US Army Corps
of Engineers ®
Walla Walla District

OWYHEE RIVER ECOSYSTEM RESTORATION

Draft Feasibility Report with Integrated Environmental Assessment

Appendix C

Monitoring and Adaptive Management Plan

OWYHEE RIVER ECOSYSTEM RESTORATION

MONITORING AND ADAPTIVE MANAGEMENT PLAN

January 2025

1. PROJECT OVERVIEW

The U.S. Army Corps of Engineers (USACE), Walla Walla District, and the Shoshone-Paiute Tribes (Tribes) are conducting a feasibility study with an intended goal of improving aquatic habitat and ecosystem functionality to the Owyhee River on the Duck Valley Indian Reservation in south-central Idaho and northern Nevada states.

The study area is located along the Owyhee River within the Duck Valley Reservation and straddles both Owyhee County, Idaho and Elko County, Nevada (Figure 1). The Owyhee River is a 280-mile-long tributary of the Snake River with headwaters originating in the Independent Mountain Range of northern Nevada. The river flows northwest through the Duck Valley Reservation, through Idaho into Oregon to join the Snake River. It flows through the Owyhee Plateau, an arid region of sage shrub brush environment, for which aquatic and riparian habitats provide critical functions for the survival of wildlife. The Owyhee Plateau has been prioritized by the U.S. Fish and Wildlife Service (USFWS) as the most important sagebrush ecosystem in North America (USFWS 2016), and the loss of wetlands and aquatic habitat has been identified as an important factor in the decline of the ecosystem.

