

Type A and Type B Hydraulic Report Outline (For Design-Bid-Build and Design-Build Submittals)

Title Page

Title Page – The title page should have the following items:

Title page checklist:

- Project Name
- Work order number
- Program item number (PIN)
- State route (SR) and milepost
- WSDOT Region, Mega Program, or HQ Program that is delivering the project
- Type of report (A, B, or Simplified Type A)
- Report version – Conceptual, Preliminary, Intermediate, or Final
- Date completed
- Designer names and HRM Training Certificate Number
- Project engineer's professional engineer stamp, signature, and date
- Regional Administrator

Table of Content – The Table of Contents should have the following items.

Table of contents checklist:

- All sections of the hydraulic report and Appendices content should be listed in the Table of Contents
- Number all pages of the main body of the hydraulic report including maps, figures, and tables
 - The title page, table of contents, and appendices do not need numbering
- When creating the electronic file, add bookmarks for the start of each section listed in the table of contents, including each of the appendices

1.0 Project Overview

- 1.1. General Project Description – Provide a general project description that includes the following items.

Project Overview Checklist:

- Describe the purpose of the project
- Describe the work activities on the project
- Indicate if this project will be delivered using Design-Build or Design-Bid-Build contracting methodology

- 1.2. Bundled Projects Discussion – If the project is bundled with other projects, provide the following items.

Bundled Projects Checklist:

- Describe how many projects are in the bundle and why were they bundled together
- Describe how each project in the bundle was permitted; each project should have its own hydraulic report unless approved by Region Hydraulics

- 1.3. Corridor Projects Discussion – If the project is part of a group of corridor projects, provide the following items.

Corridor Projects Checklist:

- Describe how many phases or stages are in the corridor project and describe where this project is with respect to those other projects
- Describe any ties to previous projects or future projects; details of any ties should be further described in Section 3.4 Other Requirements

- 1.4. Project Type and Funding

Project Type and Funding Checklist:

- For projects that drain to Puget Sound, describe the type of project funding (federal, state, or local agency)
- For projects that drain to Puget Sound, determine if the project is a WSDOT “initiated” project; contact your RHE for additional guidance on this section
- Determine and describe if this is a local agency project or a private developer project developing on WSDOT ROW; contact your RHE for additional guidance on this section

- 1.5. Vicinity Map – Provide the following information.

Vicinity Map Checklist:

- Show and label the Project location
- Show and label any major landmarks
- Show and label streets
- Show and label water bodies
- Show and label a North arrow
- Show and label the state route(s) and mile post limits

- Show and label the nearest city

1.6. Stormwater and Hydraulic Scope of Work

Stormwater and Hydraulic Scope of Work checklist:

- Describe the stormwater and hydraulic work on the proposed on the project
- Describe the type of hydraulic features being installed, modified, removed or replaced on the project
- Add a BMP summary table showing the BMP type (existing and proposed), TDA location, and which stormwater requirement it satisfies. A BMP could satisfy multiple stormwater requirements (HRM, ESA programmatic, etc.)

1.7. Specialty Reports - See HM Table 1-1 for a list of specialty report types. The specialty report is a separate document from the hydraulic report.

Specialty Report Checklist (if hydraulic specialty design is done on the project)

- List and discuss each Specialty Report; include the following
 - Who provided the design
 - Describe the nature of the work
 - Provide the title of the Specialty Report

2. Site Assessment

2.1. Provide a list of resources used for the site assessment.

Site Assessment Checklist:

- List the resources used for the site assessment; some examples include:
 - Maps
 - Site visits
 - Hydraulic Reports
 - As-builts using WSDOT's Enterprise Content Management (ECM)
 - Existing WSDOT base map files
 - WSDOT Stormwater Discharge Point Inventory data
 - WSDOT Online Map Center for Traffic, Roadway Classification, and other useful information
 - Basin and water quality data from Washington State Department of Ecology (Ecology)
 - Water supply well information from the Washington State Department of Health (DOH)
 - Wetland Inventory Information from the US Fish & Wildlife Service (USFWS) Wetlands Mapper
 - Information from the WSDOT Environmental Office

2.2. Existing Project Site Conditions

Existing Project Site Conditions Checklist:

- Describe the existing site conditions along highways within the project limits. This may include things like:
 - posted speed,
 - highway classification
 - AADT per the [state highway log](#)
 - land use
 - sag locations
 - roadway slopes
 - curbed roadway sections
 - embankment slopes
- List any [City Streets as a part of a State Highway](#) within the project limits
 - If any part of the project is within a City Street as a part of a State Highway, list the limits of highway that are managed access and list those parts that are limited access
 - Use the [WSDSOT Access Control map app](#)
- List any sites where potential stormwater BMPs will be installed that may also contain suspected contaminated soils
- Identify potential sources of water within the project limits and describe how water is conveyed across the site; some sources of water include:
 - Roadway runoff
 - Waterbodies (streams, creeks, unnamed tributaries, lakes, rivers, bays, ocean)
 - Sheet flow from offsite areas
 - Pipes discharging to WSDOT right of way (ROW)
 - Drainage ditches discharging to WSDOT ROW
 - Irrigation channels
 - Wetlands
 - Wells
 - Groundwater (including seeps into a ditch, roadside area, or stream channel)
 - Floodplains
 - Backwater conditions
 - Describe if any existing sources of water will affect proposed hydraulic and stormwater design

2.3. Existing Waterbodies

Existing Waterbodies Checklist:

- List and describe existing waterbodies within the project limits and up to a quarter mile beyond the project limits
- Note which water bodies eventually receive project runoff

- Note if waterbodies are tidally influenced

2.4. Existing Critical Areas

Existing Critical Areas Checklist:

- List and describe existing wetlands, along with their class and type (estuarine vs. pothole), that are within the project limits
- List steep slopes and erosion hazard areas within and adjacent to the project limits

2.5. Existing Stream Crossings

Existing Stream Crossings Checklist:

- List and describe the existing stream crossings within the project limits
- Note if each stream crossing is fish passable
- Describe if each stream crossing will be addressed by the project
- Note if a Specialty Report is needed or has been created for the project

2.6. Existing Flood Plains

Existing Flood Plains Checklist:

- List and describe existing flood plains within the project limits.
- Note if a Conditional Letter of Map Revision (CLOMR) or Letter of Map Revision (LOMR) is needed for the project.

