetry.

6.1 Goals and Objectives of Study

The goal of this study is to evaluate fish movement through the zone of influence of the Project which is defined by the zone of passage (ZOP) concept (FWS, 2017). The ZOP concept defines discrete areas for analysis of the pathway fish use to move through the influence of the Project. These areas include far field, near field, entry, internal fishway, exit, and upstream (*see* **Figure 6-2** for ZOP concept and definitions). The ZOP concept provides a method to measure passage effectiveness and identify attributing causes and influences (Project and non-project related) to upstream passage effectiveness. This study will focus on fish movement in the far field, near field, and fish passage facility entrance.

The study objectives are to assess the effectiveness of upstream fish passage and residual Project influences, if any.

Figure 6-1. Study area for the radio telemetry study No. 5.

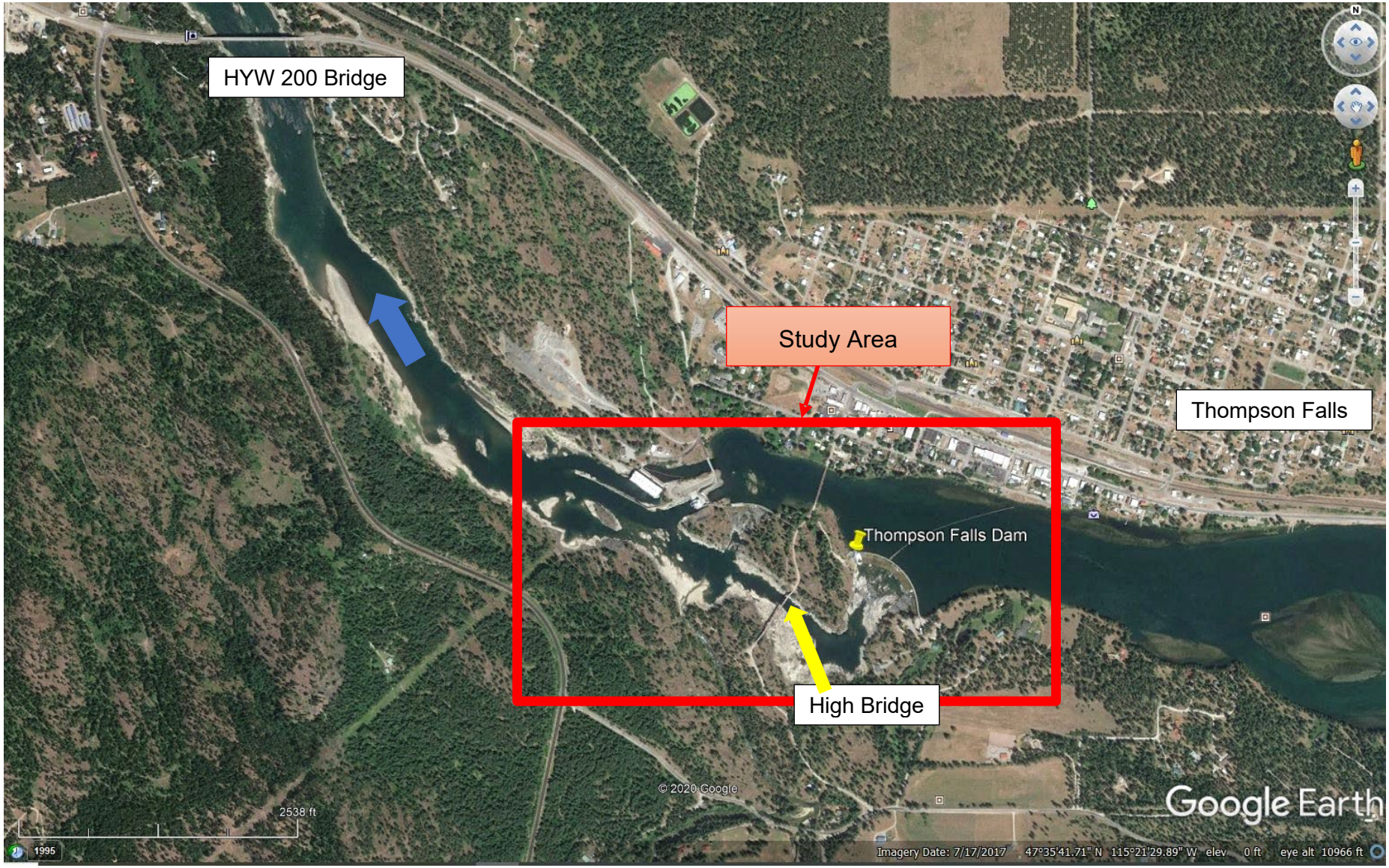
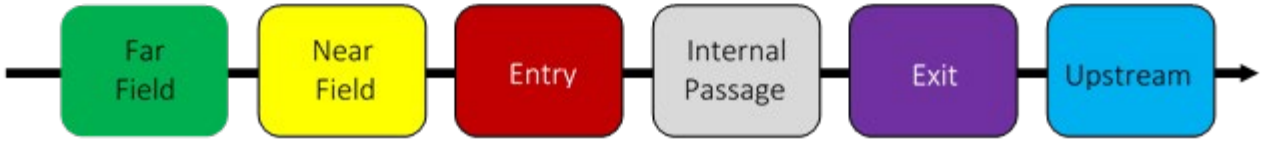


Figure 6-2. Zone of Passage Concept (Note: Figure not to scale).



Far Field	Downstream of fishway/dam where powerhouse and spill serve as primary attraction to migrating fish
Near Field	In proximity to fishway where fishway attraction flow may lure fish to entrance
Entry	Immediately downstream of entrance channel/gate where fishway discharge dominates hydraulics/velocity field/fish behavior
Internal Passage	Hydraulics, structure, and fish movement with the ladder (i.e., entrance channel, pools, trap, exit channel)
Exit	Immediate upstream of the fishway exit gate/exit channel where inflow into fishway dominates hydraulics/velocity field/fish behavior
Upstream	Beyond the influence of the fishway into the reservoir/impoundment

6.2 Study Description

Background

In compliance with the terms and condition (TC) 1-h in the BO (FWS 2008) and 2009 license amendment (FERC 2009), NorthWestern, in collaboration with the TAC, formulated a Scientific Panel to evaluate the fish passage facility (*see* Section 6.4 – Existing Information and Need for Additional Information, for more background information about the Scientific Panel). This study is proposed to address the questions the Scientific Panel raised in their 2020 report by providing quantitative results and analysis for the proportion of "motivated" fish entering the ZOP and finding the fish passage facility entrance. The study assumes that study fish entering the ZOP are "motivated" to move upstream.

NorthWestern proposes the use of radio telemetry to monitor upstream fish migration downstream of the Project in 2021 and 2022 (*refer to* **Figure 6-2)**. This study will include radio-tagging Brown and Rainbow trout (surrogate species for Bull Trout).

Brown Trout will be the focus for 2021 study efforts with fish collection and radio-tagging starting in June and monitoring extending into October/November. The extent of tagging will depend on the ability to capture adequate sample size. There is potential for fish collection efforts to extend into July and September. It is assumed conditions in August will be too warm (water temperatures > 20°C) for fish collection, tagging, and transport. The monitoring duration will occur through the fall until the fish passage facility is closed for the season. The passage facility is typically closed by November due to operations limitations caused by freezing conditions. In addition, upstream fish movement typically declines rapidly when temperatures are less than 8 °C. Brown Trout will provide data on salmonid behavior and movement assessment during the summer and fall months.

Rainbow Trout will be the focus for 2022 study efforts with fish collection and radio-tagging starting in March and monitoring extending through August. The fish collection time frame is dependent on sampling conditions and sample size and could last through May. Rainbow Trout will provide data on salmonid behavior and movement during spring and early summer flows.

The telemetry monitoring efforts will focus on assessing fish movement, including:

- Travel time from the far field to the near field
- Movement patterns (e.g., left bank, right bank) in the near field (Main Channel Dam area)
- Travel time from the near field (the falls area) to the entrance of the fish passage facility
- Proportion of fish that enter the ZOP and locate the entrance of the fish passage facility entrance
- Locations where fish hold within the ZOP

The results of the study will be reviewed in concert with the CFD model (*refer to* Section 5 – Proposed Study 4 Hydraulic Conditions) to assess near field hydraulics and identify potential hydraulic influences on fish upstream movement patterns. Also included will be a literature review of relative swimming capabilities and behaviors of Rainbow, Westslope Cutthroat, Brown, and Bull trout.

Internal fish passage will continue to be monitored by passive integrated transponders (PIT) and reported in Annual Reports per FERC (2009) and BO (FWS 2008) compliance requirements.. Additionally, attractant flows available through fish passage facility operations (e.g., high velocity jet) or dam operations (i.e., spill configuration at the Main Channel Dam) will continue to operate as in past years during this study.

Study Area

This study will focus on fish movement in the far field, near field, and fish passage facility entrance (*see* **Figure 6-2**).

Study Methods

Species

This study will use Brown Trout and Rainbow Trout as a surrogate for Bull Trout. Low numbers of Bull Trout in the project area, and their Threatened status preclude using them in the proposed study. Although a perfect surrogate for Bull Trout does not exist, as they are behaviorally unique, Rainbow Trout may serve as a comparison for the spring migration period and the tendency to use channel margins during high, turbid flows. Brown Trout may be more closely sized to Bull Trout so jumping and swimming abilities may be more similar. Brown Trout also tend to migrate in summer and fall, which indicates that they could be effective surrogates for a fall migration period.

Fish will be collected from the Thompson River, located approximately 6 miles upstream of Thompson Falls Dam (**Figure 6-3**). This study assumes that Thompson River fish, because they come from waters upstream of Project, are motivated to return upstream after transport and release downstream of the dam.

The goal of the study will be to radio tag 100 fish total, including 50 individuals from each species. FWP routinely samples fish populations in the Thompson River. In 2019, the Big Hole section of the Thompson River was estimated to contain 253 Brown Trout per mile and 327 Rainbow Trout per mile (FWP 2019a). Based on these estimates, NorthWestern anticipates being able to collect the targeted number of sample fish. Adult fish will be captured, typically greater than or equal to 350 mm total length to maintain a 2 percent tag to body weight ratio. Previous research has shown implanted tags typically impart no negative effects until body to weight ratio reaches from 4 to 7 percent. This proportion of species is subject to change based on individuals available for capture.

Fish Collection

Brown Trout collection will occur in June, July and/or September 2021. Sampling of Rainbow Trout will occur in March, April, and/or May 2022. Timing of sampling may be modified depending on river conditions in the Thompson River (e.g., stream temperatures, streamflows). Field conditions and related safety considerations for the field crew will determine when sampling can commence. Collection of fish will occur via boat electrofishing and angling. Specific sample locations in the Thompson River will be coordinated with FWP.