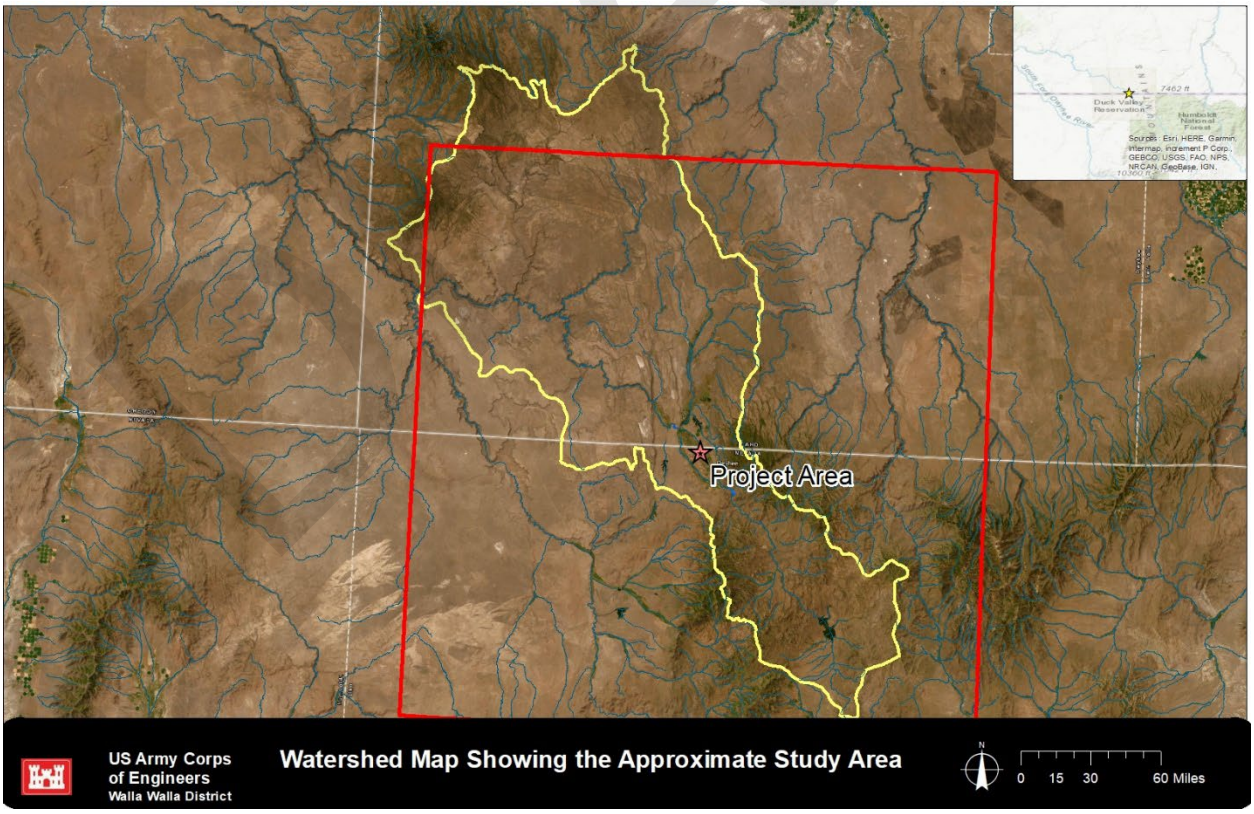

Figure 1. Watershed map showing approximate study area.

Need for Project

The project is needed because the aquatic ecosystem in the Owyhee River, as well as its adjacent habitats, have been altered by ranching, farming, associated irrigation diversions and flood control measures. The River has been channelized and deepened to accommodate these practices. Consequently, the side channels and meanders were severed from the main channel, leading to evaporation and the creation of stagnant pools. The adjacent wetland habitat no longer performs river and wetland ecosystem functions and processes. Greater sage grouse (*Centrocercus urophasianus*) found on the Reservation rely on these wetlands as critical food sources for raising successful broods. Additionally, the native redband trout (*Oncorhynchus mykiss gairdneri*) require riffles and pools, presence of cover, meanders, and an active floodplain as suitable habitat. These species are of paramount importance to the Tribe for ceremonial and sustenance purposes. Without enhancements to these habitats, the populations of these species would continue to decline. They hold intrinsic significance to the culture and local wildlife, serving as symbols of cultural importance, vital sources of primary sustenance, contributors to biodiversity, and integral components of the natural food web.

Project Site Identification

Eight sites within the study area (Figure 2) were originally identified based upon initial selection criteria including:

- Proximity to existing riparian and wetland habitat
- Evidence of historic meanders
- Potential to improve instream habitat
- Potential to restore floodplain function and connectivity (e.g. side channel and wetland habitat)

Through a comprehensive process of public and stakeholder meetings, site visits, brainstorming sessions, literature review and the application of the U.S. Water Resource Council's six-step planning process (USACE 2023 the Project Delivery Team (PDT) identified the candidates among the eight potential sites most likely to meet project objectives. Ultimately, two locations (Sites #3 and #4) were determined the best candidates most likely to achieve project objectives (Figure 2). A thorough discussion of the screening process undertaken for site elimination and final selection can be reviewed in Section 3 of the Owyhee River Feasibility Report and Environmental Assessment (USACE 2023). Following identification of the two best candidate sites, nine project alternatives (including a "no action" alternative) were initially developed for analysis. These alternatives were evaluated using screening criteria of stakeholder acceptability, project feasibility, completeness (likelihood of success), efficiency (cost-benefit ratio) and overall project effectiveness in meeting the Purpose and Need. Three final alternatives (Table 1) were defined and further analyzed to identify the best (preferred) restoration approach.

Table 1. Final array of project alternatives considered.

Alternative #	Brief description
5	Side channel creation with connection to main River channel with beaver dam analogs and riparian plantings.
6	Excavate notches in existing main channel berms to re-direct flows onto historic floodplain for wet meadow creation with riparian plantings.
7	Excavate large side channel to accommodate main channel flow; divert main flow to detain, periodically, within side channel. Riparian plantings.

