Summary

Meeting dates: February 7- 8, 2014 Commission Meeting

Agenda item 5: Update of Chapter 220-110 Hydraulic Code Rules

Presenter(s): Randi Thurston, Protection Division Manager
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Background summary:

This briefing will inform the Fish and Wildlife Commission about three proposed hydraulic code rule sections.

This presentation will cover:

1) Changes to 220-110-070 Water crossing structures (proposed 220-110-190)
2) New section to 220-110-200 Fish passage improvement structures
3) New section 220-110-230 Beaver dam management

Policy issue(s) you are bringing to the Commission for consideration:

None, briefing only

Public involvement process used and what you learned:

N/A

Action requested:

None, briefing only

Draft motion language:

N/A

Justification for Commission action:

N/A

Communications Plan:

N/A

Form revised 12/5/12

Section Title: WAC 220-110-190 Water crossing structures

Background: This section covers the design and construction of stream simulation and no-slope culverts and bridges as well as temporary crossings, and culvert abandonment. The existing rules did not cover stream simulation, fords or culvert abandonment (removal). Hydraulic culvert design method was moved to fish passage improvement structures since this method does not pass all fish at all life stages.

Summary of New Section or Proposed Changes: The performance-based criteria and design-type criteria are intended to protect fish life and its habitat. The revised regulations strengthen the requirements for bridge design and construction standards to avoid floodplain impacts and channel disturbance. New restrictions on culvert construction and design are included. Many of the changes relate to modeling requirements for designing water crossing structures. Criteria are also included for fords, temporary water crossings, and water crossing removal.

Public Comments:

Support

No specific comments received.

Concerns

1) This chapter includes specific design requirements that are not applicable at all sites. Instead of providing specific numerical requirements, the chapter should provide general guidance then reference applicable design documents that are quicker to update than a WAC and will ensure the latest design procedures are used.
2) Given the controversy over blocking culverts (section 220-110-190) and the difficulty of both properly permitting culverts and installing culverts that actually pass fish we would have expected the updated hydraulic code to place more emphasis on stream simulation culvert designs.
3) To design water crossing structures in areas where there are no fish present and "retain upstream and downstream connection to natural channel processes (e.g. shifting channel patterns)" is a significant fiscal impact with no quantifiable benefit to fish life than a structured designed based on our current design method(s).
4) This section needs more work including discussion about culvert velocities that can impact passage and the need to allow natural processes to create and maintain fish habitat as an end goal.
5) It would be more appropriate to use a channel forming flow, such as the 2-year flood, instead of a rare flood like the 100-year to evaluate how changes in flow velocity will affect fish life. Over the course of a bridge's lifespan, the flow velocity during the 100-year flood will have less influence on the channel form than the 2-year flood.

6) Given recent research indicating that a vast majority of "no-slope" culverts fail (this research is referenced in WDFW's 2013 stream crossing guidelines), why are "no-slope" culverts still allowed using basically the same methodology that has led to failures in the past, but the "hydraulic design" culvert method has been removed even though it had better performance and was based on a more robust design methodology than "no-slope"?

7) The hydraulic culvert design is inconsistent with the recent federal court order for State culverts, as hydraulic designed culverts are often found to impede fish passage. This design approach should be placed into the section on alternative designs.

8) The proposed revision to the water crossing structures section (WAC 220-110-190) appears to incorporate the 2013 guidelines into the WAC. Alternatively, please consider retaining flexibility in design and give the option to either incorporate agency guidelines or provide equal or better engineered solutions. An unintended consequence of the proposed rule change requiring specific design requirements may shift legal and financial responsibilities onto WDFW if the project fails.

Existing Rule Language:

WAC 220-110-070 Water crossing structures

In fish bearing waters, bridges are preferred as water crossing structures by the department in order to ensure free and unimpeded fish passage for adult and juvenile fishes and preserve spawning and rearing habitat. Pier placement waterward of the ordinary high water line shall be avoided, where practicable. Other structures which may be approved, in descending order of preference, include: Temporary culverts, bottomless arch culverts, arch culverts, and round culverts. Corrugated metal culverts are generally preferred over smooth surfaced culverts. Culvert baffles and downstream control weirs are discouraged except to correct fish passage problems at existing structures.

An HPA is required for construction or structural work associated with any bridge structure waterward of or across the ordinary high water line of state waters. An HPA is also required for bridge painting and other maintenance where there is potential for wastage of paint, sandblasting material, sediments, or bridge parts into the water, or where the work, including equipment operation, occurs waterward of the ordinary high water line. Exemptions/5-year permits will be considered if an applicant submits a plan to adhere to practices that meet or exceed the provisions otherwise required by the department.

Water crossing structure projects shall incorporate mitigation measures as necessary to achieve no-net-loss of productive capacity of fish and shellfish habitat. The following technical provisions shall apply to water crossing structures:

(1) BRIDGE CONSTRUCTION

(a) Excavation for and placement of the foundation and superstructure shall be outside the ordinary high water line unless the construction site is separated

from waters of the state by use of an approved dike, cofferdam, or similar structure.

(b) The bridge structure or stringers shall be placed in a manner to minimize damage to the bed.

(c) Alteration or disturbance of bank or bank vegetation shall be limited to that necessary to construct the project. All disturbed areas shall be protected from erosion, within seven calendar days of completion of the project, using vegetation or other means. The banks shall be revegetated within one year with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center), and maintained as necessary for three years to ensure eighty percent survival. Where proposed, planting densities and maintenance requirements for rooted stock will be determined on a site-specific basis. The requirement to plant woody vegetation may be waived for areas where the potential for natural revegetation is adequate, or where other engineering or safety factors preclude them.

(d) Removal of existing or temporary structures shall be accomplished so that the structure and associated material does not enter the watercourse.

