DRAINAGE REPORT

Nixon Rapids Ln Chelan County, Wa
Project Engineer: Eric Schossow, PE
Prepared By: Ryan Yokum, PE
January 29, 2025

1 INTRODUCTION

The proposed project includes the partial development of Parcel 212205000050, located at Nixon Rapids Ln in Chelan County, WA. The site is not currently developed. This project proposes the construction of a new office building, assembly building, and associated parking and landscaping. This project consists of only phase 1 of 2 for this site. Phase 2 will consist of the construction of a 100,000 SF generator building. All proposed drainage improvements have been designed in accordance with the latest edition of the Stormwater Management Manual for Eastern Washington (latest edition) hereby referred to as "The Manual". See Appendix A for a project location map.

2 SITE SOILS AND CONDITIONS

2.1 GEOTECHNICAL INVESTIGATION

Nelson Geotechnical Associates, Inc. prepared a geotechnical Engineering Report. The full geotechnical report is included as Appendix B. Highlights from the report include the following:

- Exploration pits near the site went to at least 25.5' in depth and groundwater was not encountered.
- Soils generally consisted of brown to grey, boulder-to-cobble gravel with some sand and trace silt.
- A preliminary design infiltration rate of 8.27 in/hr was given.

2.2 SITE DESCRIPTION

The proposed project site is located off of Nixon Rpds Ln in Chelan County. The site is bound to the north, east, and west by vegetation and to the south by Nixon Rpds Ln. The project site generally slopes from southwest to northeast. The proposed development includes the construction of a 25,000 SF assembly building, a 10,000 SF office building, and associated hardscape and landscaping.

3 EXISTING DRAINAGE CONTROL SUMMARY

The existing site is not yet developed. It is assumed that all stormwater runoff percolates into the existing soil.

4 DISCUSSION OF CORE REQUIREMENTS

From Figure 2.1: Flow Chart for Determining Requirements for New Development in The Manual, all core elements apply to this project. See below for a discussion of each core requirement that is required to be evaluated for this project and how each is addressed.

Core Element #1: Preparation of a Stormwater Site Plan
The Stormwater Site Plan (civil plan set) has been prepared and submitted under separate cover.

Core Element #2: Construction Stormwater Pollution Prevention Plan
The Construction Stormwater Pollution Prevention Plan (SWPPP) has been prepared in accordance with Volume 1 Chapter 1-2 of the Stormwater Manual, utilizing the Department of Ecology's (DOE) Construction Stormwater General Permit SWPPP template for the building permit submittal. As the site disturbance is more than one acre, a Stormwater Permit through the DOE will be required. See Appendix D for the CSWPPP.

Core Element #3: Source Control of Pollution
All known available and reasonable source control BMPs will be utilized on the project site to minimize stormwater from coming in contact with pollutants. The silt fence and inlet protection serve as source control of pollution. Other source control BMPs will be utilized depending on construction conditions.

In order to control pollutants, proper maintenance and cleaning of debris, sediments, and oil from stormwater collection and conveyance systems is required per the operation and maintenance recommendations found in Volume 5 of the Stormwater Manual. Source Control BMPs are also outlined and talked about in more detail in the CSWPPP in Appendix D.

Core Element #4: Preservation of Natural Drainage Systems and Outfalls
There are no outfalls on or in the vicinity of the site. All stormwater runoff is proposed to infiltrate into the soil.

Core Element #5: Runoff Treatment
Runoff treatment is required as the project proposes to construct greater than 5,000 SF of PGIS. Stormwater runoff from PGIS will be treated via infiltration swales. See Appendix C for a PGIS graphic and swale calculations.

Core Element #6: Flow Control
Flow control is required to be implemented on this project. All stormwater runoff from the proposed development will infiltrate via infiltration swales and drywells. See Appendix C for a graphic which shows the stormwater runoff from impervious surfaces contributing to each infiltration drywell and each infiltration swale as well as calculations used to determine the size required for each swale and number of drywells per basin.

Core Element #7: Operation and Maintenance
An operation and maintenance manual has been provided in Appendix E.

Core Element #8: Wetlands Protection

Stormwater runoff from this project does not discharge into a wetland. Nor are there any wetlands on or within the vicinity of the site. Therefore, this core element is not applicable to this project.