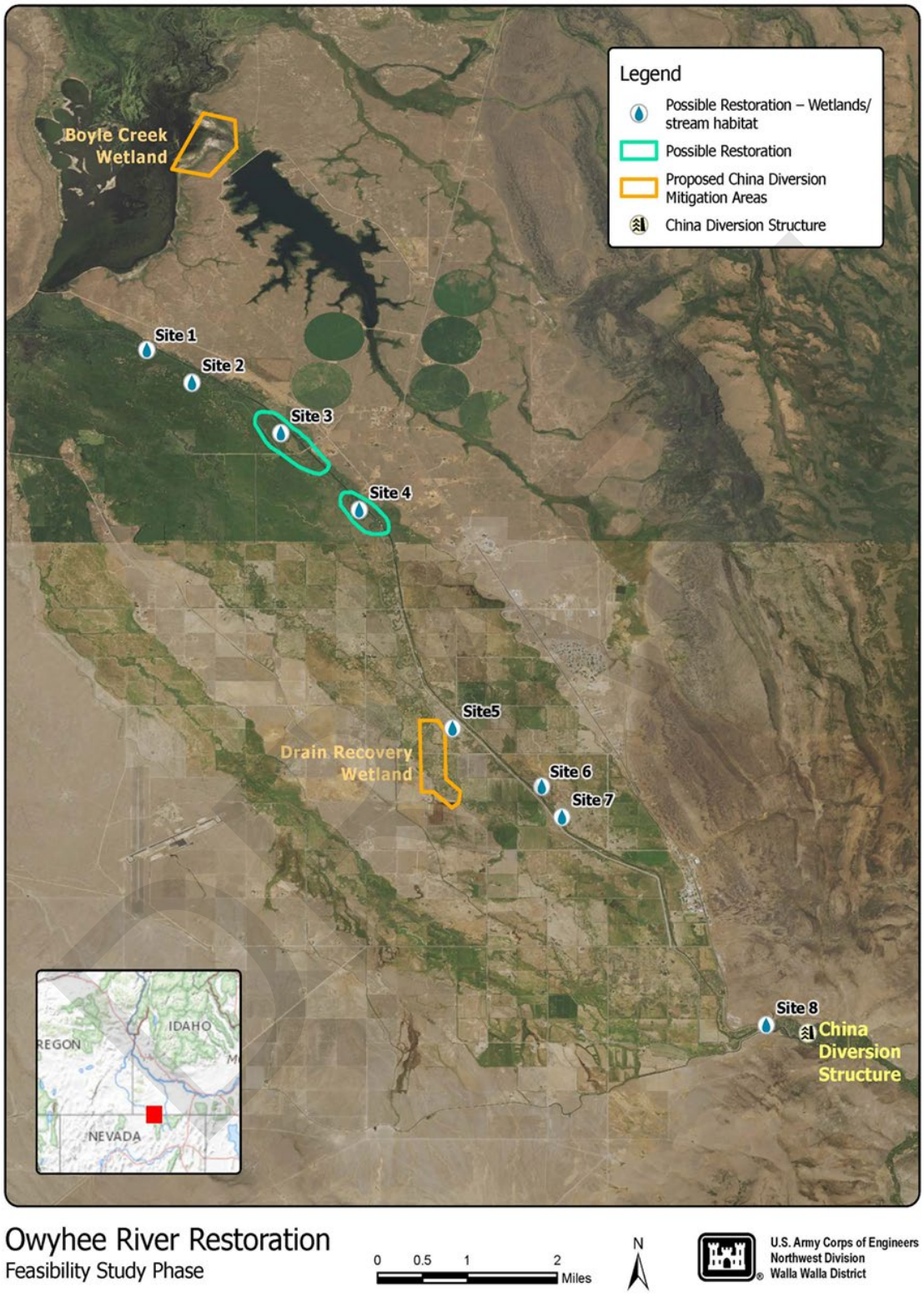

Figure 2. The eight potential project sites initially identified for further analysis and the two sites (#3 and #4) selected as the most likely restoration candidates.

Preferred Alternative Selection

The array of three final alternatives were subjected to rigorous analysis using the Functional Assessment of Colorado Streams (FACStream) model (Johnson et al. 2015). FACStream is described as a "value-neutral assessment of function" by the authors and provides an objective evaluation without incorporating subjective values or biases. Instead, the model focuses on holistic components of the ecosystem, considering the interconnectedness of aquatic, riparian, and watershed elements including fish, wildlife, and plants. The index the model generates for each alternative results in a value system of habitat units (HU) that can be interpreted over the life of the project to help identify the most beneficial approach or “preferred alternative” among those considered.

Alternative 6 was identified as the plan most likely to meet all project objectives, the least invasive approach (requiring less heavy equipment involvement over a smaller footprint) and the greatest benefit for the cost. Alternative 6 involves excavating notches in the existing berms along the Owyhee River to allow for the river to overbank onto the historic floodplain. Notches would also be created to redirect the flow of the Owyhee River into historic meanders to reactivate a relic side channel. The fill material from the notched berms would be placed in the Owyhee River to cause water to backflow and overbank onto the historic floodplain. Beaver dam analogs or other detainment structures may be implemented to allow for water retention and groundwater recharge over extended periods of time.

