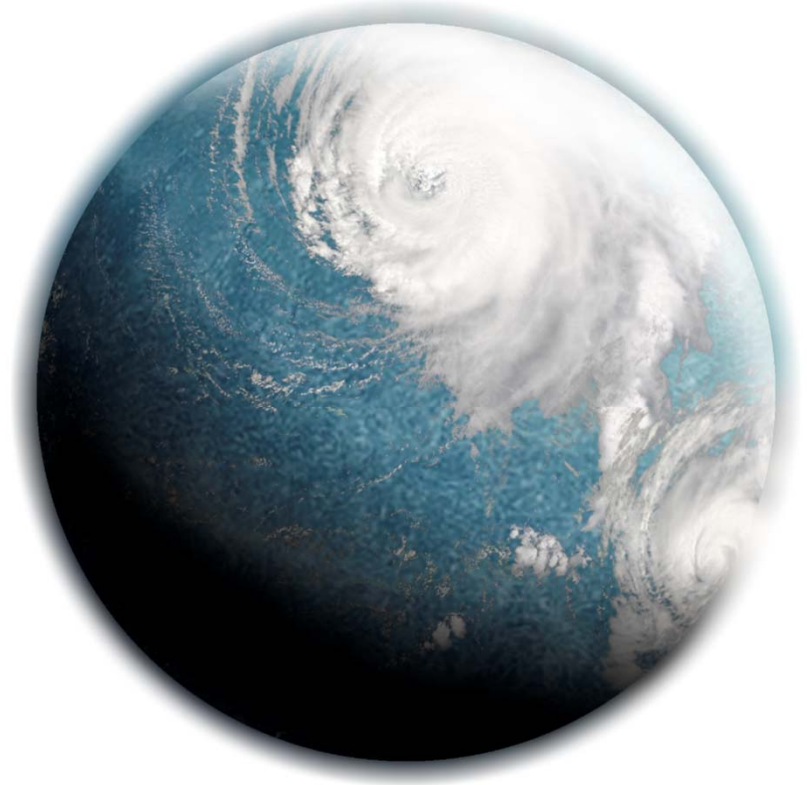
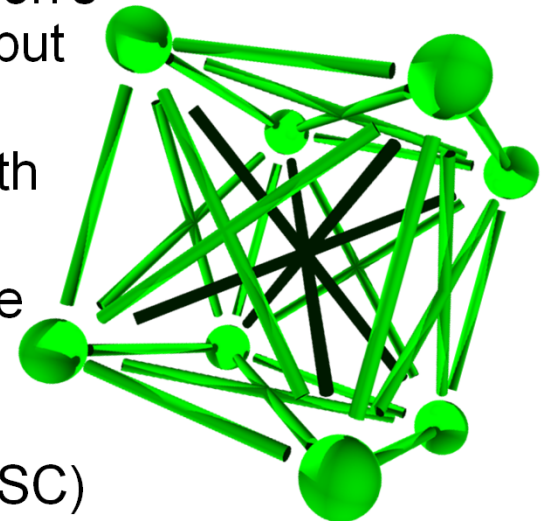


# Lesson 1: Hydraulics Manual Policies (**HM Chapter 1**)



# Hydraulics Manual Policies

- Hydraulic Design Policy
  - Design drainage facility to convey water across, along, or away from the highway in the most economical, efficient, and safe manner without damaging the highway or adjacent property.
  - Generally based on Federal Highway Administration's (FHWA) Hydraulic Engineering Circulars (HECs) but tailored for WSDOT
  - Hydraulics Manual (HM) is used in conjunction with the:
    - Highway Runoff Manual (HRM) when there are stormwater designs and stormwater Best Management Practices (BMPs)
    - Temporary Erosion and Sediment Control (TESC) Manual for construction related BMP design
    - Design Manual (some ditch design criteria in the DM)
    - Developer Services Manual
    - Local Agency Guidelines



# Hydraulics Manual Policies

- Responsibilities - Project Engineer's Office (PEO)
  - Preparation and approval of hydraulic reports and PS&E
  - Hydraulic design of drainage structures and facilities (culverts, storm drains, pipe networks, roadway ditches, stormwater BMPs, channel changes, head walls and wing walls, etc.)
  - Design of stream bank erosion along roadways and river migration and the design of stabilization counter measures and environmental mitigation.
  - Design of large woody debris (LWD) for stream enhancement.
  - Initiating coordination for Specialty Reports (See HM Figure 1-3)



# Hydraulics Manual Policies

- Responsibilities – Region Hydraulics Engineer
  - Concurrence of hydraulic reports making sure they follow the policies and guidelines in the HM and HRM
  - Direct Support PEO to fulfill their responsibilities including mentoring and coaching PEO staff
  - Coordinate HM and HRM deviations with the HQ Hydraulics Section



