Freshwater Bank Protection Replacement

The purpose of this document is to provide guidance and assistance when reviewing and permitting hydraulic project applications for the replacement of existing freshwater bank protection including evaluation of the design and development of potential mitigation requirements. The guidance provides the habitat biologist with basic information to process an application.

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1. Application Receipt

Applications or pre-applications are submitted to Aquatic Protection Permitting System (APPS). The application and plans are reviewed in Olympia for statutory completeness under RCW77.55.021. Once the application is Accepted, the Habitat Biologist reviews and processes the application within APPS. There are many training videos and self-help documents for this process located on SharePoint.

2. Office Review

Purpose

The office review allows the biologist to become familiar with the project details, location, and determine if the project was designed to meet WAC. The biologist must be knowledgeable of RCW 77.55.011(23), and WAC 220-660-130 since the RCW and WAC are where the agency's authority comes from. The Biologist reviews proposed plans for pre-existing bank protection (bulkheading, retaining walls, riprap) and the replacement alternative chosen by the applicant. The existing condition is the baseline condition for this project. Presence of fish life, including the species present, strongly influences proper project design. During the review the biologist may consult reference materials, agency data, and supervisor or coworkers as necessary to determine if the application is complete and the project is appropriately designed or if additional information is needed. The biologist should be timely in requesting additional information.

Tools and Resources

Data for reviewing hydraulic projects comes from a variety of sources and may come from government agencies (local County GIS), Non-Governmental Organizations (Wild Fish Conservancy Maps), as well as private sources of information. Most of this data is available either through WDFW's GIS database or through various internet websites. Other data may be in the form of hardcopy records acquired over time or from coworkers in the agency. All of this information is useful in preparing, but ultimately nothing replaces getting out on the ground for projects. Below is a list of commonly used resources:

- Integrated Streambank Protection Guidelines – WDFW resource to help determine causes, mechanisms of failure, and potential solutions.
- WDFW Publications – Aquatic Habitat Guidelines
- USGS Earthexplorer - provides historic reference aerials and current aerials.
- USGS Current Water Data – check for gauged river flow data and/or StreamStats can provide additional insight into expected discharge per basin.
- County Shoreline Designation - determine if the waterbody is designated Shoreline of the State.
- Shoreline Characterization Reports – if available from Shoreline Master Program work per county, this may help with site assessment including vegetation, soils, and site conditions.
- Local County Assessor's parcel search - county permit information, past violations, county planner assigned to project, and parcel data. Confirm ownership.
- Google Maps and Bing Maps - for site context, local characteristics, neighboring properties, potential equipment access, estimation of Ordinary High Water Line (OHWL), upland vegetation, vicinity of house to waterbody, relative steepness of the bank, and apparent erosion.
- WDFW PHS on the Web - Locations of Priority Habitats and Species (PHS) that have been mapped. PHS may identify other areas of importance (freshwater shellfish beds, spawning areas), or bald eagle/great blue heron rookeries for which we may request the voluntary application of timing windows during State Environmental Policy Act (SEPA) review (as the HPA can only protect for fish life). These data are not an exhaustive inventory of PHS for the State of Washington. They represent the best knowledge of the WDFW biologists. The database is periodically updated as knowledge improves.
- WDFW SalmonScape - Stream specific fish and habitat data. Also can find this data in PHS on the Web. This data source is incomplete and has limited use above Grand Coulee Dam.

- WDFW ArcMap/ArcMap RDS - WDFW possesses various GIS data sets that includes all data above, as well as a previously issued HPA layer.
- Ecology Coastal Atlas – Limited to portions of some lakeshores and major rivers in western and eastern Washington. Best imagery we have of older shoreline and current up to 2006.
- USDA NRCS Soil Survey - Soil data might help to identify erosion risk.

3. Missing Information

Biologists may require more information at any time before issuing a permit in order to effectively evaluate the project and issue an appropriate permit. The biologist should be timely in requesting additional information. This information should be requested within 10 days of receiving the complete application. If information needed to issue a permit is not provided, the agency may deny the application or the applicant may put it on hold before the end of the 45-day processing period. If these situations occur you should be working closely with your supervisor to avoid conflicts.