Fish will be anesthetized, tagged (PIT and radio), and then transported downstream of the dam prior to their release. Fish will be released approximately 4 miles downstream of Thompson Falls Dam at the Flat Iron boat launch (**Figure 6-3**). Subsequent upstream fish movement will be monitored at stationary receivers located throughout the study area as well as via manual tracking efforts (**Figure 6-4**).

Tagging

The radio tag will be internally implanted through the intra-peritoneal (body cavity) following the methods described in Mizell and Anderson (2015). It is anticipated that the tag life will range from 3 to 5 months. Radio transmitters manufactured by Lotek Wireless (model MCFT) are proposed for this study, as they are best suited to address the goals and objectives of the study. Radio tags will be equipped with depth and activity sensors and will be selected to adhere to the 2 percent tag to body weight ratio.

Fish sampled for this study will also receive a PIT tag (full-duplex) implanted in the muscle tissue ventral to the dorsal fin. PIT tags have a greater retention time when implanted in the muscle tissue (Mamer and Meyer, 2016). Remote PIT tag array stations are currently operating in: Prospect Creek, a tributary located immediately downstream of the Main Channel Dam; the fish passage facility in the lower pools and holding pool; and the mainstem of the Thompson River, a tributary located about 6 miles upstream of the dam. The same PIT tag methods implemented at the work station at the fish passage facility will be followed for this study.

Training and Testing Procedures

Field crews will be trained regarding methods to be implemented during radio tagging fish surgeries, including anesthetizing, surgery procedure, and recovery process for fish prior to transport and release in the Clark Fork River (Flat Iron boat launch).

Telemetry fixed receiving stations and antennas will be installed prior to the start of radio tagging fish. Fixed receiver stations will be tested to determine tag detection efficiency, power supply systems, adequate data downloading, and that quality assurance and quality control systems are in place.

Sampling and Transporting Temperature Thresholds

NorthWestern will coordinate with FWP to identify the threshold for the acceptable temperature differential from the sampling location (Thompson River) and release site (Clark Fork River). Sampling, tagging, and transport of fish will only occur when water temperatures (in the Thompson and Clark Fork rivers) are less than or equal to 20 °C (68 °F).

Monitoring Procedures

The fixed stations and general radio telemetry monitoring zones are shown in **Figure 6-4**. The fixed telemetry stations will record data continuously throughout each study season (June–October/November 2021 and March–July 2022). Data from the fixed stations will be downloaded weekly during the monitoring season.

Manual radio telemetry monitoring will likely occur at variable intervals during each study season. The frequency of manual tracking will depend on fish detections by the fixed stations and may vary from a weekly effort, daily effort or multiple times a day. The goal of the manual tracking will be to confirm where a fish may be located between two fixed stations and provide higher resolution of the location for an individual fish. Manual tracking will be a critical tool in monitoring fish movement in the near field. Specific monitoring protocols will be coordinated with FWP.

The existing PIT tag arrays in Prospect Creek, the fish passage facility, and the Thompson River operate remotely, and data are remotely accessed. The data from these stations will be downloaded and reviewed at a minimum weekly.

Data Analysis

In 2021, fish movement data for Brown Trout will be collected from June through October/November. These data will be analyzed to assess Brown Trout movement during baseflow conditions in the summer and fall months.

In 2022, fish movement data for Rainbow Trout will be collected from March through July. These data will be analyzed to assess Rainbow Trout movement during high flow conditions in the spring and early summer.

The evaluation of fish movement behaviors for the two species and different flow conditions will focus on addressing the following:

- Travel time from the far field to the near field (entry of ZOP to falls below the Main Channel Dam)
- Movement patterns (e.g., left bank, right bank) in the near field (Main Channel Dam area)
- Travel time from the near field to the entrance of the fish passage facility

- Proportion of fish that enter the ZOP and locate the entrance of the fish passage facility entrance
- Locations where fish hold within the ZOP

Following the completion of the telemetry study, these data will be evaluated in conjunction with the CFD modeling to assist in evaluating potential hydraulic influences on upstream fish movement in the near field. The objective of combining the behavioral data and hydraulic modeling data will be to help identify potential Project influences (e.g., velocity fields) in the near field that may affect conditions for upstream fish passage. In addition, a literature review of the relative swimming capacities and behaviors of salmonids will be completed to gain further understanding of combining the behavioral and hydraulic modeling results and included as part of this fish behavior study.

Figure 6-3. Fish Sampling Location (Thompson River) and Release Location (4 miles downstream of dam) in Relation to Study Area.

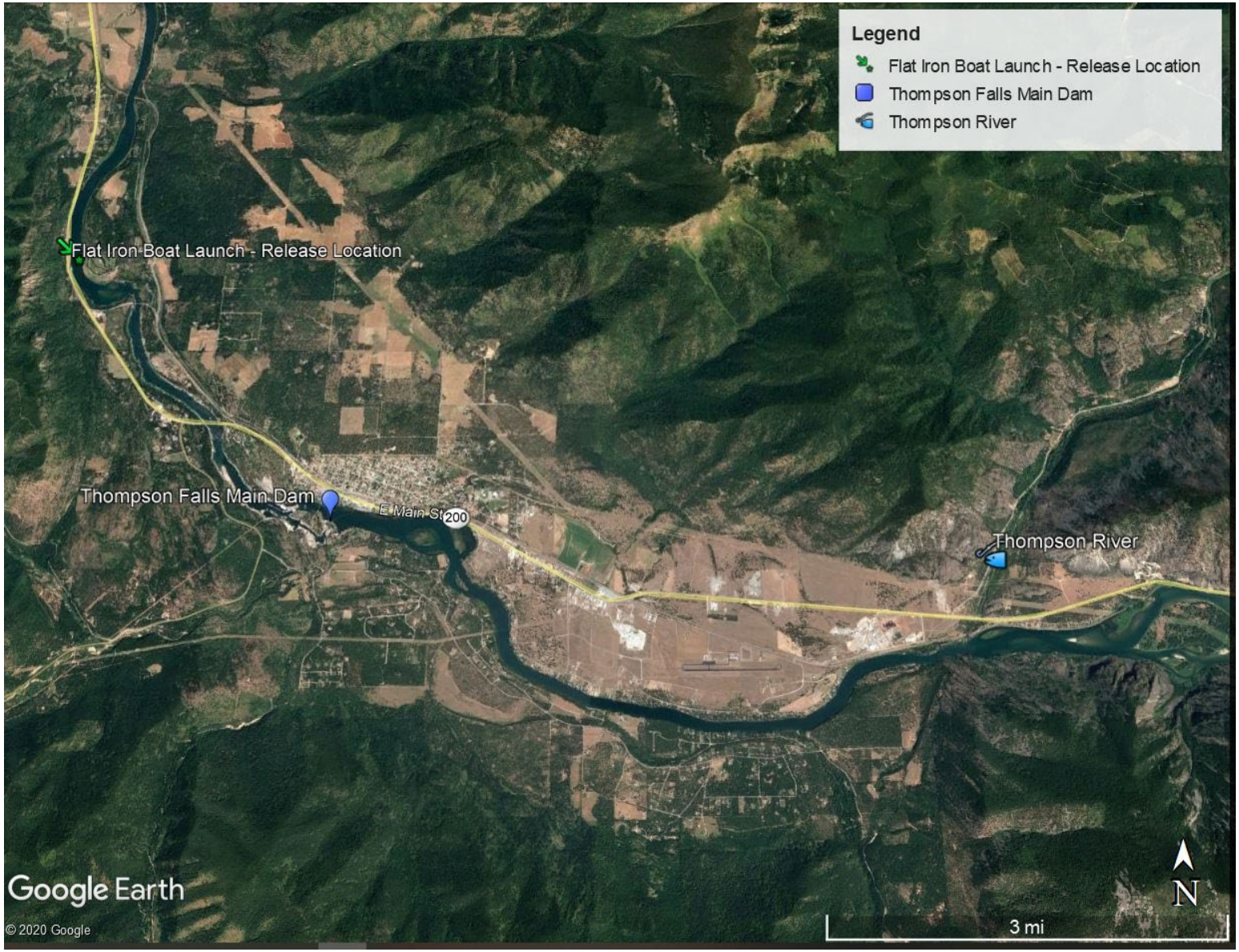


Figure 6-4. Radio Telemetry Monitoring Zones.

Schedule

Preparatory Work

Study planning, acquiring equipment, and testing equipment and procedures will take place between January and May 2021, in order to begin the study in June 2021.

First Study Season

Tagging and monitoring of Brown Trout will take place during the first study season. The anticipated activities and schedule are depicted in **Table 6-1**.

Table 6-1: First Study Season Schedule.

Timing	Activity
Jun, Jul and/or Sep 2021	Sampling and tagging Brown Trout in the Thompson River and release downstream of study area
Jun–Oct/Nov 2021	Monitor Brown Trout movement
Dec–Apr 2022	Analyze data and prepare Initial Study Report
May 12, 2022	Initial Study Report for Fall 2021 Results

Second Study Season

Tagging and monitoring of Rainbow Trout will take place during the second study season. The anticipated activities and schedule are depicted in **Table 6-2**.

Table 6-2: Second Study Season Schedule.

Timing	Activity
Jan–Feb, 2022	Planning, acquiring equipment, testing equipment and procedures
Mar, April, and/or May, 2022	Sampling and tagging Rainbow Trout in the Thompson River and release downstream of study area
Mar–Jul, 2022	Monitoring Rainbow Trout movement
Aug 2021–April 2023	Analyze data and prepare Final Study Report
May 12, 2023	Final Study Report of 2021 and 2022 results

Reporting Plan

The Initial Study Report for 2021 monitoring results of Brown Trout will be prepared and filedno later than May 12, 2022. A Final Study Report summarizing the results of Brown and Rainbow Trout upstream movements will be filed no later than May 12, 2023. The Final Study Report will also evaluate trout movement trends in conjunction with the hydraulics analysis and results from the CFD modeling (*refer to* Section 5 – Proposed Study 4 Hydraulic Conditions), and the literature review of salmonid swimming capabilities.

6.3 Resource Management Goals

The FWS manages Bull Trout under the ESA. In the FWS Bull Trout Recovery Plan (2015), the FWS calls for minimizing demographic threats to Bull Trout by restoring connectivity or populations to promote diverse life history strategies and conserve genetic diversity. The fish passage facility helps to meet the goal of restoring connectivity, and this study intends to measure the efficacy of the fish passage facility. The FWS views safe, timely, and effective fish passage as important components in the operation of an upstream fish passage facility and restoring connectivity.

FWP manages and monitors fish populations in Montana. The fisheries management direction for the Lower Clark Fork River Drainage is to conserve and monitor the Bull Trout population. The 2019-2027 Montana Statewide Fisheries Management Program and Guide prioritizes continued operation of the Thompson Falls fish passage facility and reestablishment of connectivity for Bull Trout.

