

Appendix C:

Fish Passage Project Design

Deliverables

How Appendix C is Organized

This appendix guides applicants and sponsors through the typical stages of site-specific, restoration project design development: alternatives analysis, preliminary design, final design, and construction. It is anchored by the Project Deliverables Table, which outlines the full suite of deliverables included in the fish passage design and construction process, how they are connected to a particular project stage, and when each deliverable must be provided to RCO. The Project Deliverables Table is followed by a description of each deliverable.

The goal of this appendix is to allow sponsors to tailor restoration efforts to their projects' needs, complexity, risk, and funding, while maintaining technical rigor, ensuring a consistent approach to project review, and encouraging best practices in the field.

Technical Expectations

While each project is unique, there are certain foundational requirements and analytical approaches common to all restoration projects that will help ensure a smooth technical review and timely completion of deliverables. All projects generally must follow the standard project development stages: feasibility and alternatives analysis, conceptual design, preliminary design, final design, and construction. **The FBRB has tasked the Technical Review Team to review and approve the alternatives analysis, preliminary design, and final design stages.** The table below lists deliverables for all eligible project approaches (planning, design-construction, final design and construction, or construction). All projects are expected to meet the expectations below; failure to do so is likely to have significant implications for technical review, eligibility, and future funding.

Incorporate a Qualified Design Team

Fish passage projects require a designer or team with a balance of knowledge and experience in fish biology, civil or environmental engineering, and other technical fields. The person or team completing the preliminary project design is required to include at least one licensed professional engineer with experience in fish passage restoration.

Use a Standard Design Approach

The FBRB, as previously stated, requires that projects meet fish passage design criteria in Washington Administrative Code 220-660-190, the recommendations of the [Water Crossing Design Guidelines](#) (2013), and the expectations of the FBRB grant program. As such, Chapter 4 of the *Water Crossing Design Guidelines* provides guidance on bridge design and Chapter 3 provides guidance on the stream simulation design option. These design criteria provide guidance on how to apply a geomorphic approach for fish passage for all fish species, at all life stages.

Provide Analysis and Evaluation

Engineering design and technical evaluation must be focused on achieving the project's goals and objectives. In developing an application, RCO highly recommends sponsors consult Chapters 4 and 5 of the *Stream Habitat Restoration Guidelines*, which provide guidance on developing goals and objectives, and designing and implementing fish passage techniques.

Water Crossing Design Guidelines

The *Water Crossing Design Guidelines* is a WDFW document to help the water crossing owner and designer comply with Washington State law that protects fish. This document provides practical, real-world knowledge and techniques to improve the overall success of water crossings. These guidelines do not replace regulatory requirements, though they are designed in part as technical guidance supporting regulatory streamlining and grant application review for fish passage project applications.

The FBRB highly recommends that project sponsors and designers review the *Water Crossing Design Guidelines*. Specifically, Chapter 1 discussing the geomorphic approach to designing fish passage corrections, Chapter 3 covering stream simulation culvert design, and Chapter 4 which provides bridge design criteria.

Submit a Design Report

A Design Report is a required deliverable of all FBRB-funded design stages and provides a critical record of the technical analyses and decisions that support the design. The report should provide the detail necessary for the WDFW Technical Review Team, grants

managers, permitting authorities, stakeholders, and other funders to understand how a project meets its goals and objectives. The Project Deliverables Table divides the report into chapters that follow the standard design development process. The level of completion and detail of each chapter are dependent upon the design stages in the project scope.

Design Stages

To promote a consistent technical standard of care and uniform project documentation for the public record, FBRB-funded design and restoration projects shall largely follow four standard project development stages, as further described below. Multiple design stages may be completed within the scope of a single grant or phased in multiple projects. Applicants who apply for a design-only project are required to complete final designs. The sponsor must complete the deliverables from the previous stage before beginning work on the next stage. If design stages are funded in separate projects, the sponsor must submit completed deliverables from the previous stage as part of the application for the next project stage.

Upon completion of the three design stages listed below, the sponsor must attach the required deliverables into PRISM and notify the WDFW scoping biologist and RCO outdoor grants manager so that evaluation by the Technical Review Team may begin in a timely manner. The sponsor must receive notice from the Technical Review Team that the materials are approved before beginning work on the next stage of design or construction.