5 PROPOSED DRAINAGE CONTROL SUMMARY

5.1 PROPOSED STORMWATER DESIGN

The site area consists of an assembly building, office building, generator building, parking lot, and their associated hardscape and landscaping:

Stormwater runoff from roof areas will be routed directly to one of 14 drywells. Phases 1 and 2 combined will have six roof basins, each discharging stormwater runoff to their associated drywell(s). See Appendix C for the roof basins graphic and supporting calculations for the drywells.

All at-grade hard surfaces are all considered pollution generating impervious surfaces. Therefore, stormwater runoff from these surfaces will need to be treated. Stormwater runoff from all at-grade hard surfaces will either sheet flow or discharge via tight line storm drain piping into one of seven infiltration swales. See Appendix C for the PGIS basins graphic and supporting calculations for each infiltration swale.

Area consisting of the proposed rural local access road class 2:

Stormwater runoff from the proposed rural road will sheet flow off the road to the southeast over proposed landscaping and existing vegetation and will percolate into the existing soil.

6 EROSION CONTROL

During the construction phase, sediment-laden runoff can enter newly constructed or existing stormwater facilities which can reduce their infiltration and treatment capacity. Controlling erosion and preventing sediment and other pollutants from leaving the project site during the construction phase is achievable through the implementation of temporary sediment and erosion control (TESC) BMPs. The contractor shall inspect and repair/clean all BMPs after every rainfall event. The proposed temporary TESC BMPs shall remain in place for the duration of construction and until all landscaping has been established and proposed permanent ESC BMPs have been installed and established. A TESC plan has been included in the submitted permit documents. See Appendix D for the Construction Stormwater Pollution Prevention Plan.

7 OPERATION AND MAINTENANCE

Insufficient maintenance of stormwater control facilities can lead to poor performance, shortened life, increased maintenance and replacement costs, and potential property damage. The project owner is to provide for the perpetual maintenance of all elements of the stormwater system located on-site. As good practice, the property owner should inspect all stormwater facilities after each rainfall event to ensure properly function facilities. An Operation and Maintenance Manual is included as Appendix E.

8 CONCLUSION

The above-described stormwater infiltration systems will collect, control, and dispose of the stormwater runoff from the proposed improvements associated with the development of this project in Chelan County.

The proposed project will provide the required stormwater collection and disposal as outlined in the 2024 Stormwater Management Manual for Eastern Washington. The stormwater will be directed to drywells and infiltration swales on-site. The proposed stormwater facilities are designed for a 100-year, 24-hour rainfall event.

9 APPENDICES

APPENDIX A – PROJECT LOCATION MAP

APPENDIX B – GEOTECHNICAL REPORT

APPENDIX C – STORMWATER FACILITY CALCULATIONS

APPENDIX D – CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

APPENDIX E – OPERATION AND MAINTENANCE MANUAL

APPENDIX A – PROJECT LOCATION MAP

APPENDIX B – GEOTECHNICAL DOCUMENTS

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November 1, 2024

Joe Irwin
Helion Energy Inc.
Via E-Mail: Joe.Irwin@helionenergy.com

Geotechnical Engineering and Infiltration Evaluation
Helion Energy Power Plant Facility
Chelan County Parcel Number 212205000050
Chelan County, Washington
NGA File No. 1549124

Dear Mr. Irwin:

We are pleased to submit the attached report titled **"Geotechnical Engineering and Infiltration Evaluation – Helion Energy Power Plant Facility – Chelan County Parcel Number 212205000050 – Chelan County, Washington."** This report summarizes our explorations of the surface and subsurface conditions within the site and provides general recommendations for the proposed site development. Our services were completed in general accordance with the proposal dated September 13, 2024, and signed by you on September 24, 2024.

The property consists of a rural utility parcel directly south and west of Rock Island Dam. The proposed location of the power plant lies within the southwestern portion of the parcel, east of Colockum Road. The site is generally level with undulations and covered in bare earth and sagebrush.

Based on a preliminary undated site plan provided by Helion Energy, we understand that project plans include an approximately 100,000-square-foot main building, a 25,000-square-foot assembly building, and a support building. You have requested that we evaluate the site subsurface conditions and provide our opinions and recommendations regarding the proposed site development. Preliminary evaluation of on-site stormwater infiltration was also requested.

We explored the subsurface soil and groundwater conditions on October 10 and 11, 2024, with three geotechnical borings ranging from 25.5 to 51.5 feet below existing grade. In general, we encountered brown to gray, native gravel with some sand and trace gravel throughout the site. The native soil is generally in loose to medium-dense condition. We did not encounter groundwater or seepage in any of the explorations.