4. Site Visit

Purpose

Site reviews typically occur as a pre-application review or the review of an active application in APPS. During a pre-application meeting, the objective of the biologist is to assist the landowner or agent. This typically occurs in the form of helping them determine appropriate design options and project scope. The biologist should also discuss mitigation and what might be required depending on the impacts of the final project proposal. This is a great time to let the applicant know what will need to be included in their application for it to be considered complete and for you to issue a permit. After a pre-application review, in most cases, another field visit is not necessary. Additional assistance can be found on WDFW's website here.

When processing a formal application, the purpose of the site review is to verify structural measurements, appropriateness of the project proposal, determine project impacts, and appropriate mitigation. The biologist may find the design is inappropriate for the protection of fish life and must provide suggestions for modifying the plans or suggesting an entirely different design.

- Provide educational materials to the applicant if appropriate
- Coordinate with Regional WDFW Hydraulic Engineer if site review reveals the need for technical assistance.
- Coordinate site visit with other agencies with jurisdiction when appropriate and feasible.
- Verify information gleaned from the office review.

Print out and refer to the site characterization checklist located in the Integrated Streambank Protection Guidelines Table 2-2, page 2-16.

Site Characterization Checklist

- ❑ channel geometry: cross section, streambank height, gradient, pool riffle system.
- ❑ planform: meander bend (how tight?), straight reach, physical features.
- ❑ over-bank topography.
- ❑ soils in terrace and bank.
- ❑ bed materials (bed substrate) and armoring (surficial material).
- ❑ woody debris abundance and location.
- ❑ geologic features.
- ❑ vegetation: species, abundance, location on streambank (lower vegetative limit).
- ❑ indication of the height of flood waters, or the peak erosive energy of such high flows; for example, lichen and moss limits on rocks indicating annual high water mark, debris collected in bushes indicating the height of a flood, and the size of cobbles on bars reflecting the maximum flow over the surface.
- ❑ location and depth of scour holes.
- ❑ flow patterns for existing conditions: flow direction, thalweg, angle of attack on streambank, impacts of physical features.
- ❑ approximate flow and stage at time of observation (e.g., during a flood, base flow, at bank-full flow).
- ❑ visualize flow patterns at higher or lower flows (something that may be difficult for the untrained or inexperienced observer).
- ❑ sediment transport indicators: bed-load caliber, bar formation, deposited material in eddies and backwaters, patterns in deposited sizes on bars.
- ❑ estimate channel roughness values.
- ❑ man-made features impacting flows: bridges, berms, armored streambanks.
- ❑ evidence of animal impacts.
- ❑ high-water features and ice scars.
- ❑ indicators of historical channel locations in the floodplain: channel scars or meander traces, exposed man-made structures, vegetation locations and deposits on terraces.

Table 2-2. Site characterization checklist.

Safety Highlights

Vehicles must be parked in a safe place to not create a hazard for WDFW staff or the public. Site reviews often involve working around deep and/or flowing water which may present a drowning hazard; therefore, a PFD may be necessary to maintain a safe working environment. Be sure to check in/out with a co-worker or supervisor if going to a site visit on your own.

Field Equipment and Tools

In addition to the basic safety equipment, staff should also bring the tools and equipment listed below. Conditions on site will dictate which equipment is used during the field visit.

- Business card or other agency ID
- Copy of application and plans
- IPad or other mobile device
- 100' tape measure
- Stakes
- Clinometer
- Camera
- Field notebook
- Knee or Hip boots
- Rain gear and/or other appropriate field clothing
- Personal Floatation Device (PFD)
- Optional: laser level

Verifying Application Information at the Site

Once on site, the biologist should offer the applicant or agent time to explain their design proposal and what they wish to accomplish. This initial conversation may yield useful information that may later facilitate discussion if there are problems identified in the design proposal.

