

CHAPTER 3

POLICY

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3.1 Introduction

The purpose of this chapter is to:

- define the hydraulic responsibilities of the ODOT Geo-Environmental Section's Engineering and Assets Management Unit, the Bridge Preservation Unit, and Region Technical Centers,
- define responsibilities of the hydraulics engineer, hydraulics designer, and designer; and
- present general ODOT policies and practice for the hydraulic design of highways,
- present an overview of ODOT fish passage policy.

Policy is defined as a definite course of action that guides and determines present and future decisions. Design practice and criteria are developed to implement the specific policy. Policy, practice, and criteria that are specific to a particular topic are presented in the individual Chapters.

3.2 Core Hydraulic Responsibilities, ODOT Geo-Environmental Section's Engineering and Asset Management Unit

The Geo-Environmental Section's Engineering and Asset Management Unit, is responsible for developing and maintaining the ODOT Hydraulics Manual, standards of practices, standard drawings, and specifications in the Hydraulics discipline. Core functions of this unit include:

- develop and maintain ODOT hydraulic engineering standards, practice, and standard drawings,
- review and approve design software,
- provide leadership on technical committees,
- promote transfer of technology,
- provide training,
- assistance and advise department personnel and consultants involved in critical drainage related matters,
- perform quality assurance review of agency personnel and consultant design products,
- review hydraulic design service Request-for-Proposals (RFP's), Agreements-to-Agree (ATA's), and Work Order Contracts (WOC's),
- advise and assist department personnel and consultants with matters pertaining to local jurisdiction regulations,
- advise and assist the Department of Justice on legal matters pertaining to ODOT,
- maintain the hydraulics library and files, and
- provide technical advice on roadway drainage, storm drains, culverts, water quality treatment, retention, detention, control systems (gates, valves, and weirs), pump stations,

energy dissipators, fish passage, trenchless technology, and temporary water management.

3.3 Core Hydraulic Responsibilities, ODOT Bridge Standards & Practices Unit

The ODOT Bridge Section Standards & Practices Unit manages the bridge scour program and non-National Bridge Inventory large culvert program. The Unit has core functions for hydraulics and structural design, as follows:

- support ODOT hydraulic engineering standards, practice, and standard drawings,
- review and approve design software,
- provide leadership on technical committees,
- promote transfer of technology,
- provide training,
- assist and advise department personnel and consultants involved in critical drainage related matters,
- perform quality assurance review of agency personnel and consultant design products,
- review hydraulic design service RFP's, AGA's, and WOC's,
- advise and assist department personnel and consultants with matters pertaining to local jurisdiction regulations,
- advise and assist the Department of Justice on legal matters pertaining to ODOT,
- forward Oregon Division of State Lands Fill and Removal permit applications to Region staff for their review and comment,
- maintain the scour program files and a library of structural design references for hydraulic facilities, and
- provide technical advice on bridges, scour, revetment, large culverts, open-channel hydraulics, stream bank stabilization, and coastal erosion.

3.4 Core Hydraulic Responsibilities, ODOT Region Technical Centers

ODOT divides its highway operation into five geographical regions. Each region is responsible for developing, designing and managing the construction of highway projects. Each region's technical center's unit with a hydraulics engineer on staff is responsible for the design activities considered to be hydraulic engineering such as:

- design of all hydraulic features to be included on project plans, and
- design of all hydraulic features to be included on maintenance repair or other plans,
- certification to verify hydraulic structures replaced in kind meet current hydraulic design standards and are appropriate for the application,

- preparation of preliminary reports and recommendations (see Chapter 4),
- preparation of engineering material supporting permit applications (see Chapter 4), and
- services as an expert witness representing ODOT during litigation,
- project scoping and planning where detailed written recommendations are required for engineered hydraulic structures, and
- technical review of Environmental Impact Statements, Biological Assessments, and other environmental documents addressing engineered hydraulic structures.

3.5 Professional Engineer

Many aspects of ODOT hydraulics are the responsibility of a professional engineer (P.E.) registered in Oregon. These engineers are employed by ODOT, consultants and their employees working under contract to ODOT, or others. Professional engineering involvement is required by both agency policy and practice.