Feasibility and Alternatives Analysis Deliverables

Feasibility and alternatives analysis is a standard element in the early stages of a fish passage project. This stage is also a required review step by the Technical Review Team as part of a planning project, or the planning phase of a design-build project. The feasibility and alternatives analysis may be submitted in report format (include elements 3a-3d listed in the table below) or a sponsor and the engineer may complete and submit a Barrier Correction and Analysis Form ([Appendix E](#)) that provides equivalent overview of the alternatives being considered to correct a barrier. Remember that abandonment and removal is an acceptable alternative to consider and an eligible activity.

Preliminary Design

Preliminary design advances a site-specific alternative into a more detailed understanding and quantification of all the major project elements and results in design drawings and a design report that meet the qualifications for construction permit applications with state and federal agencies. Preliminary designs include a detailed understanding that quantifies all the major project elements, including site conditions, survey and modelling designs, and drawings of the project as it should look when

finished. Sponsors should make sure preliminary designs show how *Water Crossing Design Guidelines* will be met.

See the Project Deliverables Table and detailed deliverables descriptions below for more information about preliminary design requirements.

Final Design

Final design incorporates technical comments from the Technical Review Team, stakeholders, funders, and permittees into a stand-alone and comprehensive set of final drawings, a design report, and technical specifications for project construction. The final design process must address and resolve all substantial issues raised by the Technical Review Team, permitting, and stakeholder review process so that all stakeholders agree on the final plans. See the Project Deliverables Table and detailed deliverables descriptions below for more information about final design requirements.

Construction

Construction involves implementing and documenting on-the-ground restoration actions as described in approved, permitted designs. Any deviation of the approved design plans during construction should be documented on a revised set of “as-built” drawings using the original design plans as a template. See the Project Deliverables Table and detailed deliverables descriptions below for more information about construction requirements.

Project Deliverables Table

The table below outlines when design deliverables are required for each of the proposed project approach options for a site-specific fish barrier correction project. This table specifies which deliverables are required for each stage of design and project development and when each deliverable must be provided to RCO. Project deliverables indicated across multiple design stages generally become more refined in each stage as the design work progresses. Each project deliverable and its expected level of detail is explained in the text following the table.

This appendix should serve as a key resource to applicants with a design or construction project application and scopes of work for the design and engineering teams.

Refer to Section 3 for timing of required Technical Review Team design review.

Ask questions in advance about a particular design element and do not assume an element can be left out. The grant agreement ultimately will include the specific design deliverables required based on project type, application, local evaluation, Technical Review Team recommendations, and the sponsor’s experience.

Project Deliverables		Proposed Project Approach			
		Design	Design-Build and All Construction Projects Less Than \$500,000	Final Design-Construction Greater than \$500,000	Construction Greater than \$500,000
1	Landowner Acknowledgement Form	Due at application	Due at application	Due at application	Due at application
2	Cultural Resources Compliance	May start after funded. Required before geo-tech.	Complete before disturbing ground	Complete before disturbing ground	Complete before disturbing ground
3a	Design Report: Introduction, Goals, and Objectives	All design stages. Final due by closing.	All design stages. Final due before construction.	Preliminary due at application. Final due before construction.	Preliminary due at application. Final due before construction-not in project scope.
3b	Design Report: Site Characterization	All design stages. Final due by closing.	All design stages. Final due before construction.	Preliminary due at application. Final due before construction	Preliminary due at application. Final due before construction-not in project scope.
3c	Design Report: Feasibility and Alternatives Analysis and Selection	All design stages. Final due by closing.	All design stages. Final due before construction.	Preliminary due at application. Final due before construction	Preliminary due at application. Final due before construction-not in project scope.
3d	Design Report: Cost Estimate	All design stages. Final due by closing.	Preliminary and final-required before construction	Preliminary due at application. Final due before construction	Preliminary due at application. Final due before construction-not in project scope.
3e	Design Report: Design Considerations, Evaluations, and Analyses	Preliminary and final design. Final due by closing.	Preliminary and final-required before construction	Preliminary due at application. Final due before construction	Preliminary due at application. Final due before construction-not in project scope.
3f	Design Report: Permitter and Stakeholder Consultation	Preliminary and final design. Final due by closing.	Preliminary and final-required before construction	Preliminary due at application. Final due before construction	Updates due before construction