6.4 Existing Information and Need for Additional Information

Fish movement and behavior studies were conducted during the planning of the fish passage facility. Radio telemetry studies to monitor salmonid upstream migrations downstream of the dams and powerhouses were completed in 2004 (Gillin and Haddix 2005), in 2005 (Haddix and Gillin 2006), and in 2006 (GEI 2007). The objective of these studies was to monitor fish behavior and movement downstream of the dams and powerhouses and determine the placement of the fish passage facility.

Over the course of the 3-year study, 113 fish were radio tagged. The majority of the fish were Rainbow Trout collected via electrofishing downstream of the dam and in a Denil trap (located immediately downstream of the Main Channel Dam) during the spring. Radio-tagged fish were released about 6 miles downstream of the dam and approximately 71 percent of all the radio-tagged fish were subsequently detected in the Project area (Gillin and Haddix 2005, Haddix and Gillin 2006, GEI 2007).

The 3-year study concluded the majority of fish were detected below the Main Channel Dam prior to the spring freshet. Additionally, fish movement and behavior related to spill regimes at the Main Channel Dam were successfully modified via manipulation of flashboard operations resulting in the movement of fish from the left bank to the right bank (GEI 2007). The results of these studies, along with physical construction constraints, were used to define the location and entrance of the fish passage facility that was placed in operation in 2011.

In 2010, a TDG Plan was developed for the Project. The TDG Plan describes a spillway opening schedule for the Project intended to maximize fish attraction to the upstream adult fish passage facility at discharge less than 48,000 cfs.

At discharge in excess of 48,000 cfs, the spillway opening schedule was designed to minimize the level of TDG in the downstream of the dams. The TDG Plan has been implemented annually since 2011. The effectiveness of the TDG Plan in providing beneficial hydraulic conditions for fish passage has not been evaluated.

In compliance with the terms and condition (TC) 1-h in the BO (FWS 2008) and 2009 license amendment (FERC 2009), NorthWestern, in collaboration with the TAC, formulated a Scientific Panel to evaluate the fish passage facility. The goal and objective of the Scientific Panel was to evaluate whether the fish passage facility is functioning as intended (with primary focus on the target species, Bull Trout), and whether operational or structural modifications are needed. The Scientific Panel consisted of members from FWS, FWP, and an independent consultant. The Scientific Panel reviewed available material from ladder operations from 2011 through July 1, 2019 and prepared a Memorandum (Scientific Panel 2020) with their findings and recommendations.

The Scientific Panel was challenged with a low sample size of the target species, Bull Trout (likely attributed to low abundance in the system), the lack of quantitative measurements regarding fish movement in the ZOP, and hydraulic data to evaluate attraction efficiency (far field) or entrance efficiency (near field).

The Scientific Panel concluded that the available data on upstream fish passage did not provide quantifiable measurements to evaluate effectiveness of upstream fish passage and make determinations of whether the fish passage facility is functioning as intended. This study is a direct result of the recommendations from the Scientific Panel.

6.5 Nexus Between Project Operation and Effects

Upstream fish passage for federally threatened Bull Trout and other fishes is directly impacted by the Project and effectiveness of the fish passage facility. In compliance with 2009 FERC license amendment and BO (FWS 2008), NorthWestern is tasked with evaluating upstream fish passage efficiency.

6.6 Study Methodology Consistency with Generally Accepted Practice

Many fish studies in riverine systems utilize radio telemetry to monitor fish movement. In the literature cited a list of references is included that were reviewed for development of this study. They support the selection of radio telemetry as an appropriate method to achieve the goals and objectives identified.

6.7 Level of Effort and Cost

The approximate cost to implement proposed Study 5 – Fish Behavior is $202,900.

7. Proposed Study 6 Downstream Transport of Bull Trout

NorthWestern is proposing a study to evaluate the feasibility of collecting and transporting suitable numbers of juvenile Bull Trout downstream. The study entails collecting and transporting juvenile Bull Trout from the Thompson River to Lake Pend Oreille. The long-term goal (beyond the time frame of this study) is to assess whether or not downstream transport of juvenile Bull Trout from the Thompson River to Lake Pend Oreille would increase the spawning population of adfluvial Bull Trout in the Thompson River drainage. The proposed study will evaluate and focus on the feasibility of collecting and transporting juvenile Bull Trout, goals that are attainable in the ILP 2-year study period timeframe.

7.1 Goals and Objectives of the Study

The goal of the study is to evaluate the feasibility of collecting and transporting juvenile Bull Trout from the Thompson River to Lake Pend Oreille.

During the 2-year relicensing study, NorthWestern will:

- Attempt to determine the most efficient and effective capture methods, capture locations, and seasonal capture timing of juvenile Bull Trout in Fishtrap Creek and West Fork Thompson River
- Assess downstream transport feasibility
- Evaluate juvenile Bull Trout survival during transport

7.2 Study Description

Background

Bull Trout are listed as threatened by the FWS under the ESA and populations in the Lower Clark Fork are suppressed from historic levels. The Thompson River flows into Thompson Falls Reservoir 6 miles upstream of Thompson Falls Dam. The West Fork Thompson River and Fishtrap Creek are known Bull Trout spawning tributaries to the Thompson River where Bull Trout are consistently found. Previous studies have documented the existence of both resident and migratory populations in these tributaries (Liermann 2003, Zymonas 2006, Huston 1994, Glaid 2017).

Historically, juvenile adfluvial Bull Trout in the Clark Fork River drainage outmigrated from tributary streams to feed and mature in Lake Pend Oreille. The adults would then migrate upstream from Lake Pend Oreille to the natal streams to spawn. This migration pattern has been disrupted by the construction of Cabinet Gorge, Noxon Rapids, and Thompson Falls dams. Today, Bull Trout passage in the Lower Clark Fork drainage is, in part, facilitated by Avista's trap and transport

programs. Avista captures a portion of juvenile Bull Trout within their natal streams, implants them with PIT tags, and transports them to Lake Pend Oreille. Avista seasonally collects adult Bull Trout upstream of Lake Pend Oreille near the vicinity of Cabinet Gorge Dam[13]. A fin clip from each Bull Trout is genetically tested to determine their natal stream so they can be transported to (or near) their tributary of origin. Avista has operated the adult Bull Trout transport program since 2001. Transport of Bull Trout upstream of Thompson Falls Dam began in 2007. For the last 12 years, Avista has annually transported an average 37 Bull Trout upstream of Cabinet Gorge Dam with about 21 percent (7 Bull Trout) transported upstream of Thompson Falls. A portion of the adults captured at Cabinet Gorge Dam are fish that were previously transported downstream as juveniles. Avista's downstream trap and transport program does not include tributaries upstream of Thompson Falls Dam.

The Thompson River is designated critical habitat for migratory (adfluvial/fluvial) and resident Bull Trout. Outmigrating juvenile Bull Trout from the Thompson River may pass downstream of Thompson Falls Dam and take up residence in Noxon Rapids Reservoir. As adults, they can migrate upstream to their natal stream using the fish passage facility at Thompson Falls Dam. Alternatively, they may continue their downstream movement to Cabinet Gorge Reservoir, or further to Lake Pend Oreille. There is no upstream fish passage facility or program at Noxon Rapids Dam, so Bull Trout that take up residence in Cabinet Gorge Reservoir cannot return to tributaries upstream.

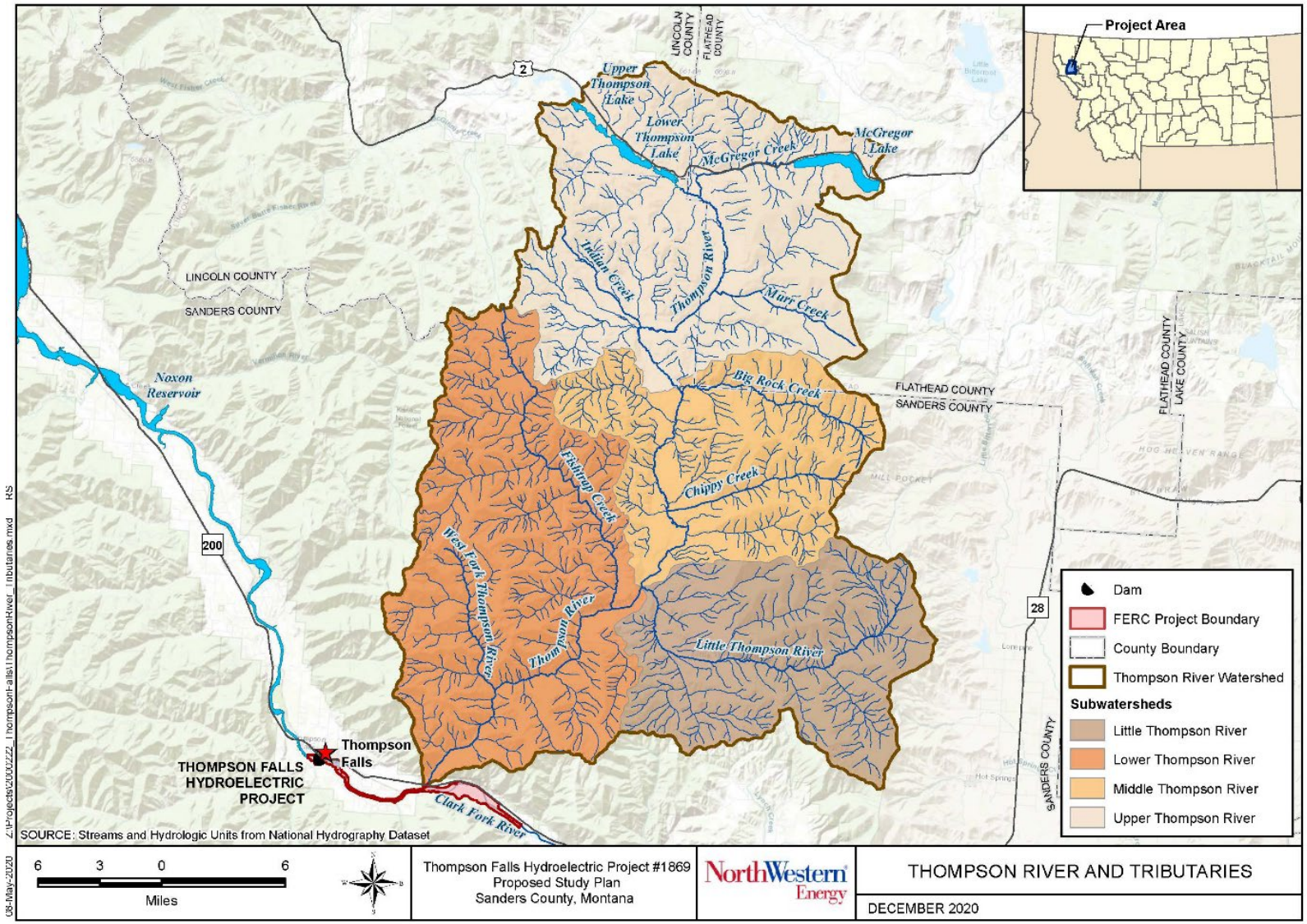
NorthWestern proposes a study to collect and transport juvenile Bull Trout from the Thompson River to Lake Pend Oreille. The study would help evaluate the feasibility of collecting and transporting suitable numbers of juvenile Bull Trout downstream from the Thompson River drainage.