(e) The bridge shall be constructed, according to the approved design, to pass the 100-year peak flow with consideration of debris likely to be encountered. Exception shall be granted if applicant provides hydrologic or other information that supports alternative design criteria.

(f) Wastewater from project activities and water removed from within the work area shall be routed to an area landward of the ordinary high water line to allow removal of fine sediment and other contaminants prior to being discharged to state waters.

(g) Structures containing concrete shall be sufficiently cured prior to contact with water to avoid leaching.

(h) Abutments, piers, piling, sills, approach fills, etc., shall not constrict the flow so as to cause any appreciable increase (not to exceed .2 feet) in backwater elevation (calculated at the 100-year flood) or channel wide scour and shall be aligned to cause the least effect on the hydraulics of the watercourse.

(i) Riprap materials used for structure protection shall be angular rock and the placement shall be installed according to an approved design to withstand the 100-year peak flow.

(2) TEMPORARY CULVERT INSTALLATION

The allowable placement of temporary culverts and time limitations shall be determined by the department, based on the specific fish resources of concern at the proposed location of the culvert.

(a) Where fish passage is a concern, temporary culverts shall be installed according to an approved design to provide adequate fish passage. In these cases, the

temporary culvert installation shall meet the fish passage design criteria in Table 1 in subsection (3) of this section.

(b) Where culverts are left in place during the period of September 30 to June 15, the culvert shall be designed to maintain structural integrity to the 100-year peak flow with consideration of the debris loading likely to be encountered.

(c) Where culverts are left in place during the period June 16 to September 30, the culvert shall be designed to maintain structural integrity at a peak flow expected to occur once in 100 years during the season of installation.

(d) Disturbance of the bed and banks shall be limited to that necessary to place the culvert and any required channel modification associated with it. Affected bed and bank areas outside the culvert shall be restored to pre-project condition following installation of the culvert.

(e) The culvert shall be installed in the dry, or in isolation from stream flow by the installation of a bypass flume or culvert, or by pumping the stream flow around the work area. Exception may be granted if siltation or turbidity is reduced by installing the culvert in the flowing stream. The bypass reach shall be limited to the minimum distance necessary to complete the project. Fish stranded in the bypass reach shall be safely removed to the flowing stream.

(f) Wastewater, from project activities and dewatering, shall be routed to an area outside the ordinary high water line to allow removal of fine sediment and other contaminants prior to being discharged to state waters.

(g) Imported fill which will remain in the stream after culvert removal shall consist of clean rounded gravel ranging in size from one-quarter to three inches in diameter. The use of angular rock may be approved from June 16 to September 30, where rounded rock is unavailable. Angular rock shall be removed from the watercourse and the site restored to pre-project conditions upon removal of the temporary culvert.

(h) The culvert and fill shall be removed, and the disturbed bed and bank areas shall be reshaped to pre-project configuration. All disturbed areas shall be protected from erosion, within seven days of completion of the project, using vegetation or other means. The banks shall be revegetated within one year with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center), and maintained as necessary for three years to ensure eighty percent survival. Where proposed, planting densities and maintenance requirements for rooted stock will be determined on a site-specific basis. The requirement to plant woody vegetation may be waived for areas where the potential for natural revegetation is adequate, or where other engineering or safety factors need to be considered.

(i) The temporary culvert shall be removed and the approaches shall be blocked to vehicular traffic prior to the expiration of the HPA.

(j) Temporary culverts may not be left in place for more than two years from the date of issuance of the HPA.

(3) PERMANENT CULVERT INSTALLATION

(a) In fish bearing waters or waters upstream of a fish passage barrier (which can reasonably be expected to be corrected, and if corrected, fish presence would be reestablished), culverts shall be designed and installed so as not to impede fish passage. Culverts shall only be approved for installation in spawning areas where full replacement of impacted habitat is provided by the applicant.

(b) To facilitate fish passage, culverts shall be designed to the following standards:

(i) Culverts may be approved for placement in small streams if placed on a flat gradient with the bottom of the culvert placed below the level of the streambed a minimum of twenty percent of the culvert diameter for round culverts, or twenty percent of the vertical rise for elliptical culverts (this depth consideration does not apply within bottomless culverts). Footings of bottomless culverts shall be buried sufficiently deep so they will not become exposed by scour within the culvert. The twenty percent placement below the streambed shall be measured at the culvert outlet. The culvert width at the bed, or footing width, shall be equal to or greater than the average width of the bed of the stream.

(ii) Where culvert placement is not feasible as described in (b)(i) of this subsection, the culvert design shall include the elements in (b)(ii)(A) through (E) of this subsection:

(A) Water depth at any location within culverts as installed and without a natural bed shall not be less than that identified in Table 1. The low flow design, to be used to determine the minimum depth of flow in the culvert, is the two-year seven-day low flow discharge for the subject basin or ninety-five percent exceedance flow for migration months of the fish species of concern. Where flow information is unavailable for the drainage in which the project will be conducted, calibrated flows from comparable gauged drainages may be used, or the depth may be determined using the installed no-flow condition.

(B) The high flow design discharge, used to determine maximum velocity in the culvert (see Table 1), is the flow that is not exceeded more than ten percent of the time during the months of adult fish migration. The two-year peak flood flow may be used where stream flow data are unavailable.

(C) The hydraulic drop is the abrupt drop in water surface measured at any point within or at the outlet of a culvert. The maximum hydraulic drop criteria must be satisfied at all flows between the low and high flow design criteria.

(D) The bottom of the culvert shall be placed below the natural channel grade a minimum of twenty percent of the culvert diameter for round culverts, or twenty percent of the vertical rise for elliptical culverts (this depth consideration does not apply within bottomless culverts). The

downstream bed elevation, used for hydraulic calculations and culvert placement in relation to bed elevation, shall be taken at a point downstream at least four times the average width of the stream (this point need not exceed twenty-five feet from the downstream end of the culvert). The culvert capacity for flood design flow shall be determined by using the remaining capacity of the culvert.