- 2.7. Existing Utilities – If existing utilities could conflict with or otherwise influence the stormwater or hydraulic design, include information on the conflict in this subsection. Note utility conflicts that have been investigated and either are or are not an issue as a result of that investigation. If there is a conflict, note how it will be resolved.

Existing Utilities Checklist:

- Identify utility conflicts within the project limits
- Is each utility conflict determined to not be an issue or have a stated solution?
- Show utilities on the drainage plan sheets in Appendix A-4

- 2.8. Hydraulic Discharge Point Inventory – All existing and new stormwater discharge points within the project limits should be identified by using the [WSDOT Stormwater Features Inventory Map](#). If the PEO changes any of these existing discharge points, they need to be listed in the [Hydraulic Discharge Point Inventory Form spreadsheet](#).

Hydraulic Discharge Point Inventory Checklist:

- Read the [Hydraulic Discharge Point Inventory Instructions](#)
- Fill out the Hydraulic Discharge Point Inventory Form spreadsheet and place it in Appendix A-2
- Send the completed Hydraulic Discharge Point Inventory Form spreadsheet to Cory.Simon@wsdot.wa.gov
- Additional information on the Hydraulic Discharge Point Inventory can be found at the link below.
<https://wsdot.wa.gov/engineering-standards/environmental-guidance/stormwater-water-quality>

2.9. Existing Connections to WSDOT's ROW

Existing Connections to WSDOT ROW Checklist:

- List the location of each constructed connection (pipe, ditch, outfall, etc.) that sends stormwater to WSDOT's ROW.
- List the stormwater connection utility permit connection (SCUP) number. If the connection does not have a SCUP number, the PEO needs to work with Region Utilities and RHE to get the connection a SCUP number
- Describe the source of water flowing to each constructed connection to WSDOT ROW and estimate the area and flow to WSDOT ROW
- Provide a table showing details like size, material, age, and condition
- Based on discussion with the local maintenance office and RHE or SHO, discuss if there are any operational problems with any of the existing stormwater connections

2.10. Existing Hydraulic Features – WSDOT's stormwater drainage system has hydraulic features that are inventoried in WSDOT's Stormwater Features Inventory Database (SFID), Highway Activity Tracking System (HATS), and Stormwater BMP Specifications (SWABS) applications. These include things like culverts, storm sewers, underdrain pipes, drain pipes, catch basins, manholes, grate inlets, bridge drains, ditches, stormwater BMPs, energy dissipaters, flow splitters, flow spreaders, and bridges. Hydraulic features should have WSDOT feature numbers as a part of asset management. If an existing hydraulic feature is discovered within the project limits but does not have a WSDOT feature number, contact the Region Hydraulics Engineer (RHE) to start the process to obtain a WSDOT feature number. Review the maintenance records of each WSDOT hydraulic feature to determine any drainage related issues beyond routine maintenance and discuss any potential solutions with the local maintenance office and document if it will be included in the project or if the solutions are outside of the project's scope.

Existing Hydraulic Features Checklist:

- Describe how existing hydraulic features operate in the existing condition; see the individual subsections for each hydraulic feature type below
- Generally describe how project improvements could impact existing hydraulic features and their operation and describe how they will function once project construction activities have been completed; project improvement include new or modified stormwater BMPs and conveyance systems
- Generally discuss which existing hydraulic features need to be replaced and which can remain as-is along with a justification documenting why. Use photographs, videos, and drawings to support the narrative
- Determine if all existing hydraulic features within the project limits have a WSDOT feature number using the SFID and ArcGIS
- The PEO should have a discussion with the local maintenance office about talk about potential maintenance issues with existing hydraulic features outside of routine maintenance and add any recommendations in the hydraulic report

2.10.1. Existing Culverts, Storm Sewer, Underdrain Pipe, and Drain Pipe

Existing Culverts, Storm Sewer, Underdrain Pipe, and Drain Pipe Checklist:

- List all existing culverts, storm sewer, underdrain pipe, and drain pipe within the project limits and describe the source of water flowing through each
- Provide a table showing culvert, storm sewer, underdrain pipe, and drain pipe location, size, length, material, age, driveway or highway crossing culvert, and condition
- Based on discussions with the local maintenance office and RHE or SHO, does the culvert, storm sewer, underdrain pipe, and drain pipe need to be repaired, replaced, or can remain as-is?

2.10.2. Existing Catch Basins, Manholes, Grate Inlets and Bridge Drains

Existing Catch Basins, Manholes, Grate Inlets and Bridge Drains Checklist:

- Describe all catch basins, manholes, grate inlets, and bridge drains within the project limits and describe which storm sewer or culvert is connected to each and list the source of water flowing through each
- Provide a table showing all catch basins, manholes, grate inlets, and bridge drains showing location, pipe size, length, material, age, and condition
- Based on discussions with the local maintenance office and RHE or SHO, list which catch basins, manholes, grate inlets, and bridge drains need to be repaired, replaced, or can remain as-is?

2.10.3. Existing Grates, Curb Openings, and Scuppers – Though grates, curb opening, and scuppers are not formally hydraulic features in the SFID, these hydraulically designed items should be examined and discussed in the hydraulic report.

Existing Grates, Curb Openings, and Scuppers Checklist:

- Describe all grates, curb openings, and scuppers within the project limits and describe the source of water flowing through each
- Provide a table showing their location, grate type, curb opening length, scupper dimensions, and condition
- Based on discussions with the local maintenance office and RHE or SHO, are there any operational problems with any grates, curb openings, or scuppers? If so, can the project help design a fix?