- Document the site inspection with photos and enter information in APPS site inspection log and/or as a document attachment in the APPS project file.
- Identify the OHWL. Look for staining, vegetation changes, other on site evidence.
- If site allows, identify opportunities to pull back the bank protection and/or allow for bioengineered opportunities.
- Determine length of existing and proposed bank protection.
- Determine height of existing and proposed bank protection.
- The preferred slope is 2:1 or less (Horizontal: Vertical). Any steeper and there is a greater risk of failure.
- Determine if the cause of erosion is 1) site based (such as vegetation removal at the site) or 2) reach based (such as a stream confined by dikes).

- Try to determine if the mechanism of failure is 1) toe erosion 2) scour 3) subsurface entrainment 4) mass failure 5) avulsion and chute- cutoff potential (See Attachment 1).
- Estimate height of bank and material composition.
- Consider how deep the toe of the bank protection will need to be buried to ensure it is below the depth of potential scour. Landowner may need to hire an engineer or WDFW Hydraulic Engineer may be able to assist.

Identify Project Impacts and Mitigation Opportunities

- Identify riparian vegetation to be impacted upland and along the water.
    - What species, age class, quantity, and size, if relevant?
- Identify access and work zone impacts.
- How does the applicant plan to control sediment delivery and erosion resulting from the project?
- How will the applicant address potential spills that might occur from equipment use?
- If in-water work is necessary, what measures will be taken to protect fish life and water quality?
- If a bypass, diversion, or coffer dam is needed, what method(s) will be used to isolate the work area?
- How will fish be excluded from the work area?
- What fish removal technique(s) will be used, and who will perform the work?
- How will waste water be treated (water pumped from within the exclusion site), where will it be pumped for filtration before re-entering the water?
- Identify or verify permanent reference points and measure the maximum distance of the waterward face for the new proposed bank protection (corner of house, tree, deck etc.)
- Reference points, measurements, or stake locations should be documented on the plans and scanned into APPS.

Site visit wrap up

- Before leaving the site clarify with the applicant the next steps in the process and be sure they understand what additional information or tasks they are responsible for.
- Discuss HPA processing timelines with the applicant so they understand the implications.

5. Mitigation Determination

Always keep in mind mitigation is based on existing conditions and must be adequate to ensure no net loss of habitat function due to impacts of the project. The mitigation document was in development at the time of this guidance, please check with your supervisor for the most up to date mitigation document.

Discuss onsite or after the site visit and be clear with the applicant what is required for mitigation under our authority. Make sure applicants that readily go above and beyond to mitigate understand the additional mitigation is voluntary and provides additional benefits to fish beyond what is required.

Incorporate large woody material or native vegetation into the design of structures as partial or complete mitigation for unavoidable impacts to fish life.

The design of the bank protection project must follow the mitigation sequence to protect fish life and fish habitat consistent with WAC 220-660-130:

> "Protect fish life and habitat that supports fish life by using the least-impacting technically feasible alternative. The common alternatives below are in order from most to the least preferred:
>
> (i) No action – Natural channel processes to occur;
>
> (ii) Biotechnical techniques;
>
> (iii) Combination of biotechnical and structural techniques; and
>
> (iv) Structural techniques."

- Set back structures or other improvements of value away from the eroding shoreline;
- Remove existing rock and concrete bulkheads whenever feasible;
- Use soft shore protection methods such as beach nourishment, large wood, bank resloping, and revegetation;
- Stress the importance of the use of native riparian plantings in order to improve future conditions for bank stability and ecological function. Prevent impacts to adjacent habitat that supports fish life; and

- Bury the base of the structure deep enough to prevent undermining. Where scour depth is deep enough, choose a design that adjusts to changing scour depth without compromising the function of the bank protection.