Table 1
Fish Passage Design Criteria for Culvert Installation

Criteria	Adult Trout > 6 in. (150mm)	Adult Pink, Chum Salmon	Adult Chinook, Coho, Sockeye, Steelhead
1. Velocity, Maximum (fps)			
Culvert Length (ft)			
a. 10 - 60	4.0	5.0	6.0
b. 60 - 100	4.0	4.0	5.0
c. 100 - 200	3.0	3.0	4.0
d. > 200	2.0	2.0	3.0
2. Flow Depth Minimum (ft)	0.8	0.8	1.0
3. Hydraulic Drop, Maximum (ft)	0.8	0.8	1.0

(E) Appropriate statistical or hydraulic methods must be applied for the determination of flows in (b)(ii)(A) and (B) of this subsection. These design flow criteria may be modified for specific proposals as necessary to address unusual fish passage requirements, where other approved methods of empirical analysis are provided, or where the fish passage provisions of other special facilities are approved by the department.

(F) Culvert design shall include consideration of flood capacity for current conditions and future changes likely to be encountered within the stream channel, and debris and bedload passage.

(c) Culverts shall be installed according to an approved design to maintain structural integrity to the 100-year peak flow with consideration of the debris loading likely to be encountered. Exception may be granted if the applicant provides justification for a different level or a design that routes that flow past the culvert without jeopardizing the culvert or associated fill.

(d) Disturbance of the bed and banks shall be limited to that necessary to place the culvert and any required channel modification associated with it. Affected bed and bank areas outside the culvert and associated fill shall be restored to pre-project configuration following installation of the culvert, and the banks shall be revegetated within one year with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center), and maintained as necessary for three years to ensure eighty percent survival. Where proposed, planting densities and maintenance requirements for rooted stock will be determined on a site-specific basis. The requirement to plant woody vegetation may be waived for areas where the potential for natural revegetation is adequate, or where other engineering or safety factors preclude them.

(e) Fill associated with the culvert installation shall be protected from erosion to the 100-year peak flow.

(f) Culverts shall be designed and installed to avoid inlet scouring and shall be designed in a manner to prevent erosion of streambanks downstream of the project.

(g) Where fish passage criteria are required, the culvert facility shall be maintained by the owner(s), such that fish passage design criteria in Table 1 are not exceeded. If the structure becomes a hindrance to fish passage, the owner shall be responsible for obtaining a HPA and providing prompt repair.

(h) The culvert shall be installed in the dry or in isolation from the stream flow by the installation of a bypass flume or culvert, or by pumping the stream flow around the work area. Exception may be granted if siltation or turbidity is reduced by installing the culvert in the flowing stream. The bypass reach shall be limited to the minimum distance necessary to complete the project. Fish stranded in the bypass reach shall be safely removed to the flowing stream.

(i) Wastewater, from project activities and dewatering, shall be routed to an area outside the ordinary high water line to allow removal of fine sediment and other contaminants prior to being discharged to state waters.

Draft Rule Language:

220-110-190 Water crossing structures

All projects must meet the mitigation requirements in WAC 220-110-080 and the requirements in WAC 220-110-100 through 220-110-440 that are included in an HPA. The department will require certain technical provisions depending upon the individual proposal and site-specific characteristics. Additional special provisions may be included to address site-specific conditions. A person can find appropriate methods to design water crossing structures in the Department's *Water Crossing Design Guidelines*, as well as other published manuals and guidelines.

(1) DESCRIPTION

Water crossings are structures constructed to move people, animals, or materials across or over water from bank to bank. These structures include bridges, culverts, fords, and conduit crossings. This chapter covers bridges, culverts, and fords. WAC 220-110-270 covers conduit crossings. Generally, people use bridges to cross over larger streams and rivers, or over unstable channels; they use culverts to cross over smaller streams with an average channel width less than fifteen feet and they use fords when other stream crossing options would result in a greater impact to fish and their habitats.

(2) FISH LIFE CONCERNS

In fish-bearing streams, a person must design water crossing structures to allow fish to move freely through them at all flows when fish are expected to move. All water crossings, even those in streams with no fish, must retain upstream and downstream connection to maintain natural channel processes. These processes include the movement and distribution of wood and sediment and the shifting of channel patterns. Water crossings that are too small in relation to the stream can block or alter these processes.

Fords have a high potential to generate and deliver sediment and may impede fish passage. However, under limited circumstances, fords may be considered when they provide better protection to fish and their habitats than other water crossing structures.

(3) PERMANENT WATER CROSSING STRUCTURES - GENERAL

(a) A water crossing design must provide unimpeded passage for adult and juvenile fishes of all species .

(b) A water crossing design must maintain the physical characteristics of a natural stream channel throughout the water crossing. The department will make an exception where there are human-made features in the floodplain that are outside the control of the applicant and that are unlikely to be removed. If channelization, encroachment, or other human-made changes have degraded the channel near the crossing, the design must have a similar slope, cross section, and velocity distribution expected under conditions in the reach.

(i) The proposed slope should be that of an equilibrium channel and not over-steepened.

(ii) The proposed cross section must have the same channel bed width, a thalweg, and overbank areas, as needed.

(iii) The proposed cross section must have a varied velocity distribution for passing fish of all sizes and abilities; particularly, low velocity margins and a high velocity central zone.

(c) The water crossing design must ensure that the structure does not constrain upstream and downstream channel processes and functions enough to cause detectible impacts to fishlife. All water crossings must provide for the processes and functions listed in provisions (i) to (ix) below. By complying with the provisions under subsections (4) and (6) of this chapter, a person is assumed to provide these processes and functions.