3.5.1 Policy

Final engineering documents such as plans, specifications, calculations, and reports, either within the agency or externally from the agency, shall be stamped by the registrant who prepared the design, or in the case of a non-registered person, by the registrant in technical supervision and control of the design. For more detailed information use the following web page link to access the ODOT Professional of Record Guidance: [Technical Guidance Web Page](#)

3.5.2 Practice

A licensed professional with sufficient expertise in hydraulic engineering should be in responsible charge of the following ODOT project design activities:

- hydraulics reports,
- stormwater reports,
- operation and maintenance manuals,
- culverts, medium and large (span, diameter, or equivalent diameter greater than 4 feet),
- structural design of culverts, pipe, and arches including headwalls and wingwalls,
- fish passage (culverts, waterway enhancement),
- bridge hydraulics including waterway openings, channel widths, scour depths, backwater and floodwater elevations,
- bridge deck drainage,
- floodplain hydraulics and documentation such as “no-rise” certifications and floodway revisions,
- large open channel designs (Q is greater than 50 cubic feet per second or grades steeper than 10 percent),
- in-stream channel modifications or restoration,

- outlet or grade control structures such as tide gates, weirs, etc.,
- stormwater control facility designs (excluding design of low impact development approaches),
- underground injection control facilities (drywells),
- storm drain system designs (diameter greater than 24 inches),
- structural scour and erosion protection designs,
- streambank stabilization (including bio-stabilization approaches),
- complex energy dissipators,
- coastal engineering,
- water budget analysis,
- pump stations,
- temporary water management designs, and
- trenchless technology designs

These project design activities are considered to be hydraulic engineering based on ODOT practice and they can be done under the seal of an engineer of another specialty. The engineer, however, must have sufficient expertise to either perform or oversee the work.

- Design of culverts 4 feet or less span, diameter, or equivalent diameter, with no fish passage issues.
- Design of small channels with design discharges equal to or less than 50 cubic feet per second on grades of 10 percent or less, with no fish passage issues.
- Stormwater treatment (Best Management Practices, only).
- Simple energy dissipators.

These activities do not require the seal of an engineer. The person doing the activity, however, must have sufficient expertise to do the work, or they must do it under the immediate supervision of someone who does.

- Support to ODOT maintenance for drainage problems and complaints where expert witness services or designs are not needed.
- Review of drainage designs submitted to ODOT Maintenance by private interests and others requesting to discharge runoff to ODOT drainage facilities.
- Project hydraulic scoping and planning where general comments are needed.
- Review and comment on Oregon Department of State Lands Fill and Removal permit applications.

3.6 General ODOT Policies

General ODOT policies that pertain to highway drainage are as follows,

1. Drainage facilities shall be designed to convey surface water through, along, or away from the highway by the most direct means consistent with economy, ease of maintenance, and the least disturbance of natural conditions without damaging the highway or adjacent property.
2. Safety of the general public is an important consideration in the hydraulic design of highways.
3. Hydraulic design shall be coordinated with other Federal, State, or local agencies concerned with water resources planning.
4. All drainage designs shall satisfy the precedent established by Oregon drainage law.
5. During the design phase the appropriate maintenance personnel shall be contacted to identify past maintenance problems and other maintenance concerns. The drainage facility shall be designed to accommodate the unique maintenance requirements of the site. The design of the drainage facility shall consider the frequency and type of maintenance expected, and to make allowance for access of maintenance equipment and personnel.
6. Any ODOT maintenance activities that may alter a stream or river's hydraulics shall be designed or reviewed by a professional engineer with expertise in hydraulics. Activities include but are not limited to bank stabilization projects; design of stream barbs or other flow deflectors; in-stream boulder and root wad placement; and retrofitting culverts for fish passage. A professional engineer, upon review of the in-stream work, may authorize maintenance or other ODOT personnel to complete the work without a sealed design.
7. Bank stabilization methods that provide an environmental benefit shall be considered and used when feasible to protect highway embankments and bridge abutments/approach fills. Biostabilization is not to be used as the sole method of protection in areas where loss of the unprotected highway is likely.
8. All hydraulic designs will strive to meet the letter, spirit, and intent of environmental laws and regulations. During the design process, coordination should occur between the designer and the appropriate State or Federal agencies to ensure that the proposed design satisfies the applicable environmental laws and regulations. If possible, the design should avoid the resource. If the resource cannot be avoided, the hydraulic design should

minimize the impact to the resource. Where the resource cannot be avoided, and where minimization harms the resource, then the design must incorporate mitigation measures to compensate for the harmful impacts.

9. Hydraulic Reports or memoranda should be prepared for all culverts larger than 4 feet in diameter, all bridges, channel changes on large streams, and other significant hydraulic structures such as energy dissipators and riverine or tidal control structures. Stormwater Reports should be prepared for all stormwater conveyance facilities larger than 24 inches in diameter. Stormwater Reports and Operation and Maintenance Manuals should be prepared for all stormwater treatment and/or storage facilities, pump facilities, and control structures. The detail of the studies, reports, and memoranda should be commensurate with the risk associated with the drainage facility and with other economic, engineering, social, or environmental concerns. A registered professional engineer shall stamp all hydraulic or stormwater reports or memoranda.