6. Rules of Thumb

- Once you have drafted the permit in APPS, it is okay to share a draft and supporting documents with the applicant for review, if there is time.
- Look for opportunities to move replacement bulkheads further landward of the existing bulkhead if it is removed.
- When feasible, suggest removal of existing rock and concrete bulkheads. Cannot be required.
- Protect fish life and habitat that supports fish by encouraging the least-impacting technically feasible alternative. Common alternatives in order from most to least preferred: 1) no action, 2) biotechnical techniques, 3) combination of biotechnical and structural techniques, and 4) structural techniques.
- Restrict the area of stream bank protection and lake shoreline stabilization to the least amount needed to protect eroding banks.
- Where technically feasible, the toe of the structure must be located landward of the OHWL. Large wood or other materials consistent with natural stream processes can be placed waterward of the OHWL.
- Bury the base of the structure deep enough to prevent undermining.
- Use design flows appropriate for the type of protection and function of the individual bank protection elements.
- Use natural materials whenever feasible, including large wood and vegetation.
- Protect existing spawning and rearing habitat and processes that create and maintain it.
- Recognize that stream bank erosion treatments can cause the need for more stream bank protection projects upstream and downstream of the project site and that the design must prevent or minimize these impacts.
- When time and workload allow, it is strongly recommended that a post-construction compliance inspection is scheduled with the applicant and/or agent. The purpose of this inspection is to ensure the project was constructed according to the permit conditions required for the protection of fish-life. Large, complex, or high risk projects should be prioritized for inspection. Additionally, any project that implements novel, nonstandard construction techniques or structures should be inspected. This compliance inspection should be done preferably when the contractor is still on site so as to correct any issues and be recorded in APPS or other permitting databases in a timely fashion.

7. Relevant WACS

WAC 220-660-080 - Mitigation requirements for hydraulic projects
WAC 220-660-100 - Freshwater habitats of special concern
WAC 220-660-110 - Authorized work times in freshwater areas
WAC 220-660-120 - Common freshwater construction provisions
WAC 220-660-130 - Stream bank protection and lake shoreline stabilization

8. Example Plans

See Attachment 1 for example plans and examples of mechanisms of bank failure.

9. References

WDFW Integrated Streambank Protection Guidelines, 2002
http://wdfw.wa.gov/publications/00046/

Pend Oreille County Shoreline Bank Stabilization Guide: Box Canyon Reservoir and other water bodies in Pend Oreille County. 2016.
http://pendoreilleco.org/wp-content/uploads/2016/04/PendOreilleShorelineStabilizationGuide_2016_April-8.5x11.pdf

Attachment 1

Example Plans

Mechanism of Failure	Possible Site-Based Causes	Possible Reach-Based Causes (Chapter 3)	Habitat Considerations
Toe erosion	Reduced vegetative bank structure from land-clearing activities Smoothed channel Along a bend (bend scour)	Meander migration Aggradation Degradation	Removal of large trees limits stream-side cover and riparian benefits (food source, shade, nutrients, woody debris, wildlife). Smoothing a channel limits diversity and complexity, pools, spawning habitat, and woody debris. Erosion along a bend or adjacent to a mid-channel bar creates deep pools and overhanging streambanks for cover.
Local Scour	Obstruction Tailout or Backwater Bar	Not applicable	Scour creates deep pools and overhanging streambanks that fish use for cover. Scoured sediments deposited downstream from scour hole may create (or smother existing) spawning habitat.
Constriction Scour	Bridge Crossing Existing streambank feature Large woody debris jam	Not applicable	
Drop/Weir Scour	Weir, ledge or sill	Not applicable	
Jet Scour	Lateral bar Sidechannel or tributary Abrupt channel bend (energy sink) Subchannels in a braided channel	Not applicable	
Mass Failure	Saturated soils Increased surcharge Lack of root structure Removal of lateral/underlying support	Meander migration Aggradation Degradation	Increased sediment load may fill pools or smother spawning beds. May serve as source of spawning substrate.
Subsurface Entrainment	Groundwater seepage Rapid drawdown	Not applicable	Subsurface flows important for maintaining floodplain connectivity, base flows and temperature.
Avulsion/Chute Cutoff Potential	Floodplain activities, natural conditions	Aggradation, channel relocation, downstream constriction, braided channel, large storm event	Removal of riparian corridor limits stream-side cover.

Mechanisms of failure, site and reach-based causes, and habitat considerations.