2.10.4. Existing Ditches

Existing Ditches Checklist:

- Describe all existing ditches within the project limits and describe the source of water flowing through each ditch
- Provide a table showing ditch locations, shape, depth, length, lining, age, condition, and last time ditch was cleaned out
- Analyze ditches for compliance with current manual standards (freeboard, critical depth, etc.)

- Based on discussions with the local maintenance office and RHE or SHO, are there any operational problems with any existing ditch? If so, can the project help design a fix?

2.10.5. Existing Stormwater BMPs

Existing Stormwater BMP Checklist:

- List hydraulics reports within your project limits documenting the existing stormwater BMPs. Refer to the ECM or ECM.
- Describe all existing stormwater BMPs within the project limits and describe the source of water flowing to each and where water discharges after flowing through the BMP
- Provide a table showing stormwater BMP location, type, size, age, and condition
- Based on discussions with the local maintenance office and RHE or SHO, does the stormwater BMP need to be repaired, replaced, or can remain as-is?

2.10.6. Existing Energy Dissipaters, Flow Splitters, and Flow Spreaders

Existing Energy Dissipaters, Flow Splitters, and Flow Spreaders Checklist:

- Describe all existing energy dissipaters, flow splitters, and flow spreaders within the project limits and describe the source of water flowing to each
- Provide a table showing details like size, material, age, and condition of each
- Based on discussions with the local maintenance office and RHE, or SHO, discuss if there are any operational problems with any of the energy dissipaters, flow splitters, and flow spreaders within the project limits

2.10.7. Existing Bridges

Existing Bridge Checklist:

- Describe all existing bridges (span, height, material, age, and condition) within the project limits and describe the source of water flowing through each and how it is conveyed (scuppers, bridge inlets, curb and gutter, etc.)
- Based on discussions with the local maintenance office and RHE or SHO, determine if there are any stormwater or hydraulic fixes needed for each bridge beyond routine maintenance.
- Determine and provide a discussion if these stormwater and hydraulic fixes can be addressed on the project

3. Threshold Discharge Areas (TDAs)

3.1. Threshold Discharge Areas (TDAs) – Each TDA must be delineated to account for the full extent of stormwater runoff changes, including those related to land cover changes, that will occur once the project is complete. The delineation should be based on the existing on-site drainage patterns and the existing discharge locations from the proposed WSDOT right of way limits.

TDA Checklist:

- For each TDA within the project limits, provide a complete description of the general drainage systems and flow patterns including any unusual or unique drainage patterns that extend beyond the project limits or WSDOT right of way. For each TDA describe the eventual downstream receiving water body.
- Provide a table summarizing each TDA within the project limits and include each TDA name, total areas of existing impervious, existing pervious, new impervious, replaced impervious, new PGIS, replaced PGIS, and proposed or postdeveloped amount of pervious area in each TDA, and which receiving water body or discharge location each TDA discharges to
- Describe how each TDA's boundaries were determined and how areas were combined to form each TDA; include:
 - The general existing drainage systems and existing flow patterns
 - Any unusual or unique drainage patterns that extend beyond project limits or WSDOT right of way
 - The downstream receiving water body
 - Any proposed right of way or permanent easements acquired by the project
- Provide TDA drawings in Appendix A-2, including flow paths that extend at least ¼ of a mile downstream of discharge locations from WSDOT ROW:
 - Provide TDA drawings that show and label the areas of existing impervious, existing pervious, new impervious, replaced impervious, new PGIS, replaced PGIS, and proposed or postdeveloped amount of pervious area in each TDA
 - If there is an approved HRM Minimum Requirement #4 deviation (or HRM adjustment), provide a second set of proposed TDA drawings that show and label the areas of proposed impervious, pervious, replaced impervious, new PGIS, replaced PGIS, and proposed or postdeveloped amount of pervious area in each TDA
 - Record quantities of existing impervious and PGIS and proposed impervious and PGIS in a table on the exhibit
 - TDA delineations do not include off-site drainage areas that discharge flows to WSDOT ROW; TDAs are from ROW to ROW and beginning project limit to end project limit so offsite drainage areas should not be a part of the TDA delineation

- Delineate the downstream flowpath for at least ¼ mile from each discharge location where water leaves WSDOT ROW. This is also required for the downstream analysis

4. Geotechnical Conditions

- 4.1. Describe the geotechnical investigations done for the project site. The investigation typically is summarized in a project specific soils report or geotechnical report. If the geotechnical report includes information relevant to the stormwater and hydraulics design, include those sections that are relevant in the hydraulics report Appendix A-5. Do not include the entire geotechnical report in Appendix A-5. The soils report will generally show things like soil type(s), soil pH and resistivity (to determine acceptable pipe alternatives), soil borings locations, soil infiltration rates, well monitoring, piezometer monitoring, and groundwater level determination. These are typically needed for stormwater BMP design and pipe material determination. The designer can get very generalized soil type information from the National Resource Conservation Service (NRCS) if the project specific soils report or geotechnical report is not done yet.

Geotechnical Conditions Checklist:

- Describe soil types across the project site especially at stormwater BMP locations
 - Determine soil pH and resistivity
 - Discuss if piezometers were installed on the project and monitored for at least one wet season; this is needed to determine the seasonal high groundwater level as well as determine how the groundwater fluctuates seasonally for construction purposes
 - Discuss if the seasonal high groundwater table elevation determined at each BMP site
 - If the project has any infiltration BMPs, describe how each BMP location meets the Site Suitability Criteria (SSC) in HRM Chapter 4
- 4.2. Infiltration Rate Determination – When requested by the PEO, the geotechnical engineer will use the design methods in HRM Appendix 4-D to develop site specific infiltration rates for stormwater BMP design.