Site #3 would receive approximately 15 acres of riparian plantings and create approximately 50 acres of wet meadow habitat for greater sage grouse. Approximately 6,400 linear feet of side channel would be re-activated, creating foraging habitat for juvenile and adult redband trout (Figure 3). Site #4 would receive approximately 13 acres of riparian plantings and create approximately six acres of wet meadow habitat for greater sage grouse. Approximately 5,400 linear feet of side channel would be re-activated, creating foraging habitat for juvenile and adult redband trout (Figure 4).

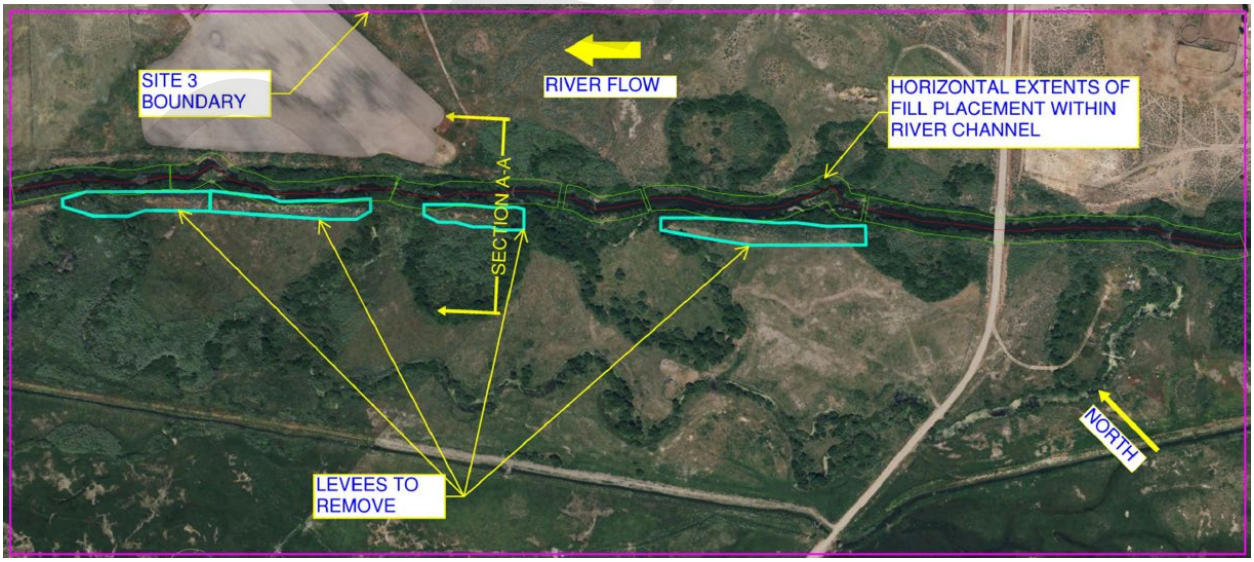

Figure 3. Restoration approach at site #3

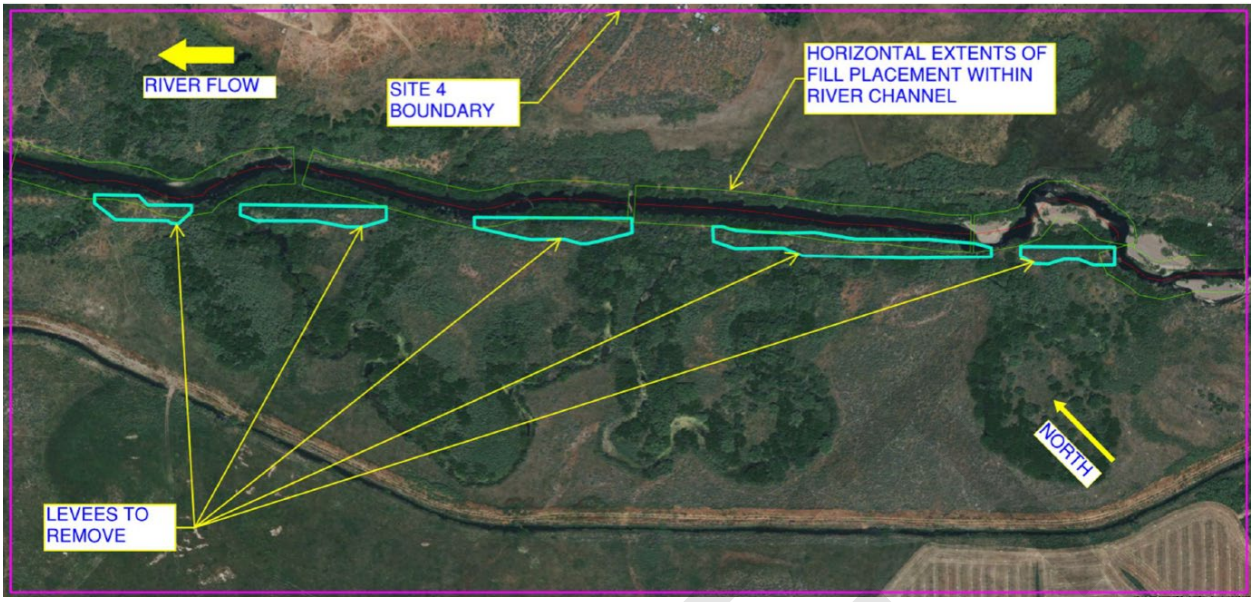

Figure 4. Restoration approach at site #4.

There are uncertainties related to the physical and/or biological performance of these measures that could affect the ability to meet the project goals and objectives:

- Construction and operations occurs during a drought year
- Stochastic event(s) during project implementation (catastrophic flood, wildfire, etc.)
- Inadequate or improper hydrology due to irrigation demands, water rights changes or design problems
- Unforeseen delays in vegetative planting schedule or plant establishment or survival
- No sources available for acquiring appropriate plant or seed materials

These measures will be monitored following project construction or after initial implementation to inform decision-makers whether 1) The project is meeting performance measures and should continue as implemented 2) The project is not meeting performance measures and should be adjusted, or 3) The project has met success criteria and no further monitoring for ecological performance is needed.

USACE Implementation Guidance for Section 1161 (Monitoring Ecosystem Restoration) of the Water Resources Development Act of 2016, and Section 2036 (Mitigation for Fish and Wildlife and Wetlands Losses) of the Water Resources Development Act of 2007 require monitoring sufficient to evaluate ecosystem restoration and mitigation success. USACE is required to consider adaptive management (or contingency plans) for ecosystem restoration projects and mitigation projects because they often involve uncertainty