Examples of mechanisms of failure from the ISPG.

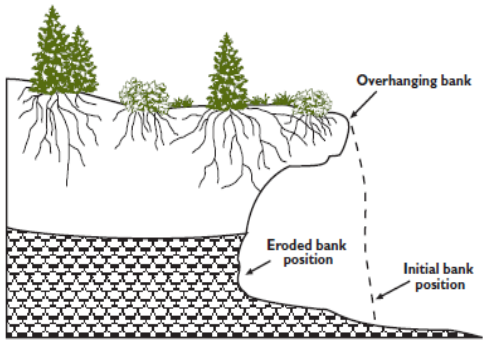


Figure 2-2. Toe erosion.

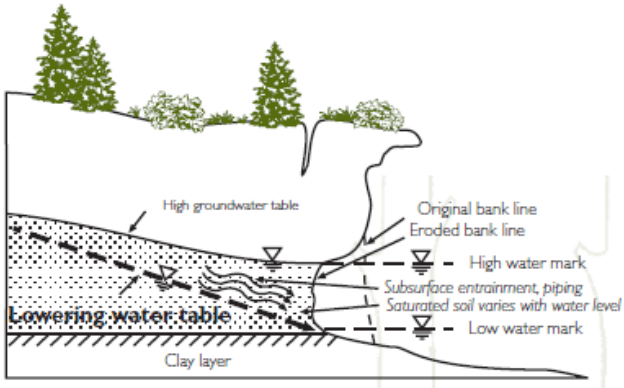


Figure 2-14. Subsurface entrainment, or piping.

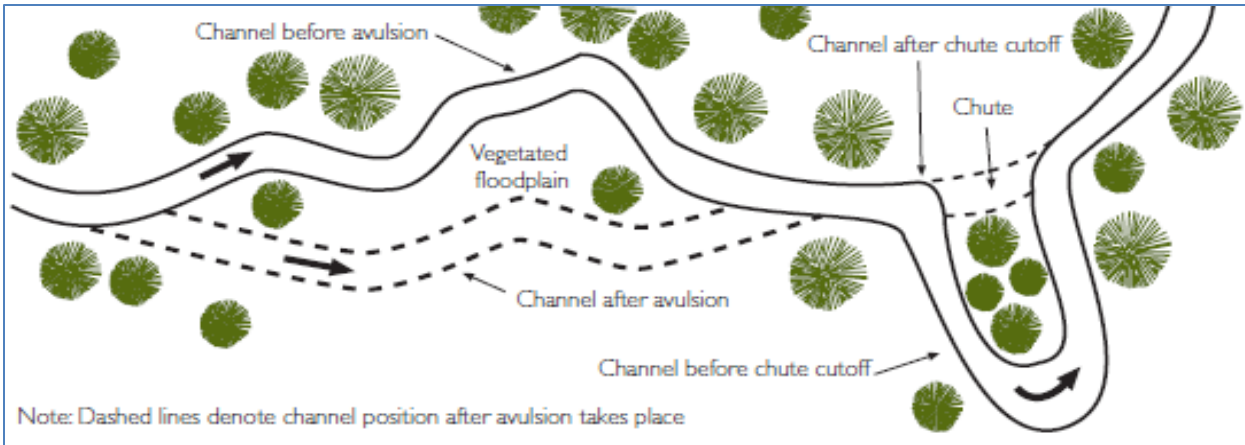


Figure 2-17. Avulsion and chute cutoff.