Infiltration Rate Determination Checklist:

- When geotechnical information is needed for stormwater BMP design, describe which method(s) were used to determine saturated hydraulic conductivity rates, gradients, and soil infiltration rates
- Follow HRM Appendix 4-D for infiltration rate determination requirements
- Describe if soil borings or Pilot Infiltration Tests (PIT) were done at BMP locations
- List the determined soil infiltration rates at BMP locations, as required by the BMP design
- Include the relevant portions of the geotechnical report that support BMP design and place those portions along with the stamped cover page in Appendix A-5

4.3. Other Considerations – In areas where doing stormwater and hydraulic work, there could be areas of hazardous materials. For example, to build a new stormwater pond, the project bought a parcel that was formerly an auto repair shop.

Other Considerations Checklist:

- Provide a discussion if there are any hazardous areas within the project where stormwater BMPs will be constructed in or stormwater will be discharged to; this may require the PEO to work with Region Environmental
- If the project limits were with any sanitary control area (per DOH) of an existing well or septic drain field, describe how the project dealt with this issue. Coordination with the RHE and Region Environmental is likely needed.

5. Design Standards

5.1. Design Manuals and Publications – List the various design manuals and publications used in developing the hydraulic report. A sample list (not all inclusive) is shown below

Design Manuals and Publications Checklist:

- WSDOT (Washington State Department of Transportation) 2011 Climate Impacts Vulnerability Assessment Report. November. Available online at <https://wsdot.wa.gov/construction-planning/protecting-environment/climate-change-transportation/climate-resilience>
- WSDOT Highway Runoff Manual (HRM). Publication Number M 31-16 April 2019
- WSDOT Hydraulics Manual. Publication Number M 23-03 April 2025.
- WSDOT Standard Plans. Publication Number M 21-01. September 2024
- WSDOT Roadside Manual. Publication Number M 25-30. January 2024.
- WSDOT Design Manual. Publication Number M 22-01. September 2024.
- WSDOT Standard Specifications for Road, Bridge, and Municipal Construction. Publication Number M 41-10. 2026
- **Update all publication dates for the resources used on the project**

5.2. Design Frequency – Document the appropriate design frequencies used to size hydraulic features on the project and where relevant show calculations.

Table 5-1 Stormwater and Hydraulic Design Standards

Type of Structure	Design Storm Frequency and Criteria	Hydrology Method or Model	Hydrology Tool or Software
Apple	Flow-based; upstream of flow control facility	Continuous Simulation Model; 15 minute time step	MGSFlood
Orange	10 Year	Rational	Irregular Trapezoidal Formula
Grape	25 Year	SBUH	StormShed3G

Design Frequency Checklist:

- Include Table 5-1 (see above) into the hydraulic report; list the type of structure, design storm frequency/criteria, hydrology method/model and hydrology tool/software used to size hydraulic features on the project
- Include hydraulic and hydrologic design calculations are in Appendix A-3
- Include a discussion of the climate and chosen precipitation values
- Include a discussion if climate change and the climate vulnerability assessment led to drainage design standard changes for the project
- If snow was considered in the design, see Hydraulics Manual (HM) Section 2-5
- Include a list of stormwater and hydraulic tools and software used for calculations

- 5.3. Stormwater Management Guidelines – The Stormwater Design Documentation Spreadsheet (SDDS) has been developed to assist designers in organizing the information required in the hydraulic report to show compliance with the requirements of the HRM. Fill out the Stormwater Design Documentation Spreadsheet (SDDS) to determine which HRM Minimum Requirements apply and place it in Appendix A-1.

Stormwater Management Guidelines Checklist:

- Fill out the [Stormwater Design Documentation Spreadsheet \(SDDS\)](#), completing all tabs of the SDDS, and place the SDDS in Appendix A-1; **make sure to complete all tabs of the SDDS**
- Provide a table showing HRM minimum requirements that apply at the project level
- Provide a table showing HRM minimum requirements that apply at the TDA level
- Provide a reference to the SDDS located in Appendix A-1
- For ease of reference, consider copying the above tables to a drawing that shows TDA on the project

- 5.4. Stormwater Retrofit Analysis – Document all project related stormwater retrofit on the project. This could be in the form of building a new stormwater BMP and providing more treatment than required or where an existing stormwater BMP is upgraded to current stormwater design standards. provides additional stormwater retrofit guidance.

Stormwater Retrofit Analysis Checklist:

- Provide a discussion on the project type (stand-alone stormwater retrofit project, fish barrier removal project, roadway widening project, etc.)
- Using HRM Section 3-4 for background on stormwater retrofits, determine the type of retrofit for each TDA
 - Statewide project-triggered stormwater retrofit for replaced impervious
 - Project-triggered stormwater retrofit within the Puget Sound Basin
 - Opportunistic retrofit
- Discuss any retrofit opportunities
- Discuss any retrofit opportunities not used due to constraints
- If there are Puget Sound Basin retrofit requirements, see HRM Section 3-4

- If this is fish barrier removal project, verify a stormwater retrofit assessment for fish barrier projects has been completed or stormwater retrofit opportunities were discussed at the stormwater and hydraulic assessment
- Document all stormwater retrofit in the Stormwater Design Documentation Spreadsheet in Appendix A-1

5.5. Other Requirements – Note any stormwater or hydraulic requirements used in the stormwater, hydraulic, and hydrologic calculations that are in addition to those found in the HM and HRM Manual.

Other Requirements Checklist:

- Provide a discussion to see if other requirements apply to the project; a possible list includes:
 - [ESA Programmatic Consultation requirements](#)
 - [City Streets as a State Highway requirements](#)
 - [Local agency guidelines and requirements](#)
 - [Total Maximum Daily Load \(TMDL\) requirements](#)
 - Other agreements or commitments made by the project office that affect stormwater, hydraulic, or hydrologic design
- Provide web links or copies of guidelines, manuals, basin plans, local agency code, technical documents, Memoranda of Understanding, or Agreements used to develop the Hydraulics Report
- Document how each “Other Requirement” was addressed in the hydraulic report

5.6. Pipe Alternatives – Note all acceptable pipe schedule alternatives for drains, culverts and storm sewers (see Divisions 7-01, 7-02 and 7-04 of the WSDOT Standard Specifications, respectively) for the project and provide engineering justification for any alternatives that are excluded. Refer to Section 8-3 of the HM for detailed information and guidance on pipe materials and limitations.