that can be reduced through an adaptive management approach. For this project, adaptive management is an appropriate management strategy because there is: 1) uncertainty regarding the outcome of the management measures, 2) an ability to monitor and evaluate the system response to management measures, 3) capacity to learn from monitoring, and 4) the ability to apply a decision to change management if needed.

2. OBJECTIVES

Ensuring project success is a primary purpose of monitoring and adaptive management therefore, metrics associated with specific, measurable, and attainable objectives are the focus of monitoring efforts that inform the adaptive management process and decision-making during implementation. An important part of the monitoring and adaptive management plan is the translation of the management goals and objectives from the planning process into specific performance measures (sometimes called metrics), success criteria (sometimes called targets), and decision triggers (triggers for implementing a contingency plan or other decision). During development of the monitoring and adaptive management plan the team worked from the planning study conceptual model(s) and impact/benefit assessments to define the physical, chemical, biological, and ecological criteria that will be monitored to assess project performance. The following objectives, measures and criteria have been developed for this monitoring and adaptive management plan:

Objective 1: **Improve aquatic habitat diversity associated with in-stream features for native fish.**

Performance Measure: Improve diversity and abundance of native vegetation.

Performance Measure: Establish aquatic macroinvertebrates within the project area.

Success Criteria: 1) Increase percent cover of native instream and streambank facultative and facultative-wetland plant species (USACE 2012, Table 2).

2) Expand distribution of aquatic macroinvertebrates (from existing aquatic habitat into re-connected side channels)

Monitoring Design: Conduct three annual assessments of three permanent plots utilizing formal sampling transects (permanent), formal or informal visual and photo monitoring assessments, remote sensing data or a combination of techniques.