(i) Maintain low flow continuity from upstream through the water crossing structure to downstream. Crossings in stream channels that normally dry out or have disconnected pools during the low flow period need not provide continuity.

(ii) The water crossing structure must convey the one hundred year peak flow or other design flood flows approved by the department.

(iii) Maintain the natural dynamics of a floodplain, including connectivity with side channels and off-channel habitats.

(iv) Design and construct the water crossing to pass large woody material.

(v) Design and construct the water crossing to pass sediment.

(vi) Maintain hydraulic diversity because it influences fish habitat in several ways including fish dispersal, habitat use, and competitor/prey relationships.

(vii) Design and construct the water crossing to maintain the shallow, low velocity stream margin habitat typical of non-channelized streams.

(viii) Design and construct the water crossing to maintain sediment gradation downstream.

(ix) The water crossing must allow the natural evolution of the channel planform and longitudinal profile.

(d) The department prohibits culvert baffles and downstream control weirs except to correct fish passage problems at existing structures.

(e) To determine the average bankfull width for water crossing structure design, a person must use at least three typical bankfull widths, measured in a stream reach that is characteristic of a natural stream. A person must measure widths that describe normal conditions at straight channel sections and outside the influence of any culvert, bridge abutments, or other artificial or unique channel constriction.

(f) Remove all structural elements of the replaced water crossing structure including abutments, piers, pilings, sills, foundations, armor rock, aprons, wing walls, guide walls, culverts, and approach fills, unless authorized by the department.

(4) BRIDGE DESIGN

(a) An HPA is required to construct or perform structural work on any bridge structure waterward of or across the OHWL of state waters. A HPA is also required for bridge painting and other maintenance where paint, sandblasting material, sediments, or bridge parts might fall into the water.

(b) The bridge design must convey the one-hundred year peak flow or other design flood flow approved by the department.

(c) The design must pass ice, large wood and other woody material, and sediment likely to move under the bridge during the one-hundred year flood flows or the design flood flow approved by the department.

(d) Where there are existing flood control levees at the bridge construction site, or other infrastructure that is not owned by the bridge owner, the department may approve a shorter bridge span than otherwise required in this section.

(e) A bridge in a watercourse with an active floodplain must have a span wide enough to prevent a significant increase in the main channel average velocity. This velocity must be determined at the one hundred-year flood flow or the design flood flow approved by the department.

(f) To minimize the need for bank armoring, a person must design (size) the bridge to account for the lateral migration expected to occur during the bridge's lifespan.

(g) The design must have at least three feet of clearance between the bottom of the bridge structure and the water surface at the one-hundred year peak flow. If a person provides an engineering justification, the department may grant an exception to this requirement.

(h) The design and alignment of the bridge must not cause bed scour and bank erosion.

(i) Unless there are geological, engineering, or safety constraints, the bridge design must avoid the need for scour protection. Where mid-channel piers are needed, design them so no additional scour protection is required. If scour protection is unavoidable, the design must minimize the scour protection to the amount needed to protect piers and abutments. The design must specify the size and placement of the scour protection so it withstands expected peak flows.

(j) The waterward face of all bridge elements that may come in contact with waters of the state, including abutments, piers, pilings, sills, foundations, armor rock, riprap, aprons, wing walls, and approach fill, must be landward of the OHWL. This requirement excludes mid-channel piers.

(k) Bank armoring associated with bridge design and construction must be limited to the amount needed to support abutment and fill at a safe angle of repose.

(5) BRIDGE CONSTRUCTION

(a) Use a cofferdam structure or similar structure to separate mid-channel construction from waters of the state.

(b) If excavation or other construction activities take place waterward of the OHWL, isolate the work area from the stream flow by using a cofferdam, bypass, or similar structure.

(c) When placing the bridge structure, minimize damage to the bed.

(d) Use biotechnical slope protection outside the bridge shadow. The department may approve exceptions for chronic instability, adverse road geometry, or other conditions beyond the control of the owner.

(6) CULVERT DESIGN

(a) Stream simulation design

(i) A stream simulation culvert must be designed and constructed to comply with the following requirements:

(A) The stream channel must generally have a channel bed that is no wider than fifteen feet. However, the department may approve a stream simulation culvert in channels with a channel bed wider than fifteen feet.

(B) The width of the channel bed inside a stream simulation culvert at the elevation of the streambed must be at least one and two-tenths times the average channel bed width plus two feet (1.2 BFW + 2 ft.).

(C) The stream simulation culvert must be set at the same gradient as the prevailing stream gradient.

(D) The slope of the bed inside a stream-simulation culvert must not exceed the slope of the upstream channel by more than twenty-five percent.

(E) The stream simulation culvert must be countersunk at least thirty percent and up to fifty-percent of the culvert rise.

(F) The particle size of sediment placed inside the stream-simulation culvert must be plus or minus twenty percent of the median particle size found in a representative reference reach of the same stream. The department may grant exceptions if the proposed alternative sediment is appropriate to the circumstances.

(b) No-slope design

(i) A no-slope culvert must be designed and constructed to comply with the following requirements:

(A) The stream channel must generally have a channel bed that is no wider than eight feet and a gradient less than three percent. However, in some site-specific situations the department may approve no-slope in channels with a gradient less than five percent.

(B) The culvert is installed at zero gradient.

(C) The culvert must not exceed seventy-five feet in length.

(D) The width of the channel bed inside a no-slope culvert at the elevation of the streambed must at least the average channel bed width.

(E) The no-slope culvert is counter sunk at least twenty percent of the culvert rise at the culvert outlet downstream and up to forty-percent of the culvert rise at the culvert inlet upstream.

(F) The no-slope culvert must be filled to the depth of the countersink stated in (6)(b)(i)(E) with material similar to what is found in the adjacent channel streambed unless either of the following conditions exist:

1. The culvert is located in a wetland or in an area where the channelbed is mostly fine sediment and the culvert will be backwatered, or

2. The culvert will fill quickly because of the frequent rate of sediment transported through the culvert and will not cause excessive cutting or slumping of the upstream channel.