Study Area

The study area for this study is the West Fork Thompson River and Fishtrap Creek, known Bull Trout spawning tributaries to the Thompson River (**Figure 7-1**).

[13] Bull Trout have been collected for the transport program via trapping, electrofishing, and angling downstream of Cabinet Gorge Dam. An upstream fish passage facility is currently under construction at Cabinet Gorge Dam.

Figure 7-1. Thompson River Drainage. West Fork Thompson River and Fishtrap Creek are Located in the Lower Thompson River Subwatershed.



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Methods

This study would involve capturing juvenile Bull Trout (120–250 mm) from Fishtrap Creek and West Fork Thompson River and inserting a PIT into their dorsal sinus cavity. Based on findings from similar efforts in the Lower Clark Fork basin (Avista 2016) backpack electrofishing and picket weir traps would be employed in October and November (weather allowing) to capture Bull Trout in the lower half of Fishtrap Creek and West Fork Thompson River. A target sample size up to 100 individuals from Fishtrap Creek and 100 from West Fork Thompson River is the goal for 2021 fall collection efforts. In 2022 another 200 total fish would be targeted for fall PIT tagging. Based on previous electrofishing and trapping efforts (Glaid 2017) it is uncertain if the sample size goal of 100 individuals in the West Fork Thompson River could be reached. For this reason, NorthWestern proposes flexibility to capture and tag more than 100 fish in Fishtrap Creek (not to exceed 200 total). Of the 120 to 250 mm Bull Trout captured, 75 percent would be transported by truck downstream to a release site in Lake Pend Oreille, and 25 percent would be released on site in the tributaries after capture and tagging. A minimum effort of 10 days (5 days per stream) of electrofishing between mid-October and mid-November in the lower portions of Fishtrap Creek and West Fork Thompson River would occur. Temporary weir traps would be operated on both streams during weekdays between mid-October and the end of November. Weirs would be operated and checked daily on weekdays and partially disassembled on Fridays to allow volitional passage through the weekend.

During the summer (July–August of 2021 and 2022), as part of regular abundance monitoring, all Bull Trout captured in Fishtrap and West Fork Thompson River would receive a PIT tag and be released on site. Summer tagging efforts are meant to further supplement the sample size of non-transported fish and provide a better comparison metric between those transported downstream. It will also provide additional information on favorable capture sites.

Permanent PIT tag antenna stations would continue to be operated at the mouths of Fishtrap Creek, West Fork Thompson River, and Thompson River mainstem. Tagged fish immigrating to and emigrating from this system would be detected by these systems allowing information on movement timing in and out of tributaries.

Schedule

Preparatory Work

NorthWestern will continue to operate the existing Thompson River, Fishtrap Creek, and West Fork Fishtrap Creek PIT antenna arrays and reader (**Table 7-1**).

First Study Season

In the first study season, Bull Trout captured as part of abundance monitoring (July 15–August 31) will be PIT tagged. Juvenile Bull Trout will be captured from the West Fork Thompson River and Fishtrap Creek and transported downstream in October through November.

NorthWestern will continue to operate the existing Thompson River, Fishtrap Creek, and West Fork Fishtrap Creek PIT antenna arrays and reader throughout the study season.

Second Study Season

In the second study season, Bull Trout captured as part of abundance monitoring (July 15–August 31) will be PIT tagged. Juvenile Bull Trout will be captured from the West Fork Thompson River and Fishtrap Creek and transported downstream in October through November.

NorthWestern will continue to operate the existing Thompson River, Fishtrap Creek, and West Fork Fishtrap Creek PIT antenna arrays and reader throughout the study season.

Table 7-1: Summary of Study Schedule.

Timing	Activity
2020–2023	Operate existing PIT-tag antenna arrays
July 15–August 31, 2021 and 2022	PIT-tag Bull Trout captured during abundance monitoring
Oct–Nov 2021 and 2022	Capture and transport juvenile Bull Trout from West Fork Thompson River and Fishtrap Creek
April 1, 2022 and 2023	Include data on PIT-tag detections in annual license compliance monitoring
May 12, 2022 and 2023	Initial and Final Study Reports

Reporting Plan

Interim Reporting – to be filed no later than April 1, 2022 and 2023 – will include ongoing efforts to maintain PIT antenna arrays in the Thompson River drainage will provide results related to adult returns. NorthWestern proposes to supplement the ILP reporting requirements for this study by issuing an annual update to resource agencies and FERC in compliance with the Project's BO (FWS 2008), focused on adult detections at PIT arrays as part of the Thompson Falls upstream fish passage compliance reporting, due annually April 1 (*refer to* **Table 7-1**).

Initial Study Report – to be filed no later than May 12, 2022 – will include a summary of all Bull Trout tagged, transported, released on site and any recapture events or PIT detections acquired. A summary of catch per unit effort for electrofishing efforts and weir trapping will be provided and a proposal for the second study season capture efforts and methodology.

Final Study Report – to be filed no later than May 12, 2023 – reporting on total number of fish PIT tagged, transported or released on site and a summary of any adult returns from any PIT tagged Bull Trout detected in the Thompson River drainage[14].

7.3 Resource Management Goals

The FWS manage Bull Trout under the ESA. Within the FWS Bull Trout Recovery Plan (2015) the FWS calls for minimizing demographic threats to Bull Trout by restoring connectivity or populations to promote diverse life history strategies and conserve genetic diversity.

FWP manages and monitors fish populations in Montana. The stated fisheries management direction for the Lower Clark Fork River Drainage is to conserve and monitor the Bull Trout population. The 2019-2027 Montana Statewide Fisheries Management Program and Guide prioritizes continued operation of the Thompson Falls fish passage facility and reestablishment of connectivity for Bull Trout.

7.4 Existing Information and Need for Additional Information

Existing information related to movement of Bull Trout in the Thompson River drainage most recently includes a graduate study completed in 2017 by Glaid. This work evaluated out-migration characteristics of subadult Bull Trout throughout the drainage to increase the understanding of the local population. PIT tags and acoustic transmitters were employed to track fish outmigration from Fishtrap Creek, West Fork Thompson River, and Thompson River. From July through December 2015, approximately 10 percent of all PIT tagged Bull Trout out-migrated from the Thompson River tributaries, with peak out-migration occurring in late October. Only 13.5 percent of all Bull Trout that entered the Thompson River entered Thompson Falls Reservoir, with peak out-migration occurring in December. Bull Trout demonstrated low out-migration rates in the Thompson River drainage and prolonged habitation of the mainstem Thompson River.

The low outmigration demonstrated in this study and other previous weir and screw trapping efforts (Liermann 2003, Zymonas 2006) illustrate that multiple life history forms exist in the drainage, although they point toward a low adfluvial/fluvial population. Based on recent tagging studies, the percentage of juvenile Bull Trout found to outmigrate from the Thompson River drainage to the Clark Fork River is less than 7 percent (NorthWestern 2019). Furthermore, genetic studies of adult Bull Trout collected below Cabinet Gorge Dam have found Bull Trout in Lake Pend Oreille with genetic markers indicating that the Thompson River is their natal stream. This is evidence that Bull Trout do successfully migrate downstream through the three hydroelectric projects (DeHaan et al. 2011). However, the number of Bull Trout able to complete their life cycle with current passage impediments is small. This study will test the ability to collect juvenile Bull Trout and transport them downstream into more suitable habitat for maturation.

[14] Results regarding Bull Trout survival-to-adulthood in Lake Pend Oreille post-transport will not be known until after this study is completed.

7.5 Nexus Between Project Operation and Effects

Continued operation and maintenance of the Project has the potential to affect adfluvial and fluvial Bull Trout in the Clark Fork River through entrainment and altered river habitat conditions. Transporting juvenile Bull Trout eliminates the need to pass through Thompson Falls Reservoir (and the two Avista-operated downstream reservoirs). These reservoirs contain abundant non-native predator fishes and summer water temperatures in excess of thermal optimums for Bull Trout.

7.6 Study Methodology Consistency with Generally Accepted Practice

Proposed methods to monitor movement of Bull Trout are common with the use of PIT tags and associated antenna arrays in tributary systems. These methods have been used in the past within Thompson River and continue to be utilized in Thompson River and other tributaries in the Lower Clark Fork River. This is a relatively non-invasive method to get substantial information on an ESA-listed species. The practice of transporting juvenile salmonids around dams is widespread and has occurred in the Pacific Northwest for decades with salmon and steelhead (National Oceanic and Atmospheric Administration [NOAA Fisheries] 2019). A similar downstream truck and transport program for Bull Trout is active in the lower Clark Fork River drainage, managed by Avista.

7.7 Level of Effort and Cost

The approximate cost to implement proposed Study 6 – Downstream Transport of Bull Trout is $25,000.

8. Proposed Study 7 Visitor Use Survey

NorthWestern is proposing to conduct a recreation visitor survey in the Project area from Memorial Day weekend through Labor Day weekend 2021. The data provided by the visitor survey will provide information about recreational use during the peak recreation season.

8.1 Goals and Objectives of Study

The goal of the visitor use survey is to monitor recreational use to help determine whether Project-induced recreation is being adequately accommodated. The study objectives are to collect and update information about use of recreation sites associated with Thompson Falls Reservoir and the Clark Fork River immediately upstream and downstream of the Project.