It is our opinion, from a geotechnical standpoint, that the planned development is feasible, provided that our recommendations are incorporated into project plans. The attached report includes recommendations for earthwork, foundation, and slab-on-grade support, temporary and permanent slopes, pavement subgrade, site drainage, and erosion control.

We appreciate the opportunity to provide service to you on this project. Please contact us if you have any questions regarding this report or require further information.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Khaled M. Shawish, PE
Principal

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Geotechnical Engineering Evaluation
Helion Energy Power Plant Facility
Chelan County Parcel Number 212205000050
Chelan County, Washington

INTRODUCTION

This report presents the results of our geotechnical engineering evaluation for the proposed Helion Energy Power Plant Facility project located north of Rock Island Dam Road (Nixon Rapids Road) near Rock Island Dam in Chelan County, Washington. The property consists of a 401.0-acre rural utility parcel directly south and west of Rock Island Dam. The proposed location of the power plant lies within the southwestern portion of the parcel east of Colockum Road within an area of approximately 81 acres. The location of the proposed development area is shown on the Vicinity Map in Figure 1.

Based on a preliminary undated site plan provided by Helion Energy, we understand that project plans include a 100,000-square-foot main building, a 25,000-square-foot assembly building, and a support office. There will also be paved access and parking areas as well as underground utilities.

SCOPE

The purpose of this study is to explore and characterize the site surface and subsurface conditions and provide geotechnical engineering and infiltration recommendations for the planned site development.

Specifically, our scope of services included the following:

1. Reviewing available soil and geologic maps of the area as well as other relevant geotechnical information and historical documents.

2. Exploring the subsurface soil and groundwater conditions within the proposed development areas with three, 25- to 50-foot-deep geotechnical boreholes using a sonic drill track rig. Drilling services were subcontracted by NGA.

3. Assessing the site for potential geologic hazards, including landslide, seismic, erosion, avalanche, and flood hazards per Chelan County Code.

4. Providing long-term design infiltration rates based on laboratory analysis on soil samples obtained at the site.

5. Performing laboratory analysis on selected soil samples obtained from the explorations, as necessary.

6. Providing recommendations for earthwork and foundation support.

7. Providing seismic design parameters, including site class, short- and long-period spectral accelerations, and amplification factors.

8. Providing an evaluation of the liquefaction potential of the site soils.

9. Providing recommendations for retaining walls.

10. Providing recommendations for temporary and permanent cut and fill slopes.

11. Providing recommendations for slab-on-grade subgrade preparation.

12. Providing recommendations for pavement, including subgrade preparation and pavement section thicknesses.

13. Providing recommendations for site drainage and erosion control.

14. Documenting our observations, explorations, conclusions, and recommendations in a written geotechnical engineering report.

SITE CONDITIONS

Surface Conditions

We visited the site and made our observations and explorations on October 10 and 11, 2024. The proposed power plant location is currently undeveloped range land owned by Public Utility District No. 1 of Chelan County. The surrounding parcels are also undeveloped range land owned by Alcoa Wenatchee. The site is generally level with generally east- to west-trending undulations and is covered with bare earth, small shrubs, and grass.

Subsurface Conditions

Geology The geologic units for this area are mapped on the Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington, by R. W. Tabor, et al., (USGS, 1982). The project site is generally mapped as being within deposits described as Columbia River Floods Deposits - Gravel of lower-level bars (Qcgl). The lower-level bar deposits are described as surfaces of cobble-to-boulder gravel generally 60 to 90 meters above the river and embellished with giant current dunes. Our explorations encountered cobbles, gravel, and sand at depth consistent with flood deposits.

Explorations: The subsurface conditions within the site were explored on September 3, 2024, with three geotechnical borings to depths ranging from 25.5 to 51.5 feet below existing grade. The approximate locations of our explorations are shown on the Site Plan in Figure 2. A Geologist from Nelson Geotechnical Associates, Inc. (NGA) was present during the boring explorations, examined the soils and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the explorations.

A Standard Penetration Test (SPT) was performed on each of the samples during drilling to document relative soil density at depth. The SPT consists of driving a 2-inch outer-diameter, split-spoon sampler 18 inches using a 140-pound hammer with a drop of 30 inches. The number of blows required to drive the sampler the final 12 inches is referred to as the “N” value and is presented on the boring logs. The N value is used to evaluate the strength and density of the deposit.