Examples of mechanisms of failure from the ISPG

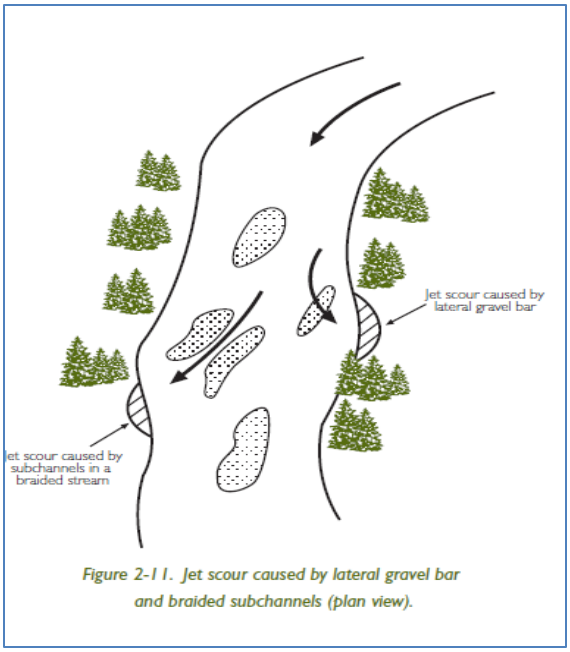


Figure 2-11. Jet scour caused by lateral gravel bar and braided subchannels (plan view).

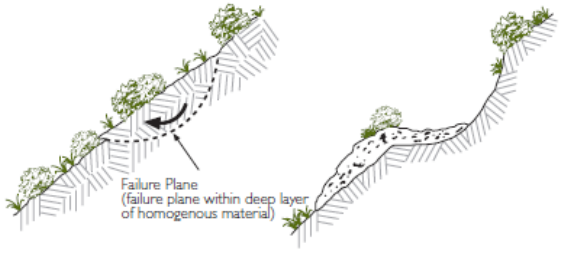


Figure 2-15. Rotational slide.

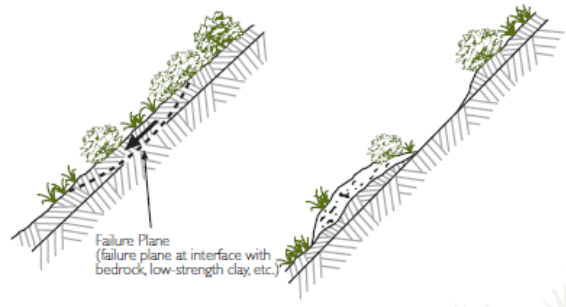
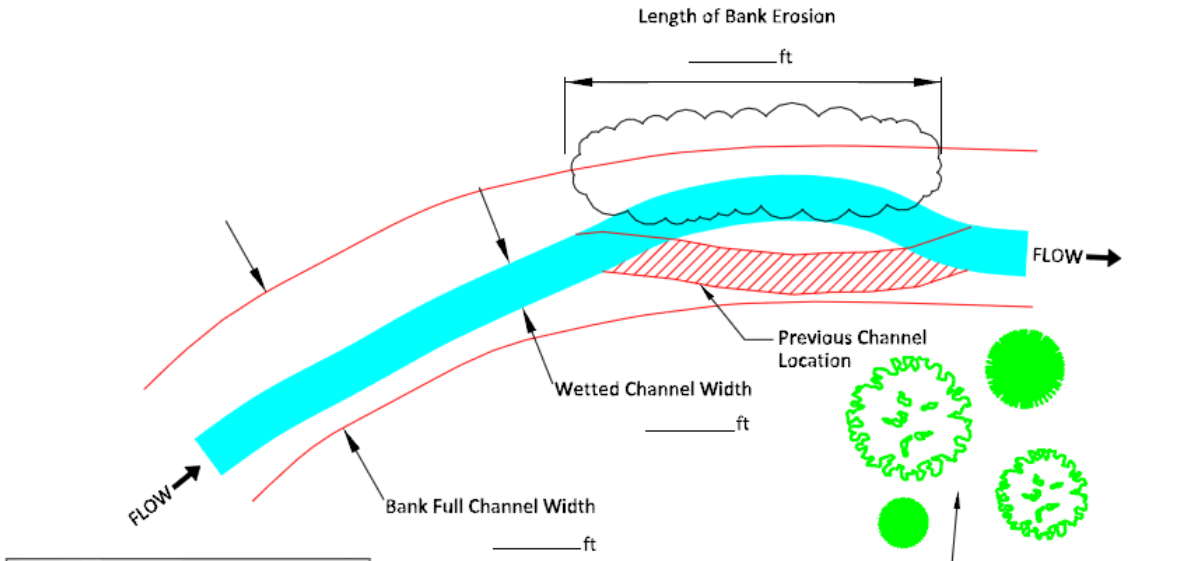