		Proposed Project Approach			
		Design	Design-Build and All Construction Projects Less Than \$500,000	Final Design-Construction Greater than \$500,000	Construction Greater than \$500,000
3g	Design Report: Appendices	Preliminary and final design. Final due by closing.	Preliminary and final-required before construction	Preliminary due at application. Final due before construction	Preliminary due at application. Final due before construction-not in project scope.
4	Design Drawings	All design phases. Final due by closing.	Preliminary and final-required project deliverable	Preliminary due at application. Final due before construction	Preliminary due at application. Final due before construction-not in project scope.
5	Landownership Certification Form	Due before agreement	Due before agreement	Due before agreement	Due before agreement
6	Construction Permit Applications	Due at closing if included in project scope	Due before construction	Due before construction	Due before construction
7	Construction Permit Receipt	Optional	Due before construction	Due before construction	Due before construction
8	Construction Quantities	Preliminary and final design. Final due by closing.	Due before construction	Due before construction	Due before construction
9	Final Design Technical Specifications	Due at closing	Due before construction	Due before construction	Due before construction
10	Contract Bidding Documents and Conditions	Optional	Due before construction (unless constructed by sponsor)	Due before construction (unless constructed by sponsor)	Due before construction (unless constructed by sponsor)
11	Landowner Agreement	Not applicable	Due before construction if land not owned by sponsor	Due before construction if land not owned by sponsor	Due before construction if land not owned by sponsor
12	As-Built Drawings and Documentation	Not applicable	Due by closing	Due by closing	Due by closing

Project Deliverables	Design	Proposed Project Approach		
		Design-Build and All Construction Projects Less Than \$500,000	Final Design-Construction Greater than \$500,000	Construction Greater than \$500,000
13 Stewardship Plan	Not applicable	Due by closing if land owned by sponsor	Due by closing if land owned by sponsor	Due by closing if land owned by sponsor

Project Deliverables Table Descriptions

1. Landowner Acknowledgement Form

When a geographically designated, site-specific project is ready to move through the standard design process, all impacted landowners must be made aware of the project. Provide signed Landowner Acknowledgment Forms for all known and potentially impacted landowners. This requirement must be met before any stage of design or construction; however, once a landowner has signed an acknowledgment form, new forms are not required at subsequent stages of design or construction unless landownership has changed or a substantial amount of time has passed between design stages.

For more information on control and tenure documentation, see [Section 3](#).

2. Cultural Resources Compliance

Real property restored through RCO funding is subject to [Governor's Executive Order 21-02](#) or compliance with Section 106 of the National Historic Preservation Act. RCO requires documented compliance with the applicable cultural resources review process before any ground-disturbing activities (including demolition). RCO will begin the initial consultation during the conceptual design stage. If next steps or further review is determined to be necessary, these should be included in subsequent design applications.

For more information on cultural resources review, see [Section 3](#).

3. Design Report

The Design Report is a detailed record of a project design process that accompanies visual plans and drawings. The following steps or chapters outline the full suite of information that should be considered and documented if appropriate for the project type. Pay most attention to ensuring the project provides the content outlined in these chapters, rather than adhering to the layout.

3a. Introduction, Goals, and Objectives

The project introduction should include a clear explanation of the fundamental purpose of the project, description of the site-specific limiting factors for specific Endangered Species Act-listed salmonids and applicable life stages, and the specific habitat restoration goals and objectives of the project. Identifying goals and objectives for each project is a critical technical framework that demonstrates a project's certainty of success and benefits for salmon recovery. The goal of the

project should be to remedy observed problems by addressing the problems' root causes.

Goals—Goals should articulate desired biological outcomes (i.e., desired future conditions) and what salmonid species, life stages, and/or seasonal needs will benefit from those outcomes.

Objectives—Objectives define the specific project outputs that will be produced to achieve the stated project goals. As described in the grant application, each objective should be SMART (Specific, Measurable, Achievable, Relevant, and Time-bound). Note that project objectives are not the same as work tasks in a project's scope of work.