Pipe Alternatives Checklist:

- Use HM Figures 8-6 to 8-12 along with pH and resistivity was used to determine acceptable pipe alternates for the project site
- Describe any engineering justification used for any pipe alternates that are excluded

6. Developed Conditions

6.1. This section provides the basis for what is shown on the developed condition as reflected in the PS&E drainage plans, profiles and details. Note that PS&E level plans may not yet be completed when an intermediate hydraulic report is produced. Final as-built plans shall be included in the final hydraulic report.

6.1.1. Drainage Basins

Drainage Basin Checklist:

- Describe the drainage basins for all stormwater and hydraulic features listed in this section. See HM Section 2-3 for drainage basin guidance

- For each drainage basin, describe the following:
 - Land cover
 - Drainage area
 - Slope
 - General drainage patterns
- Include drainage basin maps in Appendix A-2.
 - Include a legend in the map labeling the surfaces shown
 - Field verify all drainage basins
 - Delineate and include flow direction arrows
 - Show and clearly label existing and new hydraulic and stormwater features
- Use consistent drainage basin designations in all narratives and calculations in the hydraulic report
- Draw maps and figures to adequate scale to allow reviewers to verify all calculations

6.1.2. Post Developed Drainage Patterns

Post Developed Drainage Patterns Checklist:

- Describe the post developed drainage patterns on the project site and for each TDA; Specifically note any changes from the existing drainage patterns
- Include post developed drainage patterns on plan sheets or drawings in Appendix A-2.
- Include TDA maps in Appendix A-2 clearly showing post developed drainage patterns and highlight any modified drainage patterns
- Include drawings showing where areas shift from one TDA to another (requires HRM deviation)
- Include drawings showing where the project shifts runoff treatment and flow control requirements from one TDA to another TDA (requires an approved HRM deviation)

6.1.3. Hydraulics Manual Deviations - Hydraulic Manual deviations need to be approved by the State Hydraulic Engineer. They are needed when the PEO cannot meet a requirement of the Hydraulics Manual.

HM Deviations Checklist:

- List the publication year for the HM used for the project design
- List any deviations from the HM and summarize them in this section
- Indicate if the HM deviations were approved or are in the process of being approved by the State Hydraulic Director
- Include a copy of the approved HM deviations along with any correspondence in Appendix A-6

6.1.4. Highway Runoff Manual Deviations – Highway Runoff Manual Section 3-5 describes the process for approval of stormwater deviations by the Demonstrative Approach Team (DAT) made up of WSDOT and Department of Ecology staff. They are needed when the PEO cannot meet a requirement of the HRM.

HRM Deviations Checklist:

- List the publication year for the HRM used for the project design
- List any deviations from the HRM and summarize them in this section
- Indicate if the HRM deviations were approved or are in the process of being approved by the DAT
- Include a copy of the DAT submittal, DAT approval memo, and any correspondence in Appendix A-6

6.1.5. Upstream and Downstream Analysis

Upstream and Downstream Analysis Checklist:

- Follow HM 1-3.5 for the information needed in the upstream and downstream analysis. In general, the upstream and downstream analysis should be broken into three sections: 1) Review of Resources; 2) Inspection of Drainage Conveyance Systems; and 3) Analysis of Offsite Effects. Note that even if a TDA has a flow control BMP, it still may affect the downstream when stormwater flows are above the 50-year event
- Describe the impact of the project on downstream conveyance systems for up to ¼ mile upstream (if applicable) and downstream of the WSDOT ROW
- Document the condition of the downstream conveyance systems up to ¼ mile using photos, drawings, plan sheets and include these in Appendix A-3.13
- Meet with local WSDOT maintenance office to determine any existing upstream (if applicable) and downstream drainage related issues
- Discuss if there are any upstream analysis requirements for the project with the RHE

6.1.6. Hydrologic and Hydraulic Design and Calculations for Conveyance - All calculations should include enough supporting information to allow reviewers to completely duplicate the process used through the original design; however, excessive data which duplicates information already provided can often make the calculation process less understandable.

Hydrologic and Hydraulic Design and Calculations Checklist:

- Place all hydrologic and hydraulic calculation in Appendix A-3.
- Follow calculation methodologies per the HM and HRM.
- List all assumptions used in the calculations.
- Provide a narrative for each set of hydraulic and hydrologic calculations
- Clearly label and reference maps, figures, and design plans provided in the report that support the calculations. For large reports, designers should consider using a table summarizing the calculations for clarity.
- Recommend having a document showing the people who have QA/QC'd the report.

6.1.7. Flow Control BMP Design and Calculations

Flow Control BMP Design and Calculations Checklist:

- Describe all new flow control BMPs, impacted or modified flow control BMPs, removed flow control BMPs, and existing flow control replaced by another type of flow control BMP
- Provide a table listing each flow control BMP by TDA
- Follow HRM Chapter 5 for stormwater BMP design criteria and requirements
- State if the detention BMP meets HRM flow control standards and check to make sure this is consistent with what is shown in the SDDS
- Fill out the LID Feasibility Checklist for all TDAs within the project and included in Appendix A-1
- Provide a flow control inputs spreadsheet for every new flow control BMP
- Provide a flow control inputs spreadsheet for every existing flow control BMP modified by the project
- If the detention BMP has a bypass or point of compliance modeling setup, describe the real-life scenario and explain how this matches up with modeling setup
- If an existing detention BMP is modified by the project, verify the detention BMP will still meet the design standards it was originally designed to
- If there are full or partial reversion areas on the project, verify the net new impervious surface quantity is adjusted only for the full reversion areas
- Show reversion areas on plan sheets per the HRM; include relevant plan sheets in Appendix A-2
- Flow control structure orifices and weir sizes should be nominal and constructible.
- Based on the HRM BMP design requirements, provide a discussion on the amount of separation between the bottom of the BMP and the seasonal high ground water table
- As of January 1, 2025, the WSDOT Bridge Design Office can only support detention vaults. **WSDOT does not allow new wet vaults or new combination wet/detention vaults on WSDOT projects.**
- Detention vaults are Category 1 BMPs and require Region Hydraulics Engineer approval and local maintenance office approval.
- Provide maintenance access to the flow control structure, inlet pipe, outlet pipe, and emergency overflow
- If there are any Underground Injection Control (UIC) Wells for infiltrating stormwater, design the UIC per HRM 4-5.4
- Place flow control calculations in Appendix A-3.1