(ii) Combining the requirements for culvert width and countersinking, the culvert must meet the following requirements:

(A) For a circular culvert, the culvert diameter must beat least the average channel bed width plus twenty-five percent.

(B) For a culvert with an oval cross section (elliptical, pipe arch, or “squashed” pipe) the horizontal width must be at least the average channel bed width plus twenty-five percent.

(C) For a box or pipe arch culvert, the span must be at least the average channel bed width.

(c) Requirements for Other Permanent Culvert Design

(i) The department will approve alternative culvert designs if the design complies with Subsection (3) General Design Requirement for Water Crossing Structures and the design provides equal or greater protection for fish life as the stream simulation and no-slope design methods.

(d) Temporary Culvert Design Requirements

(i) The department must determine allowable placement of temporary culvert and time limitations based on the specific fish resources at the proposed water crossing location.

(ii) The design of the temporary crossing must maintain structural integrity at the peak flow expected to occur while the crossing is in place.

(iii) Where fish passage is a concern, the temporary culvert must provide unimpeded fish passage.

(iv) A person must remove the temporary culvert and block all approaches to vehicular traffic before the HPA expires.

(7) CULVERT CONSTRUCTION

(a) A person must establish the culvert invert elevation with reference point(s) or benchmark(s) created before starting work on this project. The reference point(s) must be clearly marked and preserved for post-project compliance. Before backfilling, the invert elevation, as stated on the plans, must be confirmed relative to the reference points with at least a construction-grade leveling device (such as an optical auto-level or laser level).

(b) A person must install a culvert in the dry or isolated from the stream flow by using a bypass channel or culvert, or by pumping the stream flow around the work area. The department may approve an exception if installing the culvert in the flowing stream reduces siltation or turbidity.

(c) A person must embed the top of footings of bottomless culverts deep enough below potential scour depth to prevent exposing and undermining the footing surface.

(d) The owner(s) must maintain the culvert to ensure it complies with subsection (3) of this section.

(e) If the culvert starts to hinder fish passage, the owner must obtain a HPA and promptly repair the problem.

(8) PERMANENT FORD DESIGN

(a) A person must design and maintain a ford so the ford does not constrict a channel, impede fish passage, block debris passage, or degrade water quality to the detriment to fish life.

(b) The department will authorize construction of new fords in limited situations when it is the least impacting water crossing option. The following are examples of situations where the department may authorize a ford:

(i) Where there is no maintenance access during winter or early spring months and the crossing has a high risk of failure from rain-on-snow events.

(ii) The road is inaccessible due to snow pack, weather, or other conditions that seasonally limit access to the water crossing structure;

(iii) The stream has extreme seasonal flow variations and low flows during anticipated ford use;

(iv) The channel has low bank height and low gradient approaches;

(v) The stream has dynamic floodplains, such as alluvial fans; or

(vi) The stream is subject to mass wasting events, debris transport, or extreme peak flows.

(c) Permanent fords must not impede fish passage.

(d) Fords must be located outside of all known or potential fish spawning areas such as pool tailouts.

(e) To minimize the delivery of sediment to a stream, fords must be used only during periods of no or low stream flow (whether dry or frozen).

(f) Traffic should be separated from flowing water by using vented fords or other appropriate alternatives.

(9) TEMPORARY FORD DESIGN

(a) The department may permit temporary fords only during the time of year that avoids high stream flows or expected fish spawning or migration.

(b) If the driving surface of a temporary ford contains fill, it must consist of clean washed gravel between one-quarter and four inches in diameter.

(c) If the natural streambed is composed of material smaller than gravel, the temporary ford must separate the watercourse bed from the fill to ensure that fill material used in ford construction is removable.

(10) FORD CONSTRUCTION

(a) Fords must be constructed during periods of low or no stream flow or isolated from flowing water.

(b) Fords must be constructed perpendicular to the stream flow, or as close to perpendicular as possible.

(c) Fords must be constructed using material approved by the department.

(d) If the streambed does not have a firm rock or gravel base, install clean, washed rock or gravel to reduce sedimentation. Concrete, pavement, or other debris should not be used to construct hardened fords. Placement of material should be limited to the approaches and crossing.

(e) A person must countersink the prism of the ford below the watercourse bed. A person must design the prism to withstand overtopping during flood events, and natural debris.

(f) Fill associated with the driving surface of a permanent ford must consist of material that will not attract spawning fish.

(g) A person must protect the driving surfaces of ford approaches from erosion to ensure that erodible fines do not enter waters of the state.

(h) Fords must be regularly inspected and maintained to provide for fish passage and maintain water quality.

(11) WATER CROSSING ABANDONMENT (REMOVAL)

(a) Water crossing removal must comply with the following provisions. A person must always protect the job site from erosion and replant the site.

(i) When removing temporary crossings, a person must remove the temporary culvert, bridge, ford, and any imported fill. The site must be restored to a width, depth, gradient, and substrate composition similar to the channel segments upstream and downstream from the crossing. If water-rounded granular materials were used for fill, and they are similar to those found in the existing channel bed, the department may allow the materials to remain on site.

(ii) When removing permanent crossings, a person must remove all of the components, such as approach fill, sills, stringers, deck, riprap, and guardrails. The department may approve leaving trees or other vegetation, some fill materials, or untreated log bridge stringers. The site must be restored to the original contours or a configuration approved by the department.

(iii) When removing an existing bridge in preparation for a new bridge crossing, a person must remove all the existing bridge components, such as approach fill, sills, stringers, deck, riprap, and guardrails within the floodplain. The department may approve the partial removal of certain components when the impacts of leaving them are minor. The site must be restored to the original contours or a configuration approved by the department.