3.7 Design Recurrence Interval

Recurrence intervals are a means of placing a statistical value on **rainfall** events. A recurrence interval (RI) of 50 years means that an **event** of that magnitude would, over a long period of record, occur on an average of once in 50 years. It is not correct to say that a 50-year **event** will occur at 50-year intervals since such an **event** could occur twice in one year although the statistical chance of this happening is low. **Rainfall events** can also be expressed in terms of the exceedance probability that the **event** will be equaled or exceeded during any year. The exceedance probability, expressed in percent, equals $100 / \text{RI}$. For example, there is a 2 percent chance that a 50-year **event** will be equaled or exceeded in any year.

Design Recurrence Intervals are listed in Table 3-1. The design **event** should not inundate the travel lane. There may be situations where the standard design **event** is not appropriate for the site.

Table 3-1 Design Recurrence Interval (Years)

Drainage Facility	Freeways	Highways Other Than Freeways	
		ADT ¹ less than 750	ADT ¹ greater than or equal to 750
Bridge Openings ^{2,4}	50	25	50
Bridge Scour	See Chapter 10	See Chapter 10	See Chapter 10
Bank Protection	50	25	50
Culverts ^{2,4}	50	25	50
Ditches, Inlets and Gutters	10	10	10
Depressed Roadways	50	25	50
Energy Dissipators ³	50	25	50
Storage Facilities	See Chapter 12	See Chapter 12	See Chapter 12
Water Quality Facilities	See Chapter 14	See Chapter 14	See Chapter 14
Storm Drains	10	10	10
Storm Drain Outfalls from Sags	50	25	50
Temporary Drainage Facilities ⁵	See Section 3.10	See Section 3.10	See Section 3.10
Channel Changes ^{2,4}	50	25	50

Table 3-1, Cont. Design Recurrence Interval (Years)

Notes

¹Average daily traffic (ADT). Part 1 of the project prospectus will give the existing and proposed ADT. The proposed ADT should be used to determine the design **event**.

²Designs should be analyzed for the base flood. This is done to assess the potential effects of inundation from floods that exceed the design **event**. Designs should be checked for either the 500-year flood if more frequent than the incipient roadway overtopping **event**, or the incipient roadway overtopping **event** if more frequent than the 500-year flood. The check is done to assess the potential scour and other damage to the installation from floods that exceed the design **event**.

³The design should be checked for a range of discharges from the 2-year through the 500-year **event** to ensure that the dissipator will perform as intended.

⁴A 100-year design flood recurrence interval is used for facilities in floodplains subject to federal National Flood Insurance Program regulations and facilities on U.S. Department of Agriculture Forest Service land. The 100-year flood is also known as the base flood.

⁵Temporary drainage facilities used for erosion control use design and check discharges as per ODOT erosion control policies, guidelines, and criteria.

The following risk factors should be considered when justifying a non-standard design event.

1. The impacts associated with interrupting traffic caused by flooding of the highway. The situation may be evaluated by considering the average daily traffic volume (ADT); the traffic delay incurred; the overall importance of the route, including the provision of emergency supply and rescue; and the availability of alternate routes. The importance of the route to national defense and to the economic well being of a community should play a large role in evaluating the risk of traffic interruptions.
2. The potential for the loss of life. Factors to be considered in potential loss of life situations should include the duration, depth, and velocity of hazardous floodwaters, the dependability of adequate warning systems, sight distances, potential for loss of structure or road washout, and the availability of detours.
3. The potential for property damage whether it is public or private. Flood damage includes eroded highway embankments, loss of highway structures, and damage to adjacent property.

3.8 Fish Passage

State agencies including ODOT have been directed by the Governor to operate within the provisions of the Oregon Plan for Salmon and Watersheds. The Oregon Plan represents an unprecedented undertaking on the part of the State of Oregon to restore salmon and trout resources. ODOT's goal is to help restore populations and fisheries to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits by removing all fish passage barriers caused by ODOT structures.

The Oregon Transportation Commission authorized the ODOT Fish Passage program in 1997. Barriers to fish passage for salmonids and other species of interest will be removed from the state highway system as funding permits. The current funding level is \$3,000,000 per year to replace structures on ODOT right of way that are a barrier to fish passage.