6.1.8. Runoff Treatment BMP Design and Calculations

Runoff Treatment BMP Design and Calculations Checklist:

- Describe the new runoff treatment BMPs being designed, existing runoff treatment BMPs being impacted or modified, and any existing runoff treatment BMPs being removed and replaced with another runoff treatment BMP
- Provide a table listing each runoff treatment BMP by TDA

- Follow HRM Chapter 5 for stormwater BMP design criteria and requirements
- State if the runoff treatment BMP meets HRM runoff treatment standards and check to make sure this is consistent with what is shown in the SDDS
- Fill out the LID Feasibility Checklist for all applicable TDAs within the project and included in Appendix A-1
- If applicable, provide runoff treatment as part of ESA programmatic consultation requirements for stormwater
- Describe how much pervious and PGIS areas are flowing into each runoff treatment BMP
- If an existing runoff treatment BMP is modified by the project, the runoff treatment BMP needs to meet (at a minimum) the design standards to which it was originally designed to
- Based on the HRM BMP design requirements, provide a discussion on the amount of separation between the bottom of the BMP and the seasonal high ground water table
- Provide maintenance access to any overflow structure, inlet pipe, outlet pipe, and emergency overflow structure
- Provide a discussion of any existing runoff treatment BMP being abandoned or replaced with another type of runoff treatment BMP; describe how the new runoff treatment BMP will provide equal or better runoff treatment
- Place runoff treatment calculations in Appendix A-3.2

6.1.9. Inlet, Curb Openings, Scuppers, and Sag Design and Calculations

Inlet and Scupper Spacing and Sag Design and Calculations Checklist:

- Describe the new inlets, curb opening, scuppers, and sag locations being designed, being impacted or modified, and being abandoned
- Follow HM Chapter 5 for inlet spacing, scuppers, and sag design and spread width design and requirements
- Use the WSDOT Inlet Spacing spreadsheet, Curb Opening – Barrier Scupper Inlet Spacing spreadsheet, and WSDOT Sag Worksheet for the curb and gutter flow analyses on the project
- Place inlet spacing, curb opening/scupper barrier spacing, and sag calculations in Appendix A-3.3

6.1.10. Storm Sewer Design and Calculations

Storm Sewer Checklist:

- List and describe the new storm sewers being designed, existing storm sewers being impacted or modified, and any existing storm sewers being abandoned or replaced with another type of stormwater conveyance (i.e., ditch)
- Follow HM Table 1-3 for approved stormwater sewer design software
- Follow HM Chapter 6 for stormwater sewer design and requirements
- Use soil pH and resistivity values to determine allowable storm sewer pipe materials
- Determine if existing storm sewer system within the project limits was inspected
- Provide energy dissipation for storm sewer discharge locations per HM 3-4.7

- Place storm sewer calculations in Appendix A-3.4

6.1.11. Drainage Basin Design and Calculations

Drainage Basin Design and Calculations Checklist:

- Follow HM 2-4 to describe and delineate onsite and offsite drainage basins contributing flows to WSDOT ROW
- For onsite drainage basins and catchment areas, describe each drainage basin or catchment area being analyzed and associated land covers
- Provide drainage basin calculations following the hydrologic methods in HM Chapter 2 for the hydraulic feature being designed
- If the project is listed as a mountainous route per the WSDOT Highway Log or is over 1,500 feet elevation, the project considered should consider snow melt in their basin runoff calculations per HM 2-5.1
- Place drainage basin exhibits in Appendix A-2
- Place drainage basin calculations in Appendix A-3.5

6.1.12. Drainage Ditch Design and Calculations.

Ditch Design and Calculations Checklist:

- Describe the new drainage ditches being designed, existing drainage ditches being impacted or modified, and existing ditches being abandoned or replaced with enclosed drainage
- Follow HM 5-5 for ditch design and requirements
- Design ditches to convey flows from the 10-year recurrence interval while providing 0.5 foot freeboard (from ditch design water surface elevation to the bottom of pavement subgrade)
- Note there is additional drainage ditch design requirements in Design Manual 1239.03.
- Provide a discussion regarding how the ditch design does or does not need to address the potential for a hydraulic jump based on HM 4-4
- Provide channel lining design and calculations for each ditch or channel, this requires the following
 - Determine the velocity and shear stress based on 10-year flow in the ditch
 - Go to HEC-15 to determine channel lining mitigation measure
 - Check with maintenance on preferred channel lining choice
- Provide a discussion of any ditches being abandoned or replaced with enclosed drainage
- Place drainage ditch exhibits in Appendix A-2
- Place ditch calculations (including tributary areas) are in Appendix A-3.6

6.1.13. Culvert (conveying non-fish bearing waters) Design and Calculations

Culvert (conveying non-fish bearing waters) Design and Calculations Checklist:

- Describe the new culverts being designed, existing culverts being impacted or modified, and any existing culverts being abandoned or replaced by another type of hydraulic conveyance

- Follow HM Chapter 3 for culvert design and requirements
- Culverts over 48 inches in diameter are designed by the SHO.
- Place culvert calculations in Appendix A-3.7

6.1.14. Outlet Protection Design and Calculations

Outlet Protection Design and Calculations Checklist:

- List and describe the hydraulic structures that need outlet protection in this section. These generally include the downstream end of a storm sewer pipe, culvert pipe, drain pipe, underdrain pipe, drainage ditch, drainage channel, stormwater BMP discharge location, or any other hydraulic structure conveying flow; these generally do not convey a stream, creek, or river
- Follow HM 3-4.7 and HM Table 3-3 for energy dissipator design and requirements
- Place Outlet Protection calculations in Appendix A-3.8

6.1.15. Flow Spreader Design and Calculations

Flow Spreader Design and Calculations Checklist:

- List and describe the hydraulic structures that need a flow spreader
- Follow HRM 5-4.3.5 for flow spreader design and requirements
- Place flow spreader calculations in Appendix A-3.9

6.1.16. Flow Splitter Design and Calculations

Flow Splitter Design and Calculations Checklist:

- List and describe the hydraulic structures that need a flow splitter
- Follow HRM 5-4.3.4 for flow splitter design and requirements
 - Flow splitters are only used upstream of runoff treatment flow based BMPs like a biofiltration swale. They are used to split off flows higher than the WQ flow rate around the flow rate-based runoff treatment BMP. This makes the flow rate-based runoff treatment BMP an “offline” BMP
- Place flow splitter calculations in Appendix A-3.10

6.1.17. Underdrain Pipe Design and Calculations

Underdrain Pipe Design and Calculations Checklist:

- List and describe the new underdrain pipes being designed, existing underdrain pipes being impacted or modified, and any existing underdrain pipes being abandoned
- Follow HM 6-4 for underdrain design and requirements
- Provide flow coming from underdrain is based on full flow conditions unless a different flow rate is recommended in a stamped geotechnical report
- Verify underdrain calculations are in Appendix A-3.11

6.1.18. Drain Pipe Design and Calculations – Describe the new drain pipes being designed, existing drain pipes being impacted or modified, and any existing drain pipes being abandoned.

Drain Pipe Design and Calculations Checklist:

- Provide drain pipe design is following HM 6-3.
- Provide underdrain calculations are in Appendix A-3.11

7. Permits and Associated Reports

- 7.1. Environmental Issues, Fish and Other Endangered Habitat – Describe any water quality and/or erosion issues in receiving water bodies, regulated floodplain areas, stream crossings, wetlands, steep slopes or other sensitive areas within the project limits, noting project impacts. Describe any fish passage design issues including culverts within the project limits or fish passage barrier removal issues. Note if fish surveys were conducted and what was determined. Also note if there are any threatened or endangered species within the project limits.

Environmental Issues, Fish and Other Endangered Habitat Checklist:

- Provide a discussion if any of the following are within or downstream of the project limits:
 - Impaired water bodies or any water quality issues in receiving water bodies (TMDLs or 303(d) listings)
 - Floodplains
 - Stream crossings
 - Wetlands
 - Steep slopes
 - Other sensitive areas within the project limits
 - Endangered Species
 - If applicable, describe any fish barrier removal design issues, including:
 - The barrier status (as determined by WDFW) of each stream crossing within the project limits
 - Fish passage barrier removal issues
 - Provide relevant environmental permitting documents in Appendix A-9
- 7.2. Permits and Approvals – List all environmental permits, variances or approvals required by federal, state, and local jurisdictions or resource agencies that are necessary to complete the project. An example list (not all inclusive) is shown below.

Permits and Approvals Checklist:

- National Environmental Policy Act (NEPA) – includes documentation on many subjects, including but not limited to, wetlands, environmental justice, 4(f)/6(f), ESA and Section 106
- State Environmental Policy Act (SEPA) – includes documentation on many subjects, including soils, air quality, noise, land use, transportation, recreation, natural resources, etc. – This is a separate approval from NEPA
- FEMA CLOMR approval
- Section 404 Clean Water Act (US Army Corps of Engineers)
- Section 401 Water Quality Certification (Ecology)

- Coastal Zone Management Consistency Determination (Ecology)
- Washington Department of Fish and Wildlife (WDFW) Hydraulic Project Approval (HPA)
- Section 106 Cultural Resources – WA Department of Archaeology and Historic Preservation
- Construction Stormwater General Permit (NPDES) – Ecology
- Section 7 Endangered Species Act Clearance – USFWS and NMFS
- Conditional Letter of Map Revision (CLOMR) – Federal Emergency Management Agency (FEMA)
- Floodplain permit – XYZ County
- Shoreline Permit Exemption– XYZ County

7.3. Stormwater, Hydraulic, and Drainage Related Commitments

Stormwater, Hydraulic, and Drainage Related Commitments Checklist:

- List and discuss all stormwater, hydraulic, and drainage related commitments made by the project
 - Provide information on who made the commitment, to whom the commitment is made to, how long the commitment lasts, and the details of the commitment
- Provide backup documentation in Appendix A-8

7.4. Easements

Easements Checklist:

- List and discuss if there are any existing or new easements on the project where work constructing permanent design elements could occur; this may require a change to TDA delineations to capture the work
- Provide plan sheets or drawings showing the easements discussed above and place them in Appendix A-2

7.5. Additional Stormwater and Hydraulic Related Reports or Studies

Additional Stormwater and Hydraulic Related Reports or Studies Checklist:

- List and briefly summarize other stormwater and hydraulic related reports and studies (not already mentioned) conducted and prepared for the project; provide a hyper link to the report/study if applicable
 - Wetland Report
 - Traffic Report

7.6. Website – Provide a list of the websites used in developing the hydraulic report. A sample list (not-all inclusive) is shown below.

Websites Checklist:

- Ecology Water Quality Atlas
<https://apps.ecology.wa.gov/waterqualityatlas/wqa/startpage>

- FEMA (Federal Emergency Management Agency) Flood Map Service Center Flood hazard maps.
<https://msc.fema.gov/>
- WSDOT (Washington State Department of Transportation) Online Map Center; Transportation Data and GIS
<https://wsdot.maps.arcgis.com/home/index.html>

8. Inspection and Maintenance

- 8.1. The Region maintenance supervisor should be consulted at the beginning of a project's stormwater and hydraulic work regarding any existing drainage problems and concerns with existing or proposed BMPs. The Region maintenance supervisor should be updated regularly as the project stormwater and hydraulic design progresses to completion.