8.2 Study Description

Background

The 2021 visitor use study will replicate previous studies, which will allow trends and patterns in recreation use to be evaluated. Information will be sought regarding:

- Previous use of site (number of years, visits in past year, typical trip duration)
- Current use of site (length of visit, group size)
- Recreation activities at site
- Reasons for visiting site
- Opinions on adequacy of site facilities and/or need for change
- Perceptions of site crowding
- Satisfaction with site and amenities/conditions
- Problems encountered at site, if any
- Awareness of other areas associated with the Thompson Falls Project
- Use of trails and satisfaction
- Geographic origin
- Socio-demographic characteristics

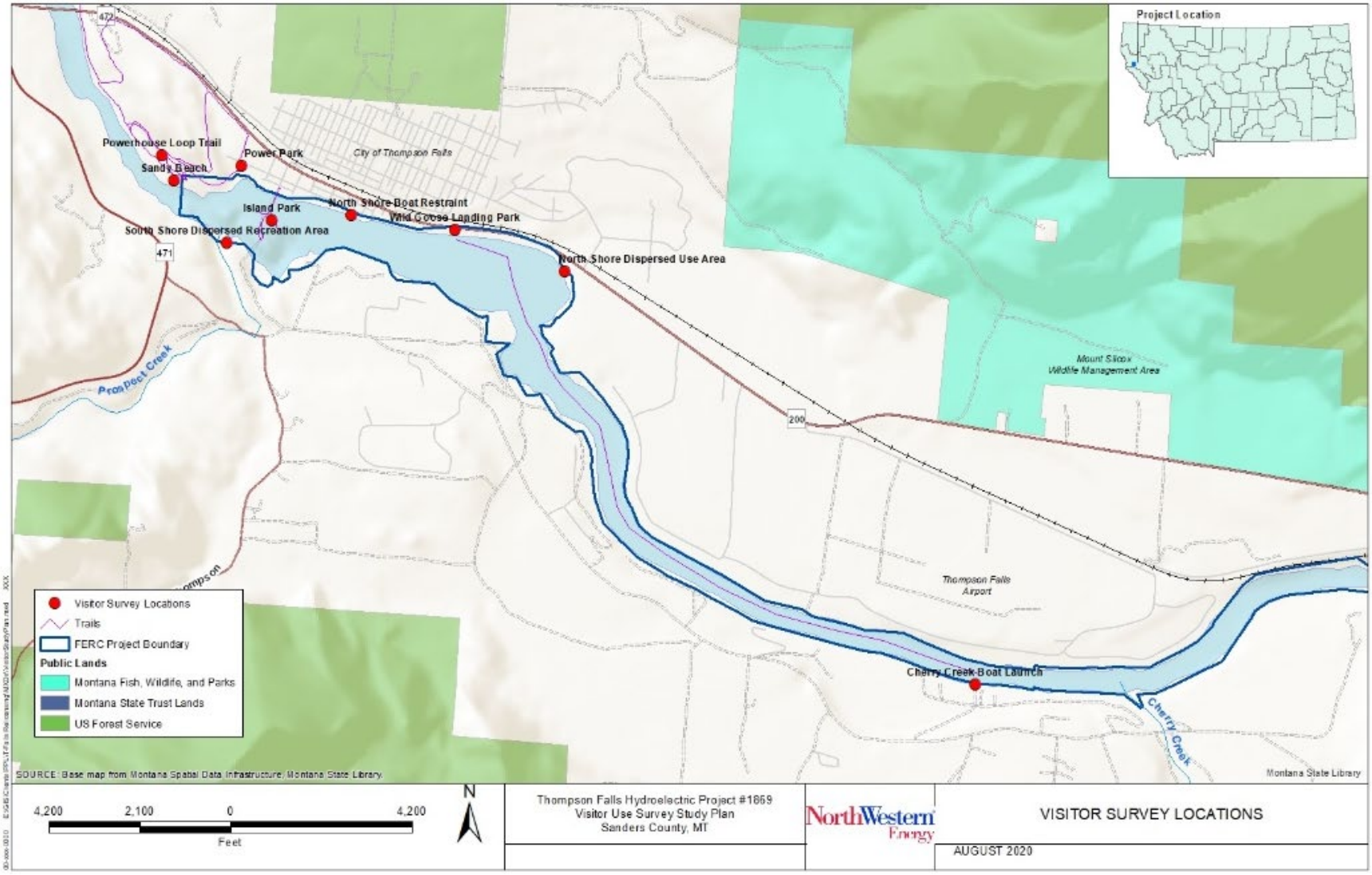
Study Area

The 2021 Thompson Falls Visitor Survey will be administered to interview visitors at nine recreation sites associated with the Project (**Table 8-1** and **Figure 8-1**). Six of the sites are managed, entirely or in part, by NorthWestern.

Table 8-1: Visitor Survey Sites

Recreation Area	Property Ownership and Managing Entity	Inside FERC Project Boundary?	Surveyed Areas
Island Park	Located on NorthWestern property. Managed by NorthWestern.	Yes.	All areas within park.
Cherry Creek Boat Launch	Located on Sanders County property. Managed by Sanders County.	Partially.	Water access site on south shore of reservoir at Cherry Creek.
South Shore Dispersed Recreation Area	Located on NorthWestern property. Managed by NorthWestern.	Partially.	Undeveloped and informal use area along south shore of the river between High Bridge and the mouth of Prospect Creek.
Wild Goose Landing Park	Located on NorthWestern and city property. Managed by city under management agreement with NorthWestern.	Partially.	All areas within park.
Power Park	Located on NorthWestern property. Managed by NorthWestern.	No.	All areas within park.
Powerhouse Loop Trail	Located on NorthWestern and other private property, and within Highway 200 right-of-way. Managed by Thompson Falls Community Trails Group.	Partially. Part of this trail is within the project boundary for Avista's Clark Fork River Project, P-2058.	Trail segment from Power Park downstream to Rimrock Lodge.
Sandy Beach (dispersed)	Dispersed beach area located on NorthWestern property adjacent to Powerhouse Loop Trail.	No. This site is within the Project boundary for Avista's Clark Fork River Project, P-2058.	Undeveloped and informal use area downstream of the original powerhouse on the north side of the river.
North Shore Boat Restraint	Located on NorthWestern property. Managed by NorthWestern.	Partially.	Undeveloped and informal use area along shoreline at the north end of boat restraint.
North Shore Dispersed Use Area (including former sawmill site)	Dispersed shoreline access partially located on NorthWestern property and within Highway 200 right-of-way, and partially on private property.	Partially.	Undeveloped and informal use area along north shoreline (and Highway 200) between abandoned mill site and Wild Goose Landing Park.

Figure 8-1. Visitor Survey Locations



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Study Methods

The study methodology and questionnaire will largely replicate previous studies conducted at regular intervals (most recently in 1999, 2003, 2008, 2014, and 2018). The methodology was developed in cooperation with the city of Thompson Falls, Sanders County, USFS, and FWP.

Visitor sampling will occur on 60 randomly selected days between the beginning of the Memorial Day weekend through Labor Day, 2021 (May 28–September 6), which is the peak recreation season. Each recreation site will be sampled at various times of the day between 8:00 am and 9:00 pm. Systematic random sampling will be used to select locations and times to provide a representative sample of times of the day and days of the week over the course of the 102-day study period. The primary objective of the sampling schedule is to arrive at a sample that is representative of typical recreation use during the study period.

Reasonable attempts will be made to include in the sample one individual from every group of visitors present at the recreation site during the sampling event. A recreation group is defined as any group of individuals, such as family, friends, or tour group visiting the recreation site together. Non-recreationists, such as NorthWestern employees, will be excluded from the sample.

Groups of visitors will be approached by the survey technician on site, briefly informed of the survey's purpose, and asked to participate. The survey respondent will be randomly chosen from the group by selecting the person (aged 16 or older) with the most recent past birthday. If the selected person opts not to participate, the survey technician will choose the person with the next most recent birthday, and so on. If no one in the group agrees to participate in the study, the survey technician will note the group refusal for survey response rate calculation.

In order to limit the amount of participation of any one person or group in the study and aid in acquiring a diverse sample, the same person will only be interviewed once at each recreation site during the study period. In other words, once a person had been interviewed at a site at any time, they will be eliminated from future sampling at that site but could be included again at other sites.

The survey technician will use a tablet computer to administer the survey. The survey questionnaire will be programmed into the tablet and will lead the survey technician through the sequence of questions; visitor responses will be entered directly into the device.

Schedule

Preparatory Work

In April and May 2021, NorthWestern will finalize the survey schedule and conduct the survey technician training. The visitor survey will begin by May 28, 2021.

First Study Season

The visitor survey will be conducted May 28 through September 6, 2021. Data analysis and report preparation will be completed in the fall and winter of 2021 – 2022.

Second Study Season

None, as the study will be completed during the first study season.

Reporting Plan

Results will be included in the Final Study Report which will be filed no later than May 12, 2022.

8.3 Resource Management Goals

Section 4(e) and 10(a) of the Federal Power Act requires FERC to give equal consideration to all uses of the water on which a project is located. When reviewing a proposed action, FERC will consider the environmental, recreational, fish and wildlife, and other non-developmental values of the project, as well as power and developmental values. Documenting visitor satisfaction with available recreation opportunities and amenities, as well as patterns of use of those facilities, will ensure that visitor needs are met under a new license.

FWP maintains four Fishing Access Sites between the lower Flathead River and the Clark Fork River down to Thompson Falls. FWP also works with the Forest Service to provide access at many other sites in the broader region through extensive road and trail systems. Water-based recreational access and experiences are an important component of outdoor recreation overall.

8.4 Existing Information and Need for Additional Information

The study will replicate previous studies conducted at regular intervals (in 1999, 2003, 2008, 2014, and 2018). As described in the PAD, recent visitor surveys have shown a high level of satisfaction with the existing recreational facilities. The 2021 visitor use survey is proposed as an update to the 2018 visitor survey, which was conducted to provide current visitor use information for the relicensing process. Unusual environmental conditions existed during the 2018 visitor survey that affected the availability of water-related recreation opportunities and, in turn, reduced on-water and shoreline-based activity participation (boating, fishing and swimming). Repeating the study in 2021 will provide data on more typical patterns of use and visitor opinions.

8.5 Nexus Between Project Operation and Effects

Many public recreation opportunities available and sought after at Thompson Falls are directly related to the existence of Thompson Reservoir and the Clark Fork River upstream and downstream of the Project. Access areas that support shoreline-based uses (swimming, fishing, etc.) as well as on-water launching facilitate public use of the waterway. Key amenities that offer comfort and conveniences (restrooms, picnic facilities, designated trails etc.) contribute to positive

visitor experiences. Additional features that demonstrate the link between the resource and the generating capacity of the Project, as well as historical materials and operational information (interpretive panels, fish ladder viewing platform, etc.) help visitors understand the nexus between the Project, the waterway, and the recreation amenities they enjoy. Monitoring visitor use of and satisfaction with these opportunities and amenities through the visitor survey ensures that information on the public need for various types of access and amenities is available for evaluation in the Final License Application.

8.6 Study Methodology Consistency with Generally Accepted Practice

Visitor use and satisfaction surveys have been conducted regularly at the Thompson Falls Project (most recently in 1999, 2003, 2008, 2014, and 2018) and at other hydroelectric projects throughout the region. Avista Corporation conducts visitor use surveys at recreation sites on Noxon and Cabinet Gorge Reservoirs, immediately downstream of the Thompson Falls project, at 10-year intervals (most recently in 2012). NorthWestern Energy also conducts visitor use and satisfaction surveys at their Missouri-Madison Project (FERC #2188) and Mystic Lake Project (FERC #2301) at regular intervals, most recently in 2014 and 2019, respectively. Replicating the Thompson Falls visitor survey in 2021 as it was conducted in previous years will produce current results as well as trend information to determine if use is changing over time.

8.7 Level of Effort and Cost

The approximate cost to implement proposed Study 7 – Visitor Use Survey is $75,000.