The main regulatory agencies for fish passage are the Oregon Division of State lands (DSL) and the US Army Corps of Engineers (USACE). The principal resource agencies that provide biological opinions and other environmental data to the regulatory agencies are the Oregon Department of Fish and Wildlife (ODFW) and the National Oceanic Atmospheric Administration (NOAA). ODOT has been working with these regulators as well as US Fish and Wildlife who regulates other non migratory species.

An impasse site is a location on a stream where fish cannot pass due to a full or partial blockage

from an ODOT structure. Each site is classified as high, medium or low priority for replacement/improvement. ODOT has committed to repair all of the high priority sites first and then work through the medium and low priorities.

There are basically two options for addressing impasse sites. One is to replace the structure, and the other is to retrofit the existing structure. Replacement involves removing the impasse and replacing it with a structure such as a bridge or very large culverts that fully spans the stream channel and is not a barrier to fish passage. Replacement is done on many sites.

The cost of replacing all impasse culverts with bridges is in excess of the available and projected funding levels. An alternative to replacement is retrofitting. Retrofitting is temporarily providing passage at a site by enhancing or modifying the existing structure. The advantage of retrofits is the lower cost, the ability to give improved passage capability to more sites and thus, expand the number of stream miles that the fish can access. The disadvantages of retrofits are that the passage improvements are typically not as good as full replacements. The ODFW considers retrofits to be a temporary solution, and the retrofits should be identified, monitored, and scheduled for future replacement.

3.9 Temporary Construction Within a FEMA Floodway

Roadway detour structures are often used in highway construction when bridges or culverts are repaired or replaced. Temporary structures such as falsework, cofferdams, and workbridges are used when bridges are repaired or replaced. Often these temporary installations are in a regulatory floodway defined in the National Flood Insurance Program (NFIP) as administered by the Federal Emergency Management Agency (FEMA).

ODOT general policy is to satisfy regulations such as those of the NFIP, and FEMA has a policy interpretation about temporary construction within an NFIP regulatory floodways. These requirements have been provided by the FEMA regional office to ODOT in written correspondence about a past project. Excerpts from this correspondence follow.

Temporary construction practices are defined as "... anything necessary during the construction phase to build the final structure and will definitely be removed; and, the only reasonable course of action on the part of the local government would be to permit only the final structure design regardless of the shape or timing of the temporary construction practice. It is assumed that the constructing agency would make preliminary calculations on the effects of the practice to assure no significant water level increases. It is also assumed that the constructing agency would assume liability for any flooding its temporary practices would cause. As a final policy note, all practicable efforts must be spent to design the construction phase so that the temporary practices and temporary crossings are not in place during the flood season (November 1 – May 31)."

Temporary crossings, as pertaining to FEMA permit policy, are defined as follows. “Temporary crossings can be defined as temporary construction practices so the above interpretation could also apply. The real difference here, however, is that, based on economics, and the political atmosphere that can be created based on the benefits of having two crossings where there was previously one crossing, the temporary crossing can likely become permanent.

Therefore, the course of action of permitting only the final structure also applies for temporary crossings with the following caveat: twelve months after the initial placement of the temporary crossing, the constructing agency must reevaluate the status of the crossing and if the temporary crossing will remain in place for an additional 12 months or more, the constructing agency will apply to FEMA for a Conditional Letter of Map Revision according to 60.3(d)4 and 65.12 of the National Flood Insurance regulations (44 CFR) within 30 days.”

3.10 Design and Check Recurrence Intervals and Exceedance Discharges for Temporary Installations

Temporary structures such as roadway detour bridges, falsework, cofferdams, and workbridges are used when bridges or culverts are repaired or replaced. Temporary water management also uses structures and operating features such as dams, pumps, pipes, ditches, etc. Discharge estimates are needed to design these installations and to assure they resist flood damage. ODOT does not have a policy listing design and check discharge recurrence intervals for these temporary installations. The following guidance is provided.

Considerable judgment is used when selecting design and check discharges for temporary facilities. A significant consideration is the damage that would occur if the facility was lost or damaged. An additional consideration is the accuracy of the check and design discharge predictions. These discharge estimates are often based on flows from nearby gaged watersheds during average conditions. Discharges may be significantly higher or lower in the subject watershed due to local watershed characteristics and variations in year-to-year climatic conditions.

Temporary Installations In Place During the Flood Season – The 5-year **event** is the typical design flow for installations in place through the flood season. Ten or 25-year discharges are often used as check flows. A larger design or check **event** may be warranted for an installation where there will be significant damage or adverse environmental impacts if a larger flood occurs while it is in place. The 5, 10, and 25-year flows can be determined by the hydrologic methods in Chapter 7.