Section Title: WAC 220-110-200 Fish passage improvement structures

Background: Currently, there are no requirements for the design and construction of fish passage facilities for upstream migrating fish in the existing rules. The section reflects current fish science and technology measures to avoid or minimize adverse impacts to fish, shellfish and their habitat.

Summary of New Section or Proposed Changes: This new section establishes criteria for constructing and operating fish ladders, weirs for fish passage, roughened channels, and trap-and-haul operations. Specifications for hydraulic design fish passage structures are also included.

Public Comments:

Support
Good new section addressing fish passage protection measures.

Concerns

1) All fishways must require monitoring for the life of the structure as a permit requirement to avoid potential impacts to fish life due to passage limitations and higher potential for failure. Fishways should be considered temporary solutions due to their passage limitations (not passing all fish at all life stages). Permanent fishways (due to exceptional circumstances or site constraints) must be mitigated.
2) It is unclear why roughened channels are included in the same category as structural fish ladders and log weirs. Fish ladders and log weirs have demonstrated their limitations, but properly designed roughened channels have demonstrated their ability to provide unrestricted fish passage.
3) Roughened channels should require monitoring and would require repair if fish passage barriers develop. This should be a temporary solution in only extreme circumstances with a valid reason why a more reliable fish passage method (e.g. stream simulation or bridge) cannot be used.
4) Please retain the hydraulic design option for replacement culverts. It can be very difficult to establish a natural bank full channel width when the stream has been ditched or armored. The stream simulation and the no slope design option both require measurement of the bank full channel width. If the hydraulic design option is not retained for replacement culverts, please provide explicit instructions on how to determine the BFCW in ditched and armored streams and for streams that flow through large wetlands. These are common design challenges.
5) If hydraulic culverts are allowed to remain, what will WDFW require for fish passage mitigation?

Draft Rule Language:

WAC 220-110-200 Fish passage improvement structures

The requirements in this section apply to fish ladders, weirs constructed for fish passage management, roughened channels, trap-and-haul operations, and hydraulic design culvert retrofits. All projects must meet the mitigation requirements in WAC 220-110-080 and any requirements in WAC 220-110-100 through 220-110-440 that are included in an HPA. The department will require certain technical provisions depending upon the individual proposal and site-specific characteristics. Additional special provisions may be included to address site-specific conditions.

(1) DESCRIPTION

Fishways facilitate the passage of fish through or around a barrier. They restore upstream and downstream fish access to habitats that have become isolated by human activities such as placing culverts, dams, and other artificial obstructions). Fishways can be mitigation measures for adverse effects caused by flow control structures.

(2) FISH LIFE CONCERNS

Barriers can block fish from using upstream spawning and rearing habitat. The main goal is to remove fish passage barriers and ensure unimpeded passage of fish at all life stages, as well as to maintain natural channel processes and function. However, when it is not possible to remove a barrier, fishways may be an alternative mitigation measure. The department does not generally recommend using fishways because they can be partial barriers to fish passage. Fish passage structures that mainly pass one species or class of fish may unintentionally limit the passage of other species. Species selection can alter species composition and community relationships upstream of the passage barrier, with important implications for conservation of individual species and biodiversity.

(3) FISH PASSAGE IMPROVEMENT STRUCTURE DESIGN

(a) The department may not favor fish passage structures over permanent natural barriers unless they are needed to restore native fish species.

(b) The HPA application must have site and biological information relevant to the specific project, such as information on species present, hydrology and topography, and existing adjacent structures.

(c) The department may require compensatory mitigation if a fish passage structure cannot pass all for all fish species present at all mobile life stages.

(d) The design must consider site-specific conditions that could affect the function of the fishway. These include meander migration or vertical change in streambed elevation, debris and bedload movement, tampering, vandalism, and poaching.

(e) The fish passage structure design must withstand the maximum expected flow.

(f) The fish passage structure must not result in significant migratory delays or mortality to fish life due to disorientation, distraction, predation, stress, or injury.

(g) The fish passage structure must accommodate expected run sizes to prevent crowding and delay of fish migration.

(4) TEMPORARY FISH PASSAGE IMPROVEMENT STRUCTURES DESIGN

(a) The department may require the installation of a temporary fish passage structure to provide passage through temporary obstructions. The department may not require a fish passage structure if a barrier exists for such short duration that is the department determines that no lasting impacts to fish life will occur.

(b) A person must maintain a fish passage structure in an effective condition. If the structure starts to hinder fish passage, the person must obtain a HPA and promptly repair the problem.

(c) The department may approve the installation of temporary fishways when permanent structures are damaged or are under construction, to conduct maintenance or repair, for enhancement projects, or for seasonal water diversion structures such as irrigation diversion dams.

(d) Temporary fishways must remain operational for the duration of the temporary obstruction and must be maintained and adjusted as needed to provide efficient passage of fish life.

(5) FISH LADDER DESIGN

(a) The department may authorize a fish ladder if:

(i) The fish ladder will enable fish passage at an existing barrier, but only until the existing barrier structure is replaced.

(ii) The department determines that constructing a bridge, culvert, or roughened channel is not possible due to the nature of the obstruction such as a flow control structure or the slope of the stream.

(b) The fish ladder design must be appropriate for the slope of the channel, water surface elevations, species present, flow regime, and conditions of the channel.

(c) The fish ladder must be designed to prevent fish from leaping out of the structure.

(d) The fish ladder pool volume must provide the hydraulic and fish capacity needed to pass all adult and juvenile fish.

(e) The fish ladder entrance:

(i) Must provide enough streaming flow attraction during high and low flows, without excessive velocity or turbulence, to ensure fish can locate and enter the fish ladder without significant delay.

(ii) To prevent fish from becoming trapped, injured, or stranded, must minimize distractions that lure fish away from the entrance.