Sponsors are encouraged to consult with experienced design professionals, the Technical Review Team biologist, and grants managers to help frame clear goals and objectives for their projects.

3b. Site Characterization

A detailed characterization of the existing conditions relevant to project design, in the context of established goals and objectives. The level of information will vary from project to project, but typically includes the following elements when available:

- A summary of site, reach, and watershed conditions
- Site history leading to the observed problems
- Biological and water quality factors as they relate to the project conditions
- Topographic, geomorphic, and vegetative survey information
- Surrounding habitat types and land uses
- Landowner and community expectations
- Water velocities, depths, and flow rates applicable to species and life stages being targeted by restoration practices
- Groundwater or hyporheic flow ranges
- Tidal elevation and ranges
- Available sediment sampling information
- Site constraints and maintenance requirements that may present challenges to natural process-based restoration

3c. Feasibility and Alternatives Analysis, and Selection

A core element of the restoration planning process is the identification of multiple alternative approaches to meet the project's goals and objectives. This section should include identification, description, and evaluation of design alternatives considered to achieve the project goals and objectives culminating in selection of a preferred alternative.

Include a written comparison of each of the alternatives through a thorough evaluation process based on consistent criteria. Applicants are highly encouraged to include visual depictions (maps with design elements applied to the specific site) or typical-style drawings to show comparison of alternatives. When assessing alternatives, applicants should consider the following evaluation criteria, at a minimum:

- Connection to project goals and objectives
- Tangible benefit to all targeted species and life stages
- Stakeholder comments and community support
- Economic feasibility (appropriate cost-to-benefit ratio)
- Likelihood of success
- Ongoing maintenance requirements
- Project sustainability and resilience

Sponsors must clearly identify and justify selection of a preferred design alternative to achieve project objectives, which will form the basis of all subsequent design stages.

Alternatively, the sponsor and the engineer could complete and submit a barrier Corrections Analysis Form to evaluate potential barrier correction alternatives and provide a rough cost estimate for each.

The sponsor must consult with the Technical Review Team on the alternatives analysis or Correction Analysis Form before selecting the preferred alternative and starting preliminary design.

The preferred alternative should include a detailed written description of all proposed design elements. To meet conceptual design requirements, the preferred alternative should be depicted in an accurately scaled site plan view drawing of existing conditions and project elements. Specifically, the drawings for the preferred alternative must include, at a minimum, the following:

- An area/location map
- Property boundaries and land ownership (either surveyed or approximated)
- Roads and other existing infrastructure
- Scale and north arrow
- Water bodies and direction of flow
- Bank-full width (freshwater), mean high water line (marine)
- Approximate location and appropriately scaled dimensions of proposed design elements

3d. Cost Estimate

The level of detail and accuracy of a cost estimate for construction is driven by the stage of design. Conceptual design-level construction cost estimates are rough calculations often not based on thorough quantification of all project costs but rather professional opinion of similar project costs. They are intended to be an initial estimate to inform evaluation of differences between project alternatives.

Preliminary-level design cost estimates should be the result of quantified costs derived from the design process to be further refined and updated at final design. Detail should include estimates of line items such as the following:

- Materials
- Contract labor costs
- Construction supervision
- Special services such as surveys, materials testing, and geotechnical
- Sales taxes

3e. Design Considerations, Evaluations, and Analyses

This chapter outlines the specific design criteria that define the intent and expectations for each project element. Design criteria are specific, measurable attributes of project features that clarify the purpose of each project element and articulate how each element will contribute to the project's overall goals and objectives. Include justification and documentation of design methods applied, including assumptions that facilitated the design. Provide a summary of data output and analysis of each technical assessment required to support the proposed design elements. Full data output should be referenced to an appendix.

3f. Permitter and Stakeholder Consultation

A description of regulatory and/or other public consultation activities. Review and address comments from agencies and other stakeholders in the Design Report, if comments were received. This section is optional based on proposed deliverables in the application or as outreach, feedback, and discussion with stakeholders occurs during the design process.

3g. Appendices

All raw data, computational data, model output, and other reports (geotechnical, hydraulic modeling, topographic survey, wetland delineation, etc.) must be included in the Design Report, either as appendices or incorporated into the Design Considerations and Analysis chapter (3e).