9. Proposed Study 8 Cultural Resources Inventory, Evaluation, and Examination of Potential Effects

NorthWestern is proposing to update inventories completed in 1982 and 1986 of Historic Architectural & Engineering Properties (H-A&E), and to develop a model to identify the high probability locations of Prehistoric and Historic Archaeological Properties (PAP and HAP) within the Study Area. The latter will be followed by field inventory of identified high probability areas.

9.1 Goals and Objectives

The goal of this study is to provide baseline data in aid of determining Project effects, if any, on archaeological resources and historic buildings and structures eligible for or listed in the National Register of Historic Places (National Register). Objectives in support of this goal are: 1) identification and documentation of H-A&E and PAP and HAP within the Area of Potential Effect (APE); and 2) for those properties that may be affected by the Project, evaluation of their eligibility for listing in the National Register. The resource management goal of all tasks in this study is to provide the baseline data to develop a Historic Properties Management Plan under the new license.

9.2 Study Description

The cultural resources study will include two tasks:

- Update the inventories of H-A&E properties
- Develop a high probability model for PAP and HAP, followed by field inventory of all identified high probability areas within the APE

Background

The original inventory of H-A&E properties at the Project was undertaken in 1982 under the sponsorship of the prior licensee, Montana Power Company (Bowers and Hanchette 1982). Four years later, the Thompson Falls Hydroelectric Dam Historic District was listed in the National Register as a district within the Thompson Falls Multiple Resource Area (the latter of which includes buildings in the commercial district of Thompson Falls (Koop 1986).

Study Area

The study area for this study is the Project's proposed APE. NorthWestern expects FERC to establish the APE in consultation with Section 106 consulting entities, as part of its review and approval of NorthWestern's Proposed Study Plan. NorthWestern proposes the following definition of the APE:

> The APE for this undertaking includes all lands within the FERC-approved Project boundary. The APE also includes lands or properties outside the Project boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.

In addition to the lands within the Project boundary, the above proposed definition of the APE would encompass lands outside of the Project boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, as informed by research studies conducted by NorthWestern and others.

The proposed APE definition above captures lands and properties directly affected by the Project, such as areas that are subject to ground disturbance, including those areas used for construction and staging areas, as well as the reservoir. The APE also includes lands associated with indirect Project effects, such as areas potentially subjected to the introduction of or changes to visual or audible elements from the Project that may diminish the integrity or character of a nearby historic property.

Methods

Update Inventories of H-A&E Properties: Because 34 years have passed since the listing and several contributing elements to the district have been altered or demolished, NorthWestern proposes to update the 1982/1986 inventory and evaluation of H-A&E properties within the APE. The study will provide information to clarify current National Register status of each element and will result in an official amendment to the existing National Register listing under the new license.

The update to the inventories of H-A&E properties will be undertaken on-site by a person qualified under the Secretary of the Interior (SOI) Standards for Professionals in Architectural History or History with experience in the inventory and evaluation of such properties. This study task will re-examine the existing National Register listing and prepare an amendment using the National Park Service's National Register Bulletin 15 (1995). The H-A&E re-inventory will include examination of both the architectural and engineering elements (including historic equipment systems) within the Thompson Falls Hydroelectric Dam Historic District.

Develop a High Probability Model for PAP and HAP, followed by field inventory of high probability areas within the APE: This will involve determining the locations, types, and importance of currently undocumented PAP and HAP that may exist in the APE. Inventories of PAP and HAP to date have covered 28 percent of the total non-reservoir (dry) lands within the existing Project license boundary. Intensive inventory of some remaining dry land acreage is impractical due to the steep terrain at much of the reservoir edge, annual inundation, and/or the narrowness of parcels. Additionally, inventory of near-shore lands within the current fluctuation zone has not occurred, primarily due to lack of access during brief and unscheduled drawdowns. Consequently, NorthWestern proposes to develop an archaeological model to identify high PAP

and HAP probability areas within the APE that are on uninventoried dry land and near-shore land that is most sensitive to reservoir fluctuation. The model will rely heavily on properties (location, type, landform, and distance to surface water) of known PAP and HAP in the Project vicinity (defined as within ½-mile of the Project boundary). Following its development and review, those high probability areas that may be subject to Project effects will be inventoried.

The development and application of a model to identify high probability areas for PAP or HAP will be undertaken by an individual qualified under the SOI's Standards for Professionals in Archaeology. The model will integrate existing data on the locations and nature of these types of properties in and adjacent to the Project, as well as other relevant reports on prehistoric and historic preferences for occupation areas in the Clark Fork River valley and across northwest Montana. It will consider such environmental factors as slope, distance to major tributaries of the Clark Fork, recent sedimentation, erosivity potential, and historic and modern changes to local topography. Previous research in at least two Montana reservoir settings has shown that PAP and HAP located below the high-water line lack cultural stratigraphy and exhibit artifact displacement (Dickerson 2009; Dickerson 2010). Therefore, the model will cover dry lands and those that are near shore in the fluctuation zone only.

Prior to completion of the draft model, a field test will be conducted to gauge its accuracy. A sample of high and low probability areas (up to 3% of total dry and near shore land within the APE) will be examined where impacts attributable to Project operations are most likely to occur. The results will be used to further refine the model, if necessary. Upon completion of the final draft model, it will be distributed for 30-day review by the Montana State Historic Preservation Office (SHPO), Lolo National Forest cultural resource staff, Native American Tribes and Nations, and Montana Department of Natural Resources and Conservation cultural resource staff.

Once all parties agree on the strategy to be employed, a person or persons qualified under the SOI Standards for Professionals in Archaeology will undertake an on-site inventory of NorthWestern-owned and public lands in the APE. Privately-owned land will be included in the inventory when explicit permission is given. This inventory will be limited to pedestrian inspection of high probability areas. Standard archaeological procedures for work in Montana, as stipulated in the SHPO's "Guidelines and Procedures," will be employed, as they apply. These cover such protocols as pedestrian transect spacing, GPS mapping, feature and artifact photography, and site form completion (SHPO 2020).

Schedule

Preparatory Work

None is anticipated.

First Study Season

The first task, updating the inventories of H-A&E properties at the Project, will be completed in 2021, with the preparation of the National Register document amendment beginning in the fall. This entire task will be completed in early 2022 and reported fully in the Initial Study Report (**Table 9-1**).

The second task will be initiated with development and refinement of the high PAP and HAP probability model. The draft final model will be submitted to reviewers by October 1, 2021. It is expected that review comments will be incorporated, as necessary, by December 1, 2021.

Second Study Season

The subsequent inventory of PAP and HAP based on the high probability model will be initiated and completed in summer 2022 and fully reported in the 2023 Final Study Report.

Table 9-1: Summary of Study Schedule.

Timing	Activity
May 2021–February 2022	Update inventories of H-A&E properties
May–Sept 2021	Develop and refine high PAP and HAP probability model and submit to reviewers
Oct 1, 2021–Oct 31, 2021	Review period for high probability model
Dec 1, 2021	Model updated to incorporate review comments
May 12, 2022	Initial Study Report
Summer 2022	Inventory of PAP and HAP
May 12, 2023	Final Study Report

Reporting Plan

The Initial Study Report detailing cultural work conducted in 2021 and study results to date will be filed no later than May 12, 2022. For the updates to the existing inventories of H-A&E properties, the report will be in the form of a National Register form amendment to be submitted to the Montana SHPO and forwarded to the National Register. For the inventory of PAP and HAP, narrative in the Initial Study Report will explain the archaeological model, any received reviewer comments, and responses and modifications (*refer to* **Table 9-1**).

The Final Study Report will incorporate the results of the inventory phase of the PAP and HAP identification task. This report will be prepared in accordance with the SHPO's "Guidelines and Procedures" (SHPO 2020) and filed no later than May 12, 2023.

9.3 Resource Management Goals

FERC must comply with Section 106 of the National Historic Preservation Act, as amended, which requires it to take into account the effect of issuing a new license on historic properties. Additionally, the Lolo National Forest Plan identifies the need for cultural resource inventories and avoidance on Forest lands where disturbance is anticipated (Lolo National Forest 1986:II-20). Finally, the Montana SHPO in its 2018-2022 State Plan encourages survey of uninventoried public and private properties where they may be at risk (SHPO 2017).

9.4 Existing Information and Need for Additional Information

As noted above, the National Register listing of H-A&E properties at the Project (within the Thompson Falls Hydroelectric Dam Historic District) needs to be amended to reflect current integrity and condition. Previous inventories for PAP and HAP covered 28 percent of the Project's dry lands and do not include all areas of high probability within the APE. Additional inventory work is required to ensure that Project effects on National Register-eligible PAP and HAP are routinely considered during the term of the new license.

9.5 Nexus Between Project Operation and Effects

The H-A&E and PAP and HAPs to be addressed in this study may be affected by Project operations and/or actions associated with the implementation of the license. These include (but are not necessarily limited to) alterations or changes to the elements of H-A&E properties in the Thompson Falls Hydroelectric Dam Historic District and to PAP and HAP during proposed recreation, land use, or other resource developments or actions. Effects can be either direct or indirect, in accordance with regulations of the Advisory Council on Historic Preservation (36 CFR Part 800). These studies will provide data necessary for compliance with Section 106 of the National Historic Preservation Act. They will guide development of a future Historic Properties Management Plan.

9.6 Study Methodology Consistency with Generally Accepted Practice

Study methods for all tasks will comply with professional methods and practices, consistent with the Secretary of the Interior's Standards and those outlined by the Montana SHPO (2020), USFS (2008), and Montana Department of Natural Resources and Conservation (Rennie 2013).

9.7 Level of Effort and Cost

The approximate cost to implement proposed Study 8 – Cultural Resources Inventory, Evaluation, and Examination of Potential Effects is $84,000.

10. Proposed Study 9 Westslope Cutthroat Trout Genetics Study

Westslope Cutthroat Trout (*Oncorhynchus clarki*) are a salmonid native to the Clark Fork River drainage and are designated as a sensitive species by the USFS and as a Species of Special Concern by the state of Montana. These state and federal designations are due to the species being at risk because of limited or potentially declining population numbers and reduced range and/or habitat, making them vulnerable to extirpation in the state. Since 2011 the Thompson Falls fish passage facility has been capturing and passing 14 to 48 Westslope Cutthroat Trout per year that were phenotypically identified as Westslope Cutthroat Trout. One of the threats to Westslope Cutthroat Trout is hybridization with introduced Rainbow Trout (*Oncorhynchus mykiss*). Ensuring that fisheries personnel are correctly identifying and classifying these species is important for future management decisions related to fish ladder operations.

10.1 Goals and Objectives of Study

The goal of the proposed study is to characterize the amount of hybridization in visually identified Westslope Cutthroat Trout and Westslope Cutthroat x Rainbow Trout hybrids that are captured at the Thompson Falls fish passage facility.

Objectives:

1) Utilize a standard approach of phenotypic characteristics to visually identify Westslope Cutthroat Trout and hybrids that are captured at the fish ladder.