Decision Trigger(s): No increase in native vegetation or macroinvertebrate diversity, distribution or recruitment is observed after year two.

Contingency Measure(s): Determine apparent or potential reasons for lack of success and respond accordingly (Tables 3 and 4):

- Low or no increase in native plants
  - **Lack of seed source**? *Supplement by seeding or planting*
  - **Overgrazing**? *Reduce or eliminate livestock access to project area*
  - **Increased cover of non-native species**? *Control non-native/invasive species*

- Low or no increase in aquatic macroinvertebrate distribution
  - **Inadequate hydroperiod**? *Investigate potential for increasing overbank flows or improving retention of water in meadow/side channel habitats*
  - **Lack of hiding cover and/or breeding/egg deposition structure**? *Supplement cover components (downed wood, improve substrate diversity or add emergent-species plantings)*

Table 2. Summary of success criteria (Objective 1) for post-restoration monitoring (source: Owyhee River 206 Draft EA).

Metric	Criteria
Plant Survival	80 percent years 1 – 5 (shrubs) 65 percent at year 10 (shrubs) 80 percent across years (trees)
Shrub Cover	25 percent at year 1 25 – 40 percent by year 3 40 – 50 percent by year 5 Over 50 percent by year 10
Tree Cover	< 25 percent at year 1 25 – 35 percent by year 3 35 – 40 percent by year 5 >50 percent by year 10
Herbaceous Cover (Native)	25 percent by year 1 40 percent by year 3 50 percent by year 5 >50percent by year 10
Percent Non-Native Vegetation	≤50 percent in year 1 ≤30 Percent in year 3 ≤20 Percent in year 5 ≤10 percent in year 10
Coarse In-stream Habitat	± 10 percent of post-construction feature distribution across years

Table 3. Success criteria relating to Objective 1 contingency measures

Problem
Site does not meet plant survivorship or cover requirements: 80% annually for 5 years (all plants) 65% annually for shrubs and 80% for trees at 10 years.
Over-competition by invasive species (meaning more than 20% cover) in the restoration area at year 5.
Site meets plant survivorship, but not expected percent cover.
Site coarse in-stream habitat has become homogenous or changed dramatically from post-construction.

Table 4. Contingency measures for identifying success criteria (Objective 1).

Adaptive Management Actions
Plant survivorship target not achieved: • Evaluate reasons for mortality (e.g., poor soil conditions, insufficient moisture, incorrect planting, excess browsing by domestic ungulates and/or wildlife, vandalism). • Address cause for mortality and replant to exceed survivorship or cover requirements (Sponsor is responsible for replacing plant materials that die during the 10 year monitoring period). • Provide protective measures if appropriate. • Modify monitoring period, if necessary. • Replace dead plants with a different species if certain species are experiencing high mortality
Non-native invasive species out-competing natives: • Evaluate predominant invasive species in the restoration areas. • Initiate invasive species control protocols appropriate to species type, conditions of infestation area (wetland or buffer), and level of infestation (e.g., herbicide application, mowing, etc.). • Various treatment methods to include herbicide, biological controls, and removal would be considered and implemented as appropriate.
Plant species survival achieved but plant cover inadequate: • Evaluate reasons for poor plant performance (e.g., poor soil conditions, insufficient moisture, incorrect planting, browsing by wildlife, vandalism). • Address plant performance issues as appropriate through irrigation, fertilizer application, pruning, etc.
In-stream habitat parameters not achieved: • Evaluate reasons for unbalanced or significant change in features (e.g., either too many or too few of specific features like riffle-run-pool sequence imbalance, large wood, boulders, backwaters, etc. • Remove, add or adjust features as needed to ensure the appropriate habitat features are present to support rearing redband trout.

Objective 2: **Restore floodplain function to improve adjacent riparian and wetland habitat.**

Performance Measure: Restore hydrologic connectivity to the Owyhee floodplain habitats (relic side channels, inundated (wet) meadows) to restore and improve foraging habitat for redband trout and greater sage grouse.

Success Criteria: Obtain presence and persistence of flows within the targeted habitat areas for redband trout during appropriate season(s) and adequate moisture levels within wet meadow habitats during the growing season (sage grouse).