Inspection and Maintenance Checklist:

- Provide any email correspondence or meeting notes with maintenance staff in Appendix A-10
- Send BMP maintenance plans to maintenance office for review and comment

9. Outstanding Stormwater and Hydraulic Issues

- 9.1. Provide a summary of any stormwater and hydraulic issues that were identified by the project but not resolved by the project.

Outstanding Stormwater and Hydraulic Issues Checklist:

- Provide any backup email correspondence or meeting notes documenting any unresolved stormwater and hydraulic issues and include them in Appendix A-10

10. Final Walk-Through Field Verification Meeting Notes

- 10.1. For Design-Build projects, a final walk-through for field verification of the stormwater drainage system is required.

Final Walk-Through Field Verification Meeting Notes Checklist:

- Provide documentation that the final walk-through field verification meetings happened, and all stormwater and hydraulic issues have been resolved
- See RFP 2.14 for details on who needs to be at final walk-through field verification meetings
- Place any backup email correspondence or meeting notes documenting in Appendix A-11

Appendix Contents

A-1 SDDS, LID Feasibility Checklist, Stormwater and Hydraulic Assessment, Stormwater Retrofit Assessment, and RCEF – The Stormwater Design Documentation Spreadsheet (SDDS) has been developed to assist designers in organizing the information required in the hydraulic report to show compliance with the requirements of the HRM. The LID Feasibility Checklist is required by all projects that exceed thresholds for HRM Minimum Requirement 5 Runoff Treatment or 6 Flow Control. The Stormwater Retrofit Assessment is specific to fish barrier projects but will be phased out by the Stormwater and Hydraulic Assessment. The Retrofit Cost Effectiveness and Feasibility (RCEF) evaluation documents how the project meets the Puget Sound Basin Retrofit Requirements. All of these tools can be found at the below link.

<https://wsdot.wa.gov/engineering-standards/design-topics/hydraulics-hydrology>

A-1 Checklist:

- Place the SDDS in Appendix A-1
- For projects that exceed HRM MR 5 Runoff Treatment or MR 6 Flow Control, place the LID Feasibility Checklist in Appendix A-1
- For fish barrier projects that don't have a Stormwater and Hydraulic Assessment, place the Stormwater Retrofit Assessment for Fish Barrier Projects in Appendix A-1
- For projects within the Puget Sound Basin that add new impervious and exceed HRM MR 5 Runoff Treatment or MR 6 Flow Control in any TDA, place the RCEF in Appendix A-1
- Place the Stormwater and Hydraulic Assessment in Appendix A-1

A-2 TDA Maps, Drainage Basin Maps, Reversion Maps, and Hydraulic Discharge Point Inventory Spreadsheet

A-2 Checklist:

- Provide drawings, maps, figures, and plan sheets showing TDA delineations, drainage basins, catchment areas, reversion maps
- Provide the completed Hydraulic Discharge Point Inventory Spreadsheet referenced in Section 2.8

A-3 Hydrologic, Hydraulic, and Stormwater Design Calculations

A-3 Checklist:

- Provide all hydrologic, hydraulic, and stormwater design calculations used in the hydraulic report; make sure they are checked by an individual in the project engineering office other than the person who prepared the report
 - A-3.1 - Flow Control BMP Design and Calculations (See Section 6.1.7)
 - A-3.2 - Runoff Treatment BMP Design and Calculations (See Section 6.1.8)
 - A-3.3 - Inlet, Curb Openings, Scuppers, and Sag Design Calculations (See Section 6.1.9)
 - A-3.4 - Storm Sewer Design and Calculations (See Section 6.1.10)

- A-3.5 - Drainage Basin Design and Calculations (See Section 6.1.11)
- A-3.6 - Drainage Ditch Design and Calculations (See Section 6.1.12)
- A-3.7 - Culvert Design (conveying non-fish bearing waters) and Calculations (See Section 6.1.13)
- A-3.8 - Outlet Protection Design and Calculations (See Section 6.1.14)
- A-3.9 - Flow Spreader Design and Calculations (See Section 6.1.15)
- A-3.10 - Flow Splitter Design and Calculations (See Section 6.1.16)
- A-3.11 - Underdrain Pipe Design and Calculations (See Section 6.1.17)
- A-3.12 - Drain Pipe Design and Calculations (See Section 6.1.18)
- A-3.13 - Upstream and Downstream Analysis and Calculations (See Section 6.1.5)

A-4 Provide Appropriate Plan Sheets, Drawings, and Details

A-4 Checklist:

- Provide appropriate plan sheets, drawings, and details for the version of the hydraulic report (conceptual, preliminary, intermediate, or final)
- Label plans as “DRAFT” unless they are as-built plan sheets
- Provide recommend plan sheets such as Structure Notes, Drainage Plans, Drainage Profiles, Drainage Details, Bridge Plans that have bridge drainage, Utilities Plan (to show potential conflicts between proposed drainage and existing utilities or existing drainage and proposed utilities that have not been resolved)
- For projects that involve modification or installation of a culvert(s) or bridge(s) include:
 - Water surface elevations and design flow rates for the 25-, 100-, and (where applicable) 500-year storms

A-5 Geotechnical Report – See Section 4

A-6 HM and HRM Deviations – See Section 6.1.3 and 6.1.4

A-7 UIC Registration Forms – See HRM 4-5.4

A-8 Stormwater, Hydraulic, and Drainage Related Commitments – See Section 7.3

A-9 Relevant Environmental Permitting Documents – See Section 7

A-10 Outstanding Hydraulic Issues Unresolved in this Report – See Section 9

A-11 Final Walk-Through Field Verification Meeting Notes – See Section 10