2) Take a genetic sample (fin clip) from all Westslope Cutthroat Trout and hybrids that are visually identified and recorded at the fish ladder work station to determine the level of genetic purity or hybridization of individuals ascending at the fish passage facility.

10.2 Study Description

Background

Westslope Cutthroat Trout are native to the Clark Fork River drainage in western Montana and are a recreationally important and highly sought-after sportfish species. Historically, migratory life history forms (fluvial- riverine; adfluvial-lake dwelling) used the Clark Fork River-Lake Pend Oreille system both as a migratory corridor as well as foraging, maturation and overwintering habitat; and were observed to be abundant in many tributaries to the lower Clark Fork River in Montana (Pratt and Huston 1993). The construction of three mainstem dams on the lower Clark Fork River (Thompson Falls in 1915, Cabinet Gorge in 1952, and Noxon in 1958) fragmented the river-lake ecosystem for migratory Westslope Cutthroat Trout. Beginning in 2011, the Thompson Falls fish passage facility commenced operations to seasonally improve upstream connectivity.

Over the last 10 years just over 2,000 Westslope Cutthroat Trout, hybrids, and Rainbow Trout ascended the fish passage facility and were released upstream of the dam, as directed by FWP.

FWP fish population estimates in the mainstem Clark Fork River near Superior, Montana show between 237 and 303 Rainbow Trout per mile (FWP, unpublished file data, 2020) while catchable Westslope Cutthroat Trout numbers are generally too low to estimate (Berg, 1989). Rainbow Trout and their hybrids generally make up 70 to 80 percent of the trout population within the middle Clark Fork River reach (FWP 2019b). Westslope Cutthroat Trout are present in moderate numbers and throughout all reaches of the middle Clark Fork River drainage (FWP 2019b). The quantity of introgression of the Westslope Cutthroat Trout that utilize the fish passage facility is currently unknown.

Study Area

The study area is the fish passage facility work station, where fish ascending the fish passage facility are worked up prior to release upstream. (*See* **Figure 6-1**, the yellow pin shows the location of the Main Channel Dam, with the pin location at the fish passage facility.)

Methods

To address a standard approach to identifying Westslope Cutthroat Trout a guide will be developed using phenotypic characteristics that include slash intensity, body spotting, anal fin spotting, head spotting, and body colorations. Additional visual aids of pure and hybrid fish will be available for reference as well. Work by others in the region have shown preliminary success in this approach and techniques would be adapted from that approach (Personal communications, C. Barfoot, CSKT; S. Bernal, Avista; and R. Kreiner, FWP). The standardized approach will be used by those operating the fish passage facility to consistently make identification determinations.

All Westslope Cutthroat Trout and hybrids captured at the fish ladder will have a small fin clip taken and preserved in alcohol. Upon closing the fish ladder in the fall these will be sent to the Conservation Genetics Lab at the University of Montana. Genetic analysis will follow standard lab protocols and a summary report from the lab will be provided to FWP and NorthWestern.

Schedule

Preparatory Work

NorthWestern proposes to take genetic samples from Westslope Cutthroat Trout and hybrids during the 2021 operating season. This sampling will begin when the fish passage facility opens in the spring, usually in March. Therefore, sampling may begin prior to the FERC Study Plan Determination.

First Study Season

NorthWestern proposes to take genetic samples from Westslope Cutthroat Trout and hybrids throughout the 2021 operating season (March–October). Upon closing the fish passage facility in October, the samples will be sent to the Conservation Genetics Lab at the University of Montana for analysis. A summary report from the lab would be received by early spring 2022 and provided in the May 2022 Final Study Report.

Second Study Season

None, as this study will be completed during the first study season.

Reporting Plan

The Final Study Report will be filed by May 12, 2022. The report will include results from the genetic analysis for each fish and also a review of the accuracy of the phenotypic identification determinations.

10.3 Resource Management Goals

FWP manages and monitors fish populations in Montana. The fisheries management direction for the Lower Clark Fork River drainage is to monitor the Westslope Cutthroat Trout population. The 2019-2027 Montana Statewide Fisheries Management Program and Guide prioritizes continued operation of the Thompson Falls fish passage facility.

In 2007 a MOU and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana was signed by state, federal, and tribal agencies that was developed to expedite implementation of conservation measures for Cutthroat Trout. This agreement serves to document Montana's efforts as part of coordinated multi-state, range wide efforts to conserve Cutthroat Trout.

10.4 Existing Information and Need for Additional Information

Minimal information exists on the genetic purity of Westslope Cutthroat Trout that are captured in the fish passage facility. From 2011 to 2019, Westslope Cutthroat Trout and hybrids were phenotypically identified by different biologists or fishery technicians without a consistent identification protocol. Genetic samples were not taken during this timeframe.

During 2020 fish passage facility operations a genetic sample was taken from all fish identified as Westslope Cutthroat Trout. Twenty-three samples were collected and have been sent to the Conservation Genetics Lab at the University of Montana and are pending analysis. A larger sample size is needed to better characterize the genetic composition of *Oncorhynchus* sp. that are captured in the fish passage facility.

10.5 Nexus Between Project Operation and Effects

Continued operation and maintenance of the fish passage facility has the potential to affect migratory Westslope Cutthroat Trout in the Clark Fork River. Correctly identifying genetically pure Westslope Cutthroat Trout or fish introgressed with Rainbow Trout and better understanding the mainstem population could be useful for future management decisions.

10.6 Study Methodology Consistency with Generally Accepted Practice

Collecting genetic samples to determine hybridization levels is a common action for *Oncorhynchu*s sp. Although no peer reviewed, published papers were found during a literature search on phenotypic Westslope Cutthroat Trout traits and genetic purity, a number of local fish biologists are utilizing the approach described in this study.

10.7 Level of Effort and Cost

The approximate cost to implement this study is $1,500.

11. Study Requests Received

In its notice of SD1, FERC requested that Relicensing Participants identify studies that would help provide information on resource areas necessary for FERC to prepare the Environmental Assessment for the Project. The deadline for filing study requests was October 27, 2020. The USFS and FWS each requested five studies, for a total of 10 study requests received (**Table 11-1**).

Table 11-1: Summary of Studies Requested by USFS and FWP

Study Request Agency and Number	Study Requests	Adopted in Whole or In Part	Studies Not Adopted
USFS Study #1	Fluid Dynamic Effects on Fisheries Movement Behavior at Thompson Falls Dam	X	
USFS Study #2	Bull Trout Supplementation Strategies		X
USFS Study #3	Population Status of Western Pearlshell Mussels		X
USFS Study #4	Fish Study with Additional PIT Arrays		X
USFS Study #5	Genetic Status of Westslope Cutthroat Trout	X	
FWP Study #1	Roving Creel Census and Angler Surveys in Clark Fork River Reaches Upstream of Thompson Falls Dam		X
FWP Study #2	Juvenile Bull Trout Capture Study	X	
FWP Study #3	Evaluation of Upstream Fish Movement and Salmonid Angler Use		X
FWP Study #4	Distributional and Genetic Status of Westslope Cutthroat Trout	X	
FWP Study #5	Upstream Fish Passage Study	X	

USFS Study # 1 – Fluid Dynamic Effects on Fisheries Movement Behavior at Thompson Falls Dam

The USFS requests a study of hydraulic conditions and fish movement in the Clark Fork River. NorthWestern is adopting portions of the USFS Study Request #1 relating to hydraulic conditions and fish behavior downstream of the Main Channel Dam as part of Study #4 – Hydraulic Conditions, which is a hydraulics study to characterize a depth-averaged velocity field and water depths between the Main Channel Dam and the High Bridge, and Study #5 – Fish Behavior Study, which is a radio telemetry study of salmonids to evaluate movement rates and behavior in response to hydraulic conditions from downstream of the powerhouses to the Main Channel Dam.

NorthWestern is not adopting the recommendation to defer the methodology to a steering committee to decide at some uncertain future date as this is not compatible with the ILP process. Section 5.13(c) of the ILP regulations states that, "Within 30 days following the date the potential applicant files its revised study plan, the Director of Energy Projects will issue a Study Plan Determination with regard to the potential applicant's study plan, including any modifications determined to be necessary in light of the record." The decision regarding the studies to be

conducted and the methods to be employed will be made by FERC's Director of Energy Projects by May 2021, when the FERC Study Plan Determination is issued for the Project.

In addition, NorthWestern is not adopting the recommendation that the study be conducted by technical experts under the direction of the steering committee. Relicensing studies are the responsibility of the applicant, as specified in 18 CFR §5.15(a), "The potential applicant must gather information and conduct studies as provided for in the approved study plan and schedule." NorthWestern is not in favor of having an outside steering committee direct its FERC relicensing studies.

The study objectives which reference climate change, mussels, temperature, and sediment are not accompanied by recommended study methods to meet those objectives. Nor is it clear how the results of these components of the study would have a nexus to Project operations or inform the development of future license conditions, as required by 18 CFR § 5.9(b)(5). Therefore, NorthWestern is not proposing to expand its study plans to include these variables.

USFS Study # 2 – Bull Trout Supplementation Strategies

The USFS proposes that a Bull Trout Supplementation Committee be convened to evaluate the feasibility of Bull Trout supplementation strategies. The study objective is to evaluate the feasibility of the following Bull Trout supplementation strategies (*emphasis added*):

- Translocate Bull Trout from adjacent reaches/streams upstream of natural barriers where suitable habitat conditions exist *but where Bull Trout are not currently present*.

- Re-introduce hatchery-raised Bull Trout to *streams that have been functionally extirpated* but where threats have been sufficiently mitigated to allow a reasonable probability of re-colonization.

- Introduce hatchery-raised Bull Trout to streams within their natural range that *may never have been occupied historically* but contain suitable habitat.

NorthWestern is not adopting USFS Study #2 because it lacks a nexus to the Project and would not inform the development of license requirements as required by 18 CFR § 5.9(b)(5). The study requests that supplementation be targeted in areas that have a natural barrier, or where Bull Trout have been functionally extirpated or were never present historically. As existing information shows (NorthWestern 2019), none of these conditions occur in the Thompson Falls Project area, nor has the Project caused these kinds of conditions anywhere.

In addition, Bull Trout are listed as 'threatened' species under the ESA. Recovery decisions regarding supplementation of Bull Trout are under the purview of FWS management authority and so should not be delegated to NorthWestern.

Further, the study request does not define study methods as provided for in 18 CFR § 5.9(b)(6), beyond the establishment of a committee. NorthWestern does not support an outside party

directing relicensing studies for which it is responsible. For the reasons stated above, NorthWestern is not proposing to conduct USFS Study #2.

USFS Study #3 – Population Status of Western Pearlshell Mussels

USFS Study #3 requests that NorthWestern evaluate Westslope Cutthroat Trout and Rainbow Trout collected at the fish passage facility for glochidia of western pearlshell mussels. The study also requests that traditional western pearlshell mussel surveys be conducted at sites surveyed in 2015 and found to contain viable populations, and a re-analysis of eDNA water samples for western pearlshell mussels.