The soils were visually classified in general accordance with the Unified Soil Classification System, presented in Figure 3. The exploration logs are presented in Figures 4 through 6. Sieve analysis results for two samples from Boring 1 and Boring 3, respectively, are presented as Figures 7 and 8.

We present a brief summary of the subsurface conditions in the following paragraph. For a detailed description of the subsurface conditions, the exploration logs should be reviewed.

In general, our explorations encountered approximately 50.0 feet of Columbia River flood deposits consisting of brown to grey, boulder-to-cobble gravel with some sand and trace silt throughout the site. Based on the SPT blow counts, the density of the deposits appears to be very dense. It is our opinion that the SPT blow counts are overstated due to the cobbles within the deposits. Based on observed surface deposits and caving during the explorations, the soils encountered consist of unconsolidated fluvial deposits and are generally in a loose to medium-dense condition.

In Boring 1, an approximately 5.0-foot-thick layer of silt was encountered at a depth of 13.0 feet below the current ground surface. We consider this to be a laterally discontinuous low-energy fluvial deposit, which may be encountered at depth within the site.

Hydrogeologic Conditions

We did not encounter groundwater seepage during our explorations. During wet weather, a perched water condition may develop on this site. Perched water occurs when surface water infiltrates through less dense, more permeable soils and accumulates on top of underlying, less permeable soils. Perched water does not represent a regional groundwater "table" within the upper soil horizons. Perched water tends to vary spatially and is dependent upon the amount of rainfall. We would expect the amount of perched water to decrease during drier times of the year and increase during wetter periods.

GEOLOGIC HAZARD EVALUATION

Erosion Hazard

The criteria used for determination of the erosion hazard for affected areas include soil type, slope gradient, vegetation cover, and groundwater conditions. The erosion sensitivity is related to vegetative cover and the specific surface soil types, which are related to the underlying geologic soil units. The Web Soil Survey, by the Natural Resources Conservation Service (NRCS), was reviewed, to determine the erosion hazard of the on-site soils. The site surface soils were classified using the NRCS classification system as Pogue fine sandy loam, 3 to 8 percent slopes (PoB), Pogue gravelly fine sandy loam, 3 to 8 percent slopes (PrB), Pogue gravelly fine sandy loam, 8 to 15 percent slopes (PrC), and Cashmont sandy loam, 3 to 8 percent slopes (CcB). These soils are listed as having a slight to moderate erosion hazard where soil is exposed or disturbed. The establishment of vegetation will significantly reduce the erosion on site.

Landslide Hazard

We did not observe indications of significant downslope movement within the site. Steep slopes are located several hundred feet to the west of this site, but we did not observe any indications of chronic landsliding or instability. The potential of catastrophic geologic landslides for native soil conditions is considered low for this site.

Flood Hazard

We did not observe evidence of seasonal stream channels or active alluvial fans within this site. The area does not indicate recent flooding or fan accumulations within the site. Accordingly, the potential for catastrophic flooding, inundation, or debris flows should be considered low.

Seismic Hazard

We reviewed the 2021 International Building Code (IBC) and the ASCE 7-16 for seismic site classification for this project. Since glacial sand and gravel deposits were encountered at depth within the subject site, the site conditions best fit the IBC description for Site Class D.

Table 1 below provides seismic design parameters for the site that are in conformance with the 2021 IBC, which specifies a design earthquake having a two percent probability of occurrence in 50 years (return interval of 2,475 years), and the 2014 USGS seismic hazard maps.

Table 1. 2021 IBC Seismic Design Parameters

Site Class	Spectral Acceleration at 0.2 sec. (g) S_s	Spectral Acceleration at 1.0 sec. (g) S_1	Site Coefficients		Design Spectral Response Parameters	
			F_a	F_v	S_{DS}	S_{D1}
D	0.435	0.179	1.452	2.242	0.421	0.267

The spectral response accelerations were obtained from the USGS Earthquake Hazards Program Interpolated Probabilistic Ground Motion website (2014 data) for the project latitude and longitude.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the groundwater table. It is our opinion that the loose to medium-dense flood sand and gravel deposits interpreted to underlie the site have a low to moderate potential for liquefaction or amplification of ground motion.