(iii) Must be large enough to accommodate all expected debris and ice without damage or loss of passage efficiency.

(iv) Must provide a stable flow pattern and uniform velocity at the entrance pools and transition channels to allow fish to pass through the structure unimpeded.

(v) If a single entrance cannot attract and provide passage to all adult and juvenile fish, the ladder must provide multiple entrances. If the work area has multiple zones where fish accumulate, each zone must have at least one entrance.

(vi) May be required to have artificial light to optimize fish passage.

(f) Fish ladder auxiliary water system:

(i) To ensure fish are attracted to the fish ladder, may be required to have an auxiliary water system (AWS) to supply supplementary water.

(ii) Must have a diffuser design that discourages attraction of fish life to it and to protect fish from injury.

(iii) Must minimize the size of spaces between diffuser to exclude and prevent injury to the smallest fish present.

(iv) Must not use an auxiliary water supply from external sources that could confuse the homing instinct of fish.

(g) To prevent harm to fish life, the department may require screening of the AWS.

(h) The department may require a trash rack at the AWS intake.

(i) Fish Ladder Exit:

(i) Must have a water depth that is similar to the depth inside the fish ladder.

(ii) Must be located to ensure fish can safely exit the structure without susceptibility to predators, without becoming disoriented, and with the ability to continue their upstream migration.

(iii) Must be designed to protect the exit from damage by debris.

(6) FISH LADDER CONSTRUCTION

(a) To reduce potential contact injuries, all edges and surfaces exposed to fish must be ground smooth to the touch, with all edges aligning in a single smooth plane.

(7) FISH LADDER MAINTENANCE

(a) Continuously supply the fish ladder with enough water to safely and efficiently pass fish at least ninety percent of the time, both upstream and downstream of the obstruction. If target fish species are present and actively migrating, enough water must be available to pass fish through the fish ladder, or the fish must be able to safely pass without the need of a fish ladder.

(b) A person must inspect the fish ladder for proper function at a frequency determined by the department.

(i) Place wood and sediment retrieved during inspection and maintenance downstream of the fishway.

(c) A person operating or maintaining the fish ladder must be trained.

(d) The department may require shutdown of the fish ladder during high flows if the flow exceeds the fish passage design flow. However, a fish ladder must not be inoperable due to high flows for longer than seven days during the migration period for the target fish species.

(8) FISH PASSAGE WEIR DESIGN

(a) Design the weir to control the water surface elevation at weir to provide fish passage over or through an obstruction.

(b) Design the weir to minimize impacts to natural channel geometry.

(c) Design the weir to ensure continued fish passage for all species present at all mobile life stages.

(i) The department may approve exceptions when it is implementing a program to restore native fish species or to protect native fish species from the introduction of non-native fish species, and fish passage blockage is an intended component of the project.

(9) ROUGHENED CHANNEL DESIGN

(a) The department may authorize a person to construct a roughened channel to facilitate the passage of fish around abrupt hydraulic drops, through culverts, or at diversion sites for water withdrawal.

(b) Only qualified professionals should design roughened channels.

(c) Where non-leaping fish are present or when other types of fish passage improvement structures would not pass fish well enough, the department may require a person to construct a roughened channel to bypass an obstruction.

(d) Roughened channels must meet the minimum hydraulic requirements of a hydraulic design culvert such as velocity, drop, turbulence, and flow requirements.

(e) Roughened channels must minimize impact on the existing fish life and their habitat in the channel.

(f) The size and gradation of roughened channel bed material must resist erosion at the design flood and must result in a dense structure that prevents subsurface flow.

(10) TRAP-AND-HAUL OPERATIONS

(a) The department requires an HPA for installing, maintaining, and removing fish traps for trap-and-haul activities.

(b) The fish trap must be designed to withstand the maximum expected flow.

(c) The fish trap must be operated in a way that prevents crowding and delaying target fish species migration.

(11) HYDRAULIC DESIGN CULVERT FISH PASSAGE DESIGN

(a) The department may authorize an existing hydraulic design culvert to remain in place until the end of its design life, until another more appropriate culvert design can be constructed, or, under exceptional circumstances, where other culvert designs cannot be constructed.

(b) Before obtaining a permit to retrofit a culvert or construct a fish passage improvement structure using the hydraulic design method, a person must submit appropriate hydrology data and hydraulic design documentation prepared by a licensed professional engineer that demonstrates compliance with this section.

(c) The hydraulic design fish passage structure must include consideration of flood capacity for current conditions and future changes likely to occur within the stream channel, and debris and bedload passage.

(d) Plans submitted to the department to retrofit a culvert or to construct a fish passage improvement structure using the hydraulic design method must address the following:

(i) Minimum water depth at any location within a hydraulic design passage structure without a natural bed, must be at least eight-tenths of a foot.

(ii) The minimum depth of flow in the passage structure is determined by:

(A) The low flow design, which is the two-year seven-day low flow discharge for the subject basin.

(B) When flow information for the site is unavailable, the department may authorize the use of calibrated flows from a comparable gauged site or the depth of the culvert when no water is flowing.

(iii) Maximum water velocity may not exceed the values in Table 1 at any point within a culvert. Measure maximum water velocity at the high fish passage design flow.

Table 1: Maximum Velocity Design Criteria for Hydraulic Design Culvert Installation

Culvert Length	Maximum Velocity
10 – 100 ft	4.0 feet per second
100 - 200 ft	3.0 feet per second
> 200 ft	2.0 feet per second

(e) The hydraulic drop within the culvert or at the culvert inlet or outlet may not exceed one-half foot. When a drop has a submerged jet (the lowest part is below the downstream water surface) or is part of a natural or roughened channel design, the department may approve an exception to this drop limit.

(f) Water turbulence within the culvert must not be a barrier to passage of target fish species.