The 100-year base flood discharge is often used as a design or check discharge for temporary structures within regulatory floodways during the flood season, such as detour structures and falsework providing critical support to structures.

Temporary Installations In Place Outside of the Flood Season - The design and check flows for these installations are based on either maximum predicted discharges based on station records and envelope curves, or mean daily exceedance discharges, for the months they will be in place. Usually these facilities are designed to be in place during the Oregon Department of Fish and Wildlife in-water work period.

Maximum predicted discharge estimates based on station records and envelope curves require hydraulic data that is not widely available. These estimates are done by hydraulics designers or others having access to this data. The procedures for calculating these discharges, as well as the exceedance discharges, are described in Chapter 7.

The design and check discharges for temporary installations are based on how critical it is that the facility convey the discharges or resist hydraulic damage, as follows.

- **Highly Critical Temporary Installations** – Check flow is the maximum predicted discharge based on station records and an envelope curve. Design discharge is the 5 percent mean daily exceedance discharge.
- **Moderately Critical Temporary Installations** – Check flood discharge is the 5 percent mean daily exceedance discharge, and the design discharge is the 25 percent mean daily exceedance discharge.
- **Less Critical Temporary Installations** – Check flood discharge is the 25 percent mean daily exceedance discharge, and the design discharge is the 50 percent mean daily exceedance discharge.

3.11 Cooperative Agreements

Cooperative hydraulic projects between ODOT and local agencies may include, but are not limited to:

- storm drains,
- flood control and/or flood protection, and
- water quality treatment.

These cooperative projects may be justified where both a mutual economic benefit and a demonstrated need exist. Early coordination with the government entity involved is necessary to determine the project scope. Each cooperative project may be initiated by a resolution adopted by the local agency governing body either (1) requesting the improvements and/or indicating its willingness to share the cost of a state project, or, (2) indicating the local agency's intent to make certain improvements and requesting state cost participation in the local agency project.

Participation in cooperative projects must be approved by the Chief Engineer with the extent of ODOT participation being restricted to the amount of benefit accruing to ODOT. No commitments should be made prior to approval by the Chief Engineer and the amount of participation shall be documented by a formal agreement. Actual work performed by ODOT under such agreements shall be limited to ODOT right-of-way or easements unless otherwise approved by the Chief Engineer.

3.12 Hydraulics Design Deviations

A hydraulic design deviation is a request to obtain a deviation from a design requirement(s) stipulated in the current version of the ODOT Hydraulics Manual. It also allows for introducing innovative designs or methods that may differ substantially from those discussed in the ODOT Hydraulics Manual.

A few possible design requirements that would require deviation approval include but are not limited to:

- Reducing documentation requirements
- Replacement “in-kind” (replace without calculations)
- Reducing design storm
- Reducing barrel material design life
- Exceed culvert allowable headwater
- Use or removal of a tidegate
- Reduce bridge opening clearance
- Eliminate or reduce scour protection, or
- Exceed water spread on pavement

3.12.1 Hydraulics Design Deviation Process

The submittal and concurrence process for hydraulic design deviations is presented below:

Step 1 - Project teams determine justification for design deviations(s) at scoping, prospectus, design phases, or planning process

Step 2 - Project Team Leader or Consultant Project Manager coordinates with Project Hydraulic or Roadway Designer to prepare Hydraulics Design Deviation Request form with supporting justification such as:

- an explanation of the issues,

- a brief description of the project,
- detailed location (bridge number, highway number, and milepost),
- a justification for the deviation, and
- supporting documentation.

Hydraulics design deviation approvals must be obtained as early as possible and prior to the design acceptance package (DAP).

Use the following link to access the Hydraulics Design Deviation Request form. The form is an Adobe Acrobat fillable form. Open the form and Save a copy. Fill in all the fields and then print:

[Hydraulics Design Deviation Request Form](#)

- Step 3 -** Submit completed Hydraulics Design Deviation Request forms prepared by individuals outside of the agency to the Region Hydraulics Engineer for review and concurrence
- Step 4 -** Region Hydraulics Engineer submits recommendations to Technical Services Geo-Environmental and/or Bridge Section Senior Hydraulics Engineer(s) [as appropriate] for final review. Hydraulics engineering staff in Technical Services will conduct the review and provide concurrence, suggested revisions, or deny the design deviation request. *NOTE: Design deviations formally obtained in writing during the Planning, Environmental or Survey phase need not be requested again.*
- Step 5 -** State Bridge Engineer or Geo-Environmental Section Manager provides approval of deviations receiving Region and Technical Services concurrence.