Monitoring Design: Evaluate treatment areas for presence of adequate flows during critical season(s). A minimum reach of 30 meters at each study area would be visually assessed for presence of surface flows primarily with secondary observation of fish presence and/or wetland-obligate amphibians (U.S. EPA 2015).

Decision Trigger(s): No surface flow observed during targeted season in >2 of 5 years.

Contingency Measure(s): Re-evaluate and correct treatment effort(s) not successfully contributing to increased flows within side channels and/or wet meadow habitats. This will require additional coordination with the Sponsor and is anticipated to be limited in effort and costs.

Objective 3: **Reconnect and restore the historic disconnected channel segments to promote a more natural hydrologic regime with improved ecological responses.**

Performance Measure: Long-term improvement of natural hydrology and ecological response in historic side channel habitats.

Success Criteria: Obtain presence and persistence of flows within the targeted habitat areas during appropriate season(s).

Monitoring Design: Monitor permanent plots or transects (as established for Objective 1) annually for first five years to evaluate frequency and persistence of flows in side channels through use of standard metrics such as stream gauges, riffle/pool ratio, pebble counts and/or sediment deposition (USDI 2011).

Decision Trigger(s): No increase in flow volume or persistence or habitat complexity (pool/riffle/meander development) within five years.

Contingency Measure(s): Re-evaluate restoration treatments intended to re-connect flows to side channel habitats. Consider deployment of stream gauges at key diversion locations in the main channel. This will require additional coordination with the Sponsor and is anticipated to be limited in effort and costs.

3. MONITORING DESIGN

The monitoring design identifies what will be measured in relation to the goals and objectives and the relevant methodologies to be used in acquiring the necessary data and information.

The monitoring design for this project includes the minimum monitoring actions necessary to evaluate success of the implemented management measures. It focuses on monitoring the performance measures of the project objectives to determine success. Each relevant objective and the associated performance measures are described below along with information required by USACE guidance.

Objectives

Objective 1: Improve aquatic habitat diversity associated with in-stream features for native fish.

Performance Measure: Improve diversity and abundance of native vegetation.

Objective 2: Restore floodplain function to improve adjacent riparian and wetland habitat.

Performance Measure: Restore hydrologic connectivity to the Owyhee floodplain habitats (relic side channels, inundated (wet) meadows)

Objective 3: Reconnect and restore the historic disconnected channel segments to promote a more natural hydrologic regime with improved ecological responses.

Performance Measure: Long-term improvement of natural hydrology and ecological response in historic side channel habitats.

Duration and Periodicity: Monitoring and Adaptive Management is estimated to be cost shared for 10 years up until project performance is deemed successful.

Metric	Criteria
Vegetation abundance and survival	80 percent years 1-5 (shrubs) 65 percent at year 10 (shrubs) 80 percent across years 1-10 (trees)
Distribution of aquatic macroinvertebrates	Increase in macroinvertebrate diversity, distribution or recruitment is observed after year two by 5% from pre-construction.
Floodplain Function	Surface flow observed during targeted season in >2 of 5 years.
Side Channel Connection	Increase in flow volume or persistence or habitat complexity (pool/riffle/meander development) within five years.

Data Analysis and Use:

A site-specific adaptation of the Multiple Indicator Monitoring (MIM) protocol would be employed to address most of the monitoring needs for the Owyhee River restoration project. The Multiple Indicator Monitoring (MIM) protocol was designed by the University of Idaho to address the need for rapid and accurate assessment of a variety of stream and riparian habitat types in the arid west (USDI 2011). This assessment method is ideal for monitoring progress toward meeting objectives for aquatic sites that have experienced – and may continue to experience – effects of external management actions including (but not limited to) restoration actions, livestock grazing, water diversion, etc.). The MIM protocol was designed for sites that are infrequently monitored and/or when teams of trained personnel are not routinely available. MIM monitoring provides a rapid means of assessing development of key stream features indicative of successful in-stream functionality. With enough precision to detect biotic and hydrologic changes in small systems within a three to five year period, the MIM protocol lends itself to quick adjustment according to the effort available to complete a data collection period. Parameters affecting level of sampling effort include monitoring detail desired (e.g., statistical validity vs. simple comparison of relative data), frequency of sampling, availability of personnel, and level of personnel training.