# Hydraulics Manual Policies

- Responsibilities – HQ Hydraulics Section
  - Ensuring that the information in the HM and HRM is accurate and current
  - Hydraulic analysis of bridges, including hydraulic conveyance, floodplain impacts, deck drainage, and foundation scour, engineered Log Jams (ELJ), and Large Woody Material (LWM)
  - River hydraulic and backwater analysis
  - Hydraulic design of all large span corrugated metal and concrete culverts (greater than 48” in diameter), pumping facilities
  - Design of water supply and sewage disposal systems for safety rest areas. Providing Concurrence for Type A hydraulic reports, unless otherwise delegated to the Region Hydraulics Engineer



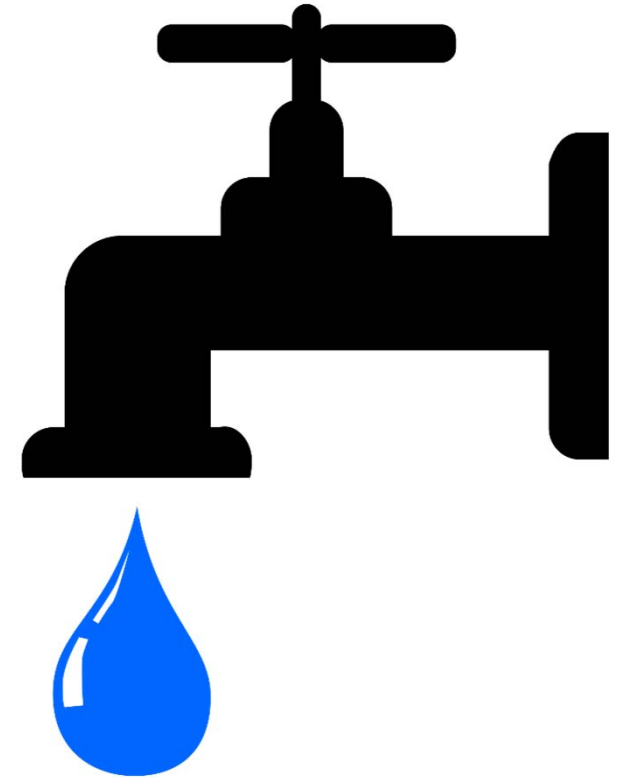
# Hydraulics Manual Policies

- Responsibilities – HQ Hydraulics Section (cont.)
  - Providing the regions with technical assistance on hydraulic issues that are the primary responsibility of the region
  - Audit Region Hydraulics program
  - Providing training on Hydraulics, Hydrology, and Stormwater designs
  - Maintaining WSDOT *Standard Plans and the Standard Specifications and General Special Provisions* (GSPs) involving drainage related items



# Hydraulics Manual Policies

- Hydraulic Reports
  - A complete documented record containing engineering justification for all drainage design including stormwater design, hydraulic design
  - Hydraulic Report Types A, B, and Hydraulic Summaries are described in Figure 1-3
  - For Design-Bid-Build
    - The PEO approves the Hydraulic Report
    - The Region Hydraulics Engineer provides concurrence on the Hydraulic Report



# Hydraulics Manual Policies

- For Design-Build
  - the Region Hydraulics Engineer (or Delegate) is involved in developing the Request for Proposal (RFP). The Region Hydraulics Engineer (or Delegate) shall have rejection authority as per the RFP of both conceptual and final design.
- Olympic, Southwest, and Northwest Regions currently delegated concurrence authority to HQ Hydraulics
- We will discuss Hydraulic Reports in more detail tomorrow

**UNDER CONSTRUCTION**  
CONTENT WILL BE AVAILABLE SOON



# Hydraulics Manual Policies

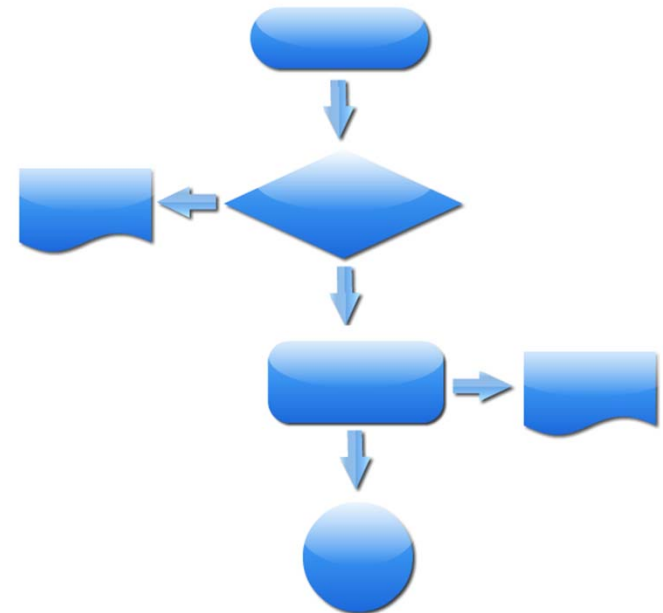
- Specialty Reports
  - Culverts greater than 48 inches in diameter
  - Bridge
  - Fish Passage
  - Bank Protection
  - River structures (e.g. barbs, ELJ, levees)
  - Channel realignment/modifications
  - Any fills in floodplain or floodway
  - Pump stations
- PEO needs to contact HQ Hydraulics Section for Specialty Report Requests