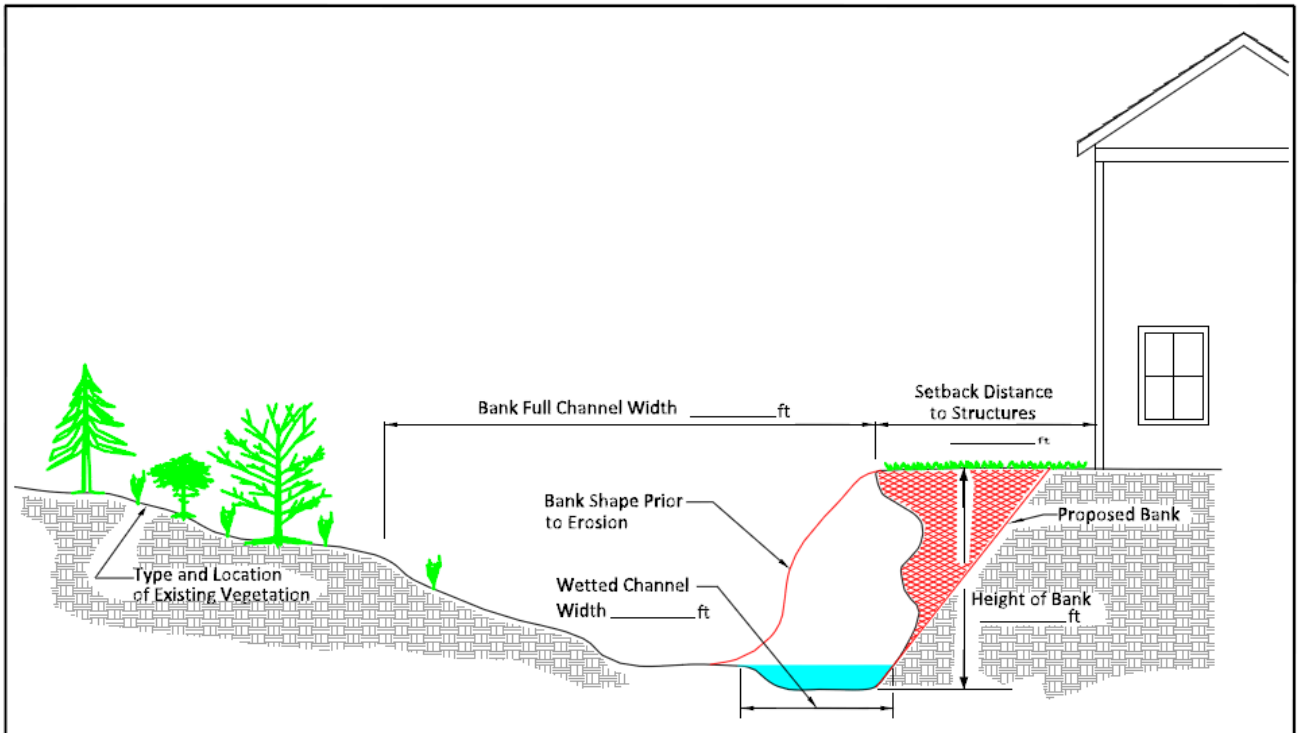
Figure 2-16. Transitional slide.



Plan View - Example

Not to scale

Washington Department of FISH and WILDLIFE	Engineer: Drawn by: J. Query Reviewed by: Approved by:	**Example Drawing S-6a** **Bank Erosion Detail - Plan View**	Date: 6 - 3 - 15 Sheet: 1 of 1



Section View - Example

Not to scale

Washington Department of FISH and WILDLIFE	Engineer: Drawn by: J. Query Reviewed by: Approved by:	**Example Drawing S-6b** **Bank Erosion Detail - Section**	Date: 6 - 3 - 15 Sheet: 1 of 1