4. Design Drawings

The preparation of design drawings is key to completing a successful habitat restoration project. All design and restoration projects require design drawings in digital format (e.g., AutoCAD). Each drawing should be to scale, with the same vertical and horizontal scales on the drawings, when possible.

For the preferred alternative, minimum drawing requirements are the depiction of all elements of the project in sufficient detail to support project permitting and include at least the following:

- Existing site plan showing area/location map; property boundaries; landownership; road, utilities, or other infrastructure as appropriate; scale; north arrow; water bodies and direction of flow; and bank-full width or mean low and high water (marine waters).
- Project site plan view drawing(s) showing proposed actions overlaid on the site plan (above). The site plan should include all project elements including installation and removal of fill, wood, rock, culverts, and infrastructure; clearing and staging; dewatering, etc. Additional structural design details should be included as needed.
- Longitudinal profile and multiple cross-sections at important project locations showing ordinary high water and other water surface elevations relevant to the design (e.g., maximum design flow, tidal elevations, flood elevations),
- LiDAR (Light Detection and Ranging) Hillshade layer with location of all major project elements, if available.

Additional design drawings should be included where available for complex projects or projects with multiple features or multiple sites.

5. Landownership Certification Form

See [Appendix E: Program Forms](#), for more information about the Landowner Certification Form.

6. Construction Permit Applications

Provide permit applications to the RCO grants manager or in a PRISM progress report. This step is optional at the final design phase because, for some sponsors, this step is more practical during the construction phase.

7. Construction Permit Receipts

Provide proof of permit receipt (e.g., copies of permits or permit numbers and issue dates) to the RCO grants manager or in a PRISM progress report. This step is optional at the final design phase because, for some sponsors, this step is more practical during the construction phase.

8. Construction Quantities

Quantified materials outlined on drawing plans or separately. The level of detail is dependent upon the stage of design but typically is provided initially at preliminary design and is refined at final design to ensure well developed bid packages.

9. Final Design Technical Specifications

Support all work shown on project drawings with one or more technical specifications to further describe and/or control the work. The construction contractor should know about project materials, technical requirements, project elevations, permit requirements, or any other elements of the proposed project. Clear and detailed technical specifications reduce on-the-ground adjustments and changes that may deviate from the original project objectives.

10. Contract Bidding Documents and Conditions

If the sponsor's construction crew will build the project, then bidding documents and contract conditions are not required; however, the requirements for technical specifications and a detailed list of work items (above) still apply.

Bidding documents should include a bid form, definitions, a proposed agreement (to be between the sponsor and contractor), general conditions, special provisions, technical specifications, and the project drawings (usually bound separately).

Sponsors should select contractors using good business practices, which could include selective negotiations with known contractors, public advertisement for bidding, or competitive bidding using some combination of proposed price and contractor qualifications. The contractor selection process should be objective and defensible in case of contest and follow all applicable state and required federal procurement procedures.

11. Landowner Agreement

Landowner agreements are required for restoration projects on land that the sponsor does not own. See [Appendix E: Program Forms](#) for more information about the Landowner Agreement Form.

12. As-Built Drawings and Documentation

Document all changes made during construction. "As-built drawings" is the conventional term applied to project design drawings modified by the engineer after completion of construction to document the completed project. Prepare "as-built drawings" if changes were made to the final design during construction. Submit these drawings to the RCO grants manager after project completion. Instead of the conventional "as-built drawings" described above, RCO may allow the sponsor to submit the following as-built documentation:

- Original final designs (if no changes were made during construction)
- Original final designs with a list of change orders describing the construction changes
- A design memo from the engineer with notations on the final design/construction plans identifying the changed elements of the project with photograph points and photographs showing the project after construction

13. Stewardship Plan

If a sponsor completes a restoration project on land owned by someone else, a ten-year stewardship plan must be completed before the close of the project. A plan is necessary to ensure the landowner will maintain the project area at least ten years after completion. This is often part of the landowner agreement. Sponsors who implement projects on their own property must complete and submit a stewardship plan outlining the long-term maintenance plan of the correction. The sponsor may follow the RCO's [Restoration Stewardship Plan Template](#) with recommendation components for this requirement.