Snow Avalanche Hazard

No evidence of snow avalanches was observed within or nearby this area, accordingly the potential for destructive avalanches is very low.

INFILTRATION TESTING

The native subsurface soils encountered generally consisted of gravel and cobbles with some sand and trace gravel. In accordance with the 2019 Department of Ecology Stormwater Management Manual for Eastern Washington (SWMMEW), we utilized the grain size analysis method with one sample obtained from Boring 3. The infiltration results utilizing the grain size distribution method are summarized in Table 2 below.

Table 2. Grain Size Analysis Results

Exploration Identification	**USCS Soil Type**		**Depth of Sample (feet)**	**Grain Size Distribution Infiltration Rate (Inches/Hour)**	**Preliminary Infiltration Design Rate (Inches/Hour)** *Correction factor of 0.33 applied to calculated infiltration rate.
B-3	GP-GM		20.0	25.06	8.27

It is our opinion that the cobble-to-gravel flood deposits encountered at depth are suitable for onsite stormwater infiltration. The native gravel deposits were encountered across the site at depth in all borings.

Per Table 6.4 of section 6.3.3 of the 2019 SWMMEW, correction factors for site variability (CF_v), test method (CF_t), and siltation (CF_m) were applied to the grain size distribution infiltration rate of 25.06 inches per hour. A total correction factor of 0.33 was determined and applied to the field infiltration rates, resulting in a long-term design infiltration rate of 8.27 inches per hour. We have selected 8.27 inches per hour as a representative preliminary long-term design infiltration rate to be utilized for design of any infiltration galleries within this site. An overflow component should be incorporated into the design of onsite infiltration systems, if possible.

Supplemental field infiltration testing should be performed to verify design rates and system sizing prior to finalizing the design. The stormwater manual recommends a five-foot separation between the base of an infiltration system and any underlying bedrock, impermeable horizon, or groundwater. Due to the silt deposit encountered at depth within Boring 1, NGA should confirm soil conditions for any future stormwater infiltration system location.

We also recommend that any proposed infiltration systems be placed to not negatively impact any nearby structures and meet all required setbacks from existing property lines, structures, and sensitive areas as discussed in the drainage manual. Infiltration systems should not be located within proposed fill areas within the site associated with site grading as such conditions could lead to failures of the placed fills and/or retaining structures. We should be retained to evaluate the infiltration system design and installation during construction to confirm specific soil conditions exposed along the base of the systems.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion, from a geotechnical standpoint, that the proposed development is generally feasible as planned, provided that the geotechnical recommendations presented in this report are incorporated into project plans and followed during construction. Due to potential loose soil conditions, specific subgrade preparation should be performed to maintain site area stability and minimize post-construction distress to the planned structure. Organic rich topsoil should be stripped from the areas to be developed, including buildings and pavement areas, and the native alluvial subgrade should be

compacted to a dense and unyielding condition. NGA should be retained to review final development plans prior to construction.

The on-site soils are considered to be moisture sensitive and will disturb when wet. We recommend that construction take place during extended periods of dry weather. If construction takes place during wet weather, additional expenses and delays should be expected due to the wet conditions. Additional expenses could include the need to additionally export on-site soil, the import of clean, granular soil for fill, and the need to place a blanket of rock spalls or crushed rock in the construction traffic areas and on exposed subgrades prior to placing structural fill or structural elements.

We recommend that we review geotechnical aspects of the final project plans prior to construction. We also recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications.

Erosion Control Measures

The erosion hazard for the on-site soils is listed as slight to moderate, but the actual hazard will be dependent on how the site is graded and how water is allowed to concentrate. Best Management Practices (BMPs) should be used to control erosion. Areas disturbed during construction should be protected from erosion. Erosion control measures may include diverting surface water away from the stripped or disturbed areas. Silt fences should be erected to prevent muddy water from leaving the site or flowing over the site slopes. Stockpiles should be covered with plastic sheeting during wet weather. Disturbed areas should be planted as soon as practical, and the vegetation should be maintained until it is established. The erosion potential for areas that have been adequately revegetated should be low.

Site Preparation and Grading

After erosion control measures are implemented, site preparation should consist of stripping any organics, undocumented fill, or loose/soft soils to expose medium-dense or better bearing soils in foundation, slab, and pavement subgrade areas. Based on our explorations, we anticipate a stripping depth of up to 1.0 to 3.0 feet throughout the site. The stripped soil should be removed from the site or stockpiled for later use as a landscaping fill.