NorthWestern proposes to not adopt USFS Study #3 because there is no nexus to the Project, and it is unclear how results of such a study would inform future license conditions.

There are no documented occurrences of live western pearlshell within the FERC Project boundary. Historically, the western pearlshell was present throughout the Clark Fork River drainage (Stagliano et al. 2007). Populations of the western pearlshell mussel in larger rivers such as the Clark Fork River are believed to be extirpated or are at such low densities that long-term viability is unlikely (Stagliano et al. 2007). Stagliano revisited stream reaches in the Clark Fork River where 20-year-old or older records of the western pearlshell mussel were known and found no populations (Stagliano et al. 2007).

The western pearlshell mussel prefers stable gravels and pebbles in small to medium coldwater rivers with Rosgen C channel morphology (Rosgen 1996) (Stagliano 2010). Thompson Falls and Noxon Rapids reservoirs do not provide suitable habitat for western pearlshell mussel. Additionally, there are no known western pearlshell mussel populations in tributaries to Noxon Rapids Reservoir. Therefore, existing data demonstrates that there is no reproduction or source for glochidia (larvae that attach to fish gills before maturing and releasing to the streambed) for fish entering the fish passage facility below the Main Channel Dam.

It is also unclear how the requested data gathering on the population status of western pearlshell mussels is necessary to define potential impacts of the Project. The study requests surveying sites where viable populations were found in 2015, such as the Clearwater River, which is 190 river miles from the Project.

USFS Study #4 – Fish Study with Additional PIT Arrays

USFS Study #4 requests that NorthWestern install six PIT tag antenna arrays in the Jocko River, St. Regis River, Fish Creek, Rattlesnake Creek, Blackfoot River, and Rock Creek and monitor them for 2 years. The USFS further requests that NorthWestern PIT tag a "random" sample of 1,000 salmonids and 1,000 non-salmonids (stratified by species).

NorthWestern is not adopting USFS Study #3 based on lack of nexus to the Project, technical challenges in implementing the study, and the cost benefit analysis of such a study. The USFS describes the nexus to the Project as a data gap regarding upstream movement of fish after they

are released upstream of Thompson Falls Dam. NorthWestern has no control over the fate of the fish that are passed upstream of the Project after they leave the Project area. All of the streams listed in the study plan are far upstream of the Project, with the furthest, Rock Creek, being 167 river miles upstream of the Project. Such distant locations cannot be reasonably characterized as potentially impacted by Project operations.

Further, there are significant technical challenges to implementing the proposed study. It is likely not feasible to install, maintain, and operate an effective PIT tag antenna array in rivers as wide and deep as the Blackfoot River. It is also infeasible to PIT tag a random sample of 1,000 salmonids, as the 10-year average annual catch of salmonids at the fish passage facility is 310. Additionally, the cost of this study is significantly underestimated. The cost of the proposed PIT tag antenna arrays alone would be well over $100,000. Such expenditures are not justified, especially since existing data has already documented several species of fish that pass through the fish passage facility migrate long distances upstream.

This study is not cost effective, does not have a nexus to the Project, and the data collected would not inform future license conditions, as required by 18 CFR § 5.9(b)(5). The Project does not impact where or how far fish will swim once released upstream of the fish passage facility.

Although NorthWestern is declining to adopt this proposed study, as part of NorthWestern's ongoing license compliance activities, NorthWestern has funded the installation and operation of PIT tag antenna arrays in Prospect Creek and in the Thompson River drainage. These are the tributaries in closest proximity to the Project. NorthWestern intends to continue to fund operation of these antennas for the remainder of the FERC license, as part of ongoing Project operation and maintenance activities.

USFS Study #5 – Genetic Status of Westslope Cutthroat Trout and FWP Study # 4 – Distributional and Genetic Status of Westslope Cutthroat Trout

USFS Study #5 requests that NorthWestern collect Rainbow Trout and Westslope Cutthroat Trout genetic samples in an unspecified number of tributaries to develop a comprehensive assessment of Westslope Cutthroat Trout genetics upstream of the Thompson Falls Project. In addition, the study would include compiling existing Westslope Cutthroat Trout genetic information and development of a GIS geodatabase of genetic data for an unspecified geographic area. The study would also include a study of Rainbow Trout genetics to attempt to determine, with genetic sampling, Rainbow Trout natal streams. The stated Project nexus is that Rainbow Trout passed upstream at the fish passage facility may spawn in Westslope Cutthroat Trout conservation streams, thus exacerbating hybridization between the two species.

FWP Study #4 is focused on identifying the distributional extent of Westslope Cutthroat Trout in Prospect Creek, the Thompson River, and tributaries to the Clark Fork River between the Project and the Flathead River. The study would entail collecting between 600 and 900 genetic samples from approximately 40 stream reaches. FWP proposes to prepare a report that would include

updated distributional information on Westslope Cutthroat Trout and their non-native competitors and prioritize protection, mitigation, and enhancement measures at the stream or reach level.

Consistent with guidance from the TAC, NorthWestern identifies the *Oncorhynchus* sp. collected at the fish passage facility using visual identification. In order to confirm the accuracy of the visual identification, NorthWestern began collecting genetic samples of Westslope Cutthroat Trout collected at the Thompson Falls fish passage facility in 2020. NorthWestern proposes to continue this activity, as described in Study # 9 – Westslope Cutthroat Trout Genetics Study. This study will provide information on the specific species mix and genetic composition of the *Oncorhynchus* sp. passed at the fish passage facility to provide information to FWP for fisheries management decisions regarding passage at Thompson Falls.

NorthWestern is not adopting the remaining aspects of the USFS Study Request #5 and FWP Study Request #4. Specifically, NorthWestern is not proposing to collect genetic information in tributaries upstream and downstream of the Project. The proposed USFS study in particular has an excessive geographic scope, with proposed sampling of streams as distant as the lower Bitterroot River, a distance from the Project of at least 140 river miles.

FWP manages the middle Clark Fork River (upstream of the Project) as a wild trout fishery and the amount of existing data on the fishery is substantial. Rainbow Trout are the most abundant trout species and most abundant fish in angler creels within the section of the Clark Fork River near Superior, between Thompson Falls and Missoula (Peters and Schmetterling 1996). Rainbow Trout and their hybrids make up 70 to 80 percent of the trout population in this reach of the river (FWP 2019b). FWP fish population estimates in the mainstem Clark Fork River near Superior show between 237 and 303 Rainbow Trout per mile (FWP, unpublished file data, 2020). Based on fish surveys in the Thompson River and Prospect Creek, relatively high densities of Rainbow Trout already inhabit these systems as well. For example, a 2019 survey of the Thompson River estimated Rainbow Trout abundance at 327 (in the Big Hole section) and 40 per mile (in the 19-Mile section) (FWP 2019a).

The approximately 175 Rainbow Trout which are passed at the fish passage facility annually are a very small fraction of the number of Rainbow Trout already present in the Clark Fork River upstream of the Project. In light of the species composition of the Clark Fork River upstream of the Project, and based on existing data, there is no demonstrated effect of the Project on Rainbow Trout and Westslope Cutthroat Trout hybridization.

Further, the genetic composition of *Oncorhynchus sp.* in tributaries upstream of the Project is unrelated to the operation of the Project. Once fish are captured and passed at the fish passage facility they can volitionally migrate to where they choose. Therefore, a study of *Oncorhynchus* sp. in the tributaries upstream of the Project does not have a nexus to Project operations, nor would it help to inform future license conditions, as required by 18 CFR § 5.9(b)(5). It is NorthWestern's position that Study #9 - Westslope Cutthroat Trout Genetics Study will provide the information required to develop the Final License Application.

FWP Study #1 – Roving Creel Census and Angler Surveys in Clark Fork River Reaches Upstream of Thompson Falls Dam

FWP Study #1 is a roving creel survey of the Clark Fork River, from the Thompson River to the Blackfoot River, a distance of 150 river miles upstream of the Project. NorthWestern is not proposing to conduct this study. This proposal far exceeds the geographical limits of potential Project impacts, as Project operations do not influence the type of angler, or the species of fish an angler might pursue, in the 150 miles of the Clark Fork River upstream of the Project.

Further, no cost estimate is provided as required by 18 CFR § 5.9(b)(7). Few details are provided regarding sampling or data analysis techniques as required by 18 CFR §5.9(b)(6).

FWP Study #2 – Juvenile Bull Trout Capture Study

The goal of this study is to explore the feasibility of collecting juvenile Bull Trout from the Thompson River drainage for transport to Lake Pend Oreille, Idaho. The study aims to investigate and refine capture methods and timing of collection of juvenile Bull Trout during their fall outmigration period.

NorthWestern is adopting the proposed study, with minor revisions in the study methods (for example, NorthWestern may elect to use alternative equipment or staff instead of that proposed by FWP), as described in NorthWestern Study # 6 – Study of Downstream Transport of Bull Trout.

FWP Study #3 – Evaluation of Upstream Fish Movement and Salmonid Angler Use

FWP Study #3 involves Floy, PIT, and radio tagging of fish passed through the fish passage facility. The movements of the radio tagged fish would be tracked after passage. NorthWestern currently tags salmonids which pass the fish passage facility with PIT tags and Floy tags as part of ongoing compliance with the Project's Biological Opinion.

NorthWestern is not proposing to adopt FWP Study #3 to radio tag and track fish passed at the fish passage facility. NorthWestern has no control over the fate of the fish that are passed upstream of the Project after they leave the Project area. While radio tagging could provide real time information on the location of tagged fish, how that information would help define Project impacts is unclear nor is the nexus to the project defined. The proposal also did not include an explanation of why the PIT tagging and existing data collection are insufficient to inform the development of license conditions, NorthWestern believes that the current efforts are sufficient to identify and analyze any Project- related effects and inform license conditions.

Further, NorthWestern is declining to adopt this study because no cost estimate is provided as required by 18 CFR § 5.9(b)(7), and developing such estimates is not possible because few details are provided regarding tagging or tracking. The number of fish to be radio tagged, type of radio tags to be used, and the frequency and extent of tracking are not specified.

FWP Study # 5 – Upstream Fish Passage Study

FWP Study #5 includes a 2D computational fluid dynamics model and radio telemetry study of fish in the "far field" downstream of the Project.

NorthWestern is adopting the proposed study, with minor revisions, in NorthWestern Study #4 – Hydraulic Conditions and Study #5 – Fish Behavior Study. NorthWestern Study #4 includes detailed descriptions of the study methods proposed and follows the recommendations of the Scientific Panel to characterize a depth-averaged velocity field and water depths between the Main Channel Dam and the High Bridge. NorthWestern Study #5 is a radio telemetry study of salmonids to evaluate movement rates and behavior, from downstream of the powerhouses to the Main Channel Dam. These studies will yield information sufficient to describe Project impacts needed to develop the Final License Application.

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