Objective 1 requires both quantitative and qualitative assessments of aquatic vegetation establishment and function to meet the success criteria of increasing percent cover of instream and streambank FAC/FACW vegetation (Appendix A). The second part of objective 1 involves a rapid assessment of aquatic macroinvertebrate assemblages, as described in Cortes et al (2014), in side stream and/or wetland habitats to indicate forage availability for juvenile redband trout and sage grouse and to provide insight into water quality.

Objective 2 calls for restoring a hydrologic connectivity to the Owyhee floodplain side channel and wet meadow habitats. Data would be acquired through installation and monitoring of stream or staff gauges located within permanent plots of key habitats (mid-stream or ponded wetlands) and groundwater monitoring wells (piezometers) in wet meadow plots. Secondary assessments may include incidental monitoring of stream, wetland and wet meadow habitats for presence of aquatic-obligate species such as fish and larval or adult amphibians.

Objective 3 evaluates success in reconnecting historic side channel habitat and function within the project area.

Costs: Monitoring and Adaptive Management is estimated to cost a total of $109,000 for 10 years.

4. ASSESSMENT

Evaluating the monitoring data includes a comparison of the results of the monitoring effort compared to predictions made in the planning process and success criteria. Table 6 summarizes monitoring efforts by-objective, the party(ies) responsible for data collection and reporting, and the reporting method.

Table 5. Assessment and reporting of monitoring data.

Monitoring Objective	Brief Description	Party Responsible
Objective 1, Part I	Vegetation monitoring	Anticipated to be tribal volunteers/school with Corps leading efforts
Objective 1, Part II	Macroinvertebrate sampling	Anticipated to be tribal volunteers/school with Corps leading efforts
Objective 2	Monitor presence of surface flow through piezometer installation and monitoring	Anticipated to be tribal volunteers/school with Corps leading efforts
Objective 3	Monitor for side channel hydrology through substrate sampling (E.g. pebble count) and/or staff gauges	Anticipated to be tribal volunteers/school with Corps leading efforts

5. DECISION-MAKING

The information generated by the monitoring efforts will be assessed and used by decisionmakers to guide decisions after construction. Information from the monitoring plan will be used by the district in consultation with federal and state resource agencies and the Tribes, to guide decisions on operational or structural changes to a project that may be needed to ensure success criteria are being met.

This section describes the process whereby the results from monitoring and assessment will be used to make decisions concerning project management. Primary components of the decision-making process include decisions to be made, decision making responsibilities, how the decision-making group operates, how they report their decisions, and the required timing of decisions in order for potential adjustments to be effective.

Once the results of monitoring have been assessed and evaluated, the Corps and Tribal Council can decide to: (1) continue the action with no adjustments because performance measures indicate a favorable trajectory, (2) adjust using a contingency plan, or reformulate the plan revisiting the planning process, or (3) decide the action is successful and complete based on meeting success criteria.

6. CONTINGENCY PLAN

Contingency plans are pre-determined actions that could include modifying the implementation of the primary management measure if the current implementation is not achieving management or restoration goals or could include an alternative management measure if the primary management measures aren't meeting goals.

To address potential problems with project features, the USACE has identified some potential modifications or different measures that could be implemented. Table 8 include a description of potential contingency measures, under what circumstances they would be implemented, an estimated cost for implementation, and identifies responsibilities.

Table 6. Potential contingency measures

Contingency Measure	Decision Trigger	Responsible Party
Replanting of Vegetation 80% annually for 5 years (all plants) 65% annually for shrubs and 80% for trees at 10 years	No increase in native vegetation diversity, distribution or recruitment is observed after year two	Corps with coordination from Tribe
Macroinvertebrates Not Present in Side Channels	No macroinvertebrate diversity, distribution or recruitment is observed after year two	Corps with coordination from Tribe
Re-assess hydrologic design and implementation.	Floodplain not connected or inadequately inundated	Corps with coordination from Tribe
Re-assess hydrologic design and implementation.	Side channels not inundating or flows inadequate	Corps with coordination from Tribe

Total costs for the contingency measures is estimated to be $23,000. Responsible Party would be Corps leading with coordination from the Tribe.

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