<http://www.wsdot.wa.gov/Design/Hydraulics>

# Hydraulics Manual Policies

- General Hydraulic Design Schedule
  - See Process Flow Diagram Figure 1-5
    - From Scoping to Ad Date
  - See Hydraulic Report Review Schedule Figure 1-6
  - See Hydraulic Report Checklist

<http://www.wsdot.wa.gov/Design/Hydraulics>



%	Milestone	Project Alignment	Estimated Task Durations <sup>1</sup>	Date of Completion
0%	Define project	Project definition complete MDL #320	TBD	
10%	Develop approved schedule		TBD	
25%	Design planning checklist complete	Design approved MDL #1685	TBD	
40%	Conceptual design complete	Complete prior to starting design	TBD	
70%	Design complete		TBD Once design is completed, allow four weeks for region review and comment.	
90%	Draft hydraulic report submitted for approval		Estimate six weeks for PEO to write and compile report contents. Once report is completed, allow eight weeks for region review, comments, and resolution of comments by PEO.	
95%	Region review completed, hydraulic report submitted to HQ Hydraulic for review	Complete prior to PS&E approval	Once submitted to HQ hydraulics, allow four weeks for review, comment, and resolution of comments by PEO.	
	Revisions and supplements	Complete prior to hydraulic report archive	TBD	
100%	Hydraulic report archived	Complete prior to project design approval	TBD	

<sup>1</sup>Allow additional time for projects submitted around major holidays.

### Hydraulic Report Review Schedule

Figure 1-6

# Hydraulics Manual Policies

- General Hydraulic Design Frequencies for Structures
  - See Figure 1-4
  - Shows Design Frequency and recommended design tools or software to use for analysis

<http://www.wsdot.wa.gov/Design/Hydraulics>

Type of Structure	MRI (Years) <sup>1</sup>	Hydrology Method	Recommended Design Tools and Software <sup>4</sup>
Gutters	10	Rational	Inlet Spreadsheet
Storm Drain Inlets <ul style="list-style-type: none"> <li>• On longitudinal slope</li> <li>• Vertical curve sag</li> </ul>	10 50	Rational Rational	Inlet Spreadsheet Sag Spreadsheet
Storm Drains <ul style="list-style-type: none"> <li>• Laterals</li> <li>• Trunk lines</li> </ul>	25 25	SBUH/SCS	StormShed or Storm Drain Spreadsheet <sup>5</sup>
Ditches <sup>2</sup>	10	SBUH/SCS	StormShed
Standard Culverts <ul style="list-style-type: none"> <li>• Design for HW/D ratio<sup>3</sup></li> <li>• Check for high flow damage</li> </ul>	25 100	Published flow records, Flood reports (FIS), USGS Regression, or Rational Method	HY-8 or HEC-RAS
Bottomless Culverts <ul style="list-style-type: none"> <li>• Design for HW depth<sup>3</sup></li> </ul>	100	Same as standard culverts (except rational method)	HY-8 or HEC-RAS
Bridges <ul style="list-style-type: none"> <li>• Design for flow passage and foundation scour</li> <li>• Check for high flow damage</li> </ul>	100 500	Same as standard culverts (except rational method)	HEC-RAS (1D) or FESWMS (2D)
Stormwater Best Management Practices (BMPs)		See HRM	MGSFlood WWA StormShed EWA

<sup>1</sup>See Appendix 4C of HRM for further guidance on selecting design storms.

<sup>2</sup>More design guidance for roadside ditches can be found in the HRM.

<sup>3</sup>For temporary culvert design see Section 3-3.1.1.

<sup>4</sup>If a different method or software is selected other than the WSDOT method should be explained and approved at the project level. The link contains a detailed description of all current programs and software used for hydraulic design.

<sup>5</sup>Must obtain prior approval from Region Hydraulic Engineer.

**HOW WE DESIGN THESE = LESSON 2 AND LESSON 3**

Design Frequency for Hydraulic Structures  
Figure 1-4