(g) The department may modify or approve design flow criteria for specific proposals as needed to address unusual fish passage requirements.

Section Title: WAC 220-110-230 Beaver dam management

Background: Currently, there are no requirements for beaver dam removal and modification in the existing rules. The section reflects current fish science and technology measures to avoid or minimize adverse impacts to fish, shellfish and their habitat.

Summary of New Section or Proposed Changes: This new section introduces regulations for beaver dam removal and installation of water leveling and exclusion devices. Beaver dams can be removed or breached, when there is a threat to private and public land or infrastructure. The methods for removal are specified and include requirements to protect fish habitat and compensatory mitigation may be required for lost habitat.

Public Comments:

Support
Another good section addition to the code.

Concerns

1) Washington Department of Fish and Wildlife should recognize in their proposed beaver dam management rule the difference in the beneficial ecological effects that beaver dams have in natural settings versus the adverse ecological effects that beaver dams can have in highly human developed watersheds and provide appropriate remedial action (to restore natural function) in [certain] situations.
2) Those removing beaver dams must provide professional determination of imminent threat to property or the environment.
3) The use of explosives to remove beaver dams must be prohibited due to concussive impacts to fish and other stream biota as well as turbidity and erosion to streambeds and banks.
4) Water leveling devices must be prohibited and used only in exceptional circumstances (large upstream wetland) and must allow fish passage without requiring engineering.

Draft Rule Language:

220-110-230 Beaver dam management

All projects must meet the mitigation requirements in WAC 220-110-080 and any requirements in WAC 220-110-100 through 220-110-440 that are included in an HPA. The department will require certain technical provisions depending upon the individual proposal and site-specific characteristics. Additional special provisions may be included to address site-specific conditions.

(1) DESCRIPTION

A person may need to remove, breach, or modify a beaver dam to prevent damage to private and public land or infrastructure from flooding. Beaver dams are normally

removed using hand tools or equipment such as backhoes.

Installing a water level (flow) control device may be a preferred alternative to removing breaching an established dam that has created or maintains a wetland. A person can install a water level control device to maintain a desirable beaver wetland. These devices are installed at the intended depth, extending upstream and downstream of the dam. This preserves the pond's habitat benefits.

Another alternative to dam removing or breaching beaver dams is installing a beaver exclusion device. These devices prevent beavers from building a dam at the mouth or inside of culverts that blocks water flow.

(2) FISH LIFE CONCERNS

Beavers play an important ecological role in creating and maintaining ponds and wetlands for fish and wildlife habitat. Ponds also provide surface water storage that improves summer flows, as well as improving water quality through retaining sediment. Breaching, notching, or removing a dam can negatively affect fish and their habitat by de-watering the upstream pond, stranding fish, and releasing sediment and large volumes of water (that can be devoid of oxygen) downstream. Releasing sediment can affect downstream spawning areas. Breaching or removing a beaver dam may not prevent future beaver activity in the area. Persistent breaching or removing a beaver dam can increase the risk of negative impacts to fish habitat. In these instances, the department may recommend that a person consider other beaver management techniques.

(3) REMOVAL OR BREACHING A BEAVER DAM

(a) Beaver dams should be removed or modified only when:

(i) The continued existence of the beaver dam poses an imminent threat to the integrity of water crossing structures or to private and public land or infrastructure;

(ii) The beaver dam has been in existence for less than one year. Older dams will be considered on a site-specific basis.

(b) The department will decide if compensatory mitigation is required to offset habitat loss caused by removing or breaching any beaver dam older than one year. The department will not require compensatory mitigation to remove beaver dams less than one year old.

(c) The department may allow the use of explosives to remove a beaver dam if the department determines that explosives have fewer impacts than other alternatives.

(d) Before starting work, install effective sediment and erosion control measures to prevent sediment from entering water of the state. Inspect the sediment and erosion control measures regularly during construction and make all needed repairs if any damage occurs.

(e) Minimize damage to vegetation along the stream. Replant disturbed areas and protect against erosion.

(f) Beaver dam management activities must take place when the work will cause the least impact to fish life. Except for an emergency or imminent danger, all work must occur in summer low flow periods when spawning or incubating fish are less likely to be present. Remove or notch beaver dams by hand or with hand-held tools and hand-operated or motorized winches. The department will authorize the use of heavy equipment if there are engineering, safety, or environmental constraints.

(g) Remove the dam gradually to allow the water to release slowly and prevent the downstream release of accumulated sediment at the bottom of the pond, or cause damage or erosion to the stream bed and banks. The notch must not extend below the height of the accumulated sediment.

(h) To prevent bank erosion and flooding of adjacent properties, the breach in the beaver dam must not be wider than the original stream channel.

(i) The department will specify the sequence in which to breach or remove a series of dams to avoid severe flooding and damage to fish habitat.

(j) Leave LWM imbedded in the stream bed or banks undisturbed.

(k) During and immediately after removal, monitor upstream and downstream for stranded fish in isolated pools. Capture and safely move all stranded or isolated fish to the nearest free-flowing water.

(4) WATER LEVEL CONTROL DEVICE INSTALLATION

(a) Design and install water level control devices so that during low flows (when beaver are more actively increasing dam height), the flow passes through the device.

(b) Design and install water level control devices so that during high flows (when fish are moving and beaver are less likely to be adding height to their dam), the device will convey enough flow over and around the dam to pass fish.

(c) Install water level control devices in beaver ponds with pool depth of four feet or more. If the water level control device is installed in water shallower than four feet, the design must have an enclosure to protect the water intake.

(d) Maintain the water level control device to ensure it functions as designed.

(5) BEAVER EXCLUSION DEVICES

(a) Design, install, and maintain guards, grates, grills, fences and other beaver exclusion devices to provide unimpeded fish passage and to prevent beavers from plugging a culvert.