If the exposed subgrade after site stripping should appear to be loose, it should be compacted to a non-yielding condition. Areas observed to pump or weave during compaction should be reworked to structural fill specifications or over-excavated and replaced with properly compacted crushed rock or rock spalls. If significant surface water flow is encountered during construction, this flow should be diverted around areas to be developed and the exposed subgrades should be maintained in a semi-dry condition. We should be retained to observe and evaluate all subgrades prior to placing foundation concrete or hard surfaces. The subgrade preparation recommendations provided in the **Foundation Support** and **Slabs-on-Grade** subsections of this report should be followed for footings and slabs.

If wet conditions are encountered, alternative site grading techniques might be necessary. These could include using large excavators equipped with wide tracks and a smooth bucket to complete site grading and covering exposed subgrade with a layer of crushed rock for protection. If wet conditions are encountered or construction is attempted in wet weather, the subgrade should not be compacted, as this could cause further subgrade disturbance. In wet conditions, it may be necessary to cover the exposed subgrade with a layer of crushed rock as soon as it is exposed to protect the extremely moisture-sensitive soils from disturbance by machine or foot traffic during construction. The prepared subgrade should be protected from construction traffic and surface water should be diverted around areas of prepared subgrade.

Temporary and Permanent Slopes

Temporary cut slope stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open, and the presence of surface or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations at all times, as indicated in OSHA guidelines for cut slopes. The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor. For planning purposes, we recommend that temporary cuts in the on-site soils be no steeper than 1.5 horizontal to 1.0 vertical (1.5H:1.0V).

If temporary cut excavations are not able to achieve safe inclinations, we recommend temporary shoring be considered for the planned cuts. We are available to provide additional options and recommendations for temporary shoring, if needed, as the project plans are developed. If significant groundwater seepage or surface water flow were encountered, we would expect that flatter inclinations

would be necessary. We recommend that cut slopes be protected from erosion. The slope protection measures may include covering cut slopes with plastic sheeting and diverting surface runoff away from the top of cut slopes. We do not recommend vertical slopes for cuts deeper than four feet if worker access is necessary. We recommend that cut slope heights and inclinations conform to appropriate OSHA/WISHA regulations. Permanent cut and fill slopes should be no steeper than 2.0H:1.0V. However, flatter inclinations may be required in areas where loose soils are encountered. Permanent slopes should be vegetated, and the vegetative cover maintained until established.

Foundation Support

The foundation support recommendations and ground improvements provided in the **Site Preparation and Grading** subsection above are intended to improve foundation performance and reduce the potential for post-construction total and differential settlements. We should review final foundation plans and be on site during earthwork construction to evaluate foundation area over-excavation and structural fill and rock spalls placement and compaction. We recommend that all foundations bear on native soil compacted to medium dense or better condition, or structural fill extending down to component native soils.

We should be on site during earthwork construction to evaluate foundation area excavation and any over-excavation, structural fill placement, and compaction. Building foundations should extend at least 24 inches below the lowest adjacent finished ground surface for frost protection and bearing capacity considerations. Footings should be sized based on the anticipated loads and allowable soil bearing pressure and should conform to current IBC guidelines. Water should not be allowed to accumulate in footing excavations. All loose or disturbed soil should be removed from the foundation excavation prior to placing concrete.

For foundations constructed as outlined above we recommend an allowable design bearing pressure of not more than 3,000 pounds per square foot (psf) be used for sizing the footings. We estimate that footings constructed in accordance with these recommendations will experience total settlements less than 1 inch and differential settlements less than ½ inch across a distance of about 20 feet. A representative of NGA should evaluate the foundation excavations. We should be consulted if higher bearing pressures are needed. Current IBC guidelines should be used when considering increased allowable bearing pressure for short-term transitory wind or seismic loads, and for snow loading.

Lateral loads may be resisted by friction on the base of the footing and passive resistance against the subsurface portions of the foundation. A coefficient of friction of 0.35 may be used to calculate the base friction and should be applied to the vertical dead load only. Passive resistance may be calculated as a triangular equivalent fluid pressure distribution. An equivalent fluid density of 200 pounds per cubic foot (pcf) should be used for passive resistance design for a level ground surface adjacent to the footing. This level surface should extend a distance equal to at least three times the footing depth. To achieve this value of passive resistance, the foundations should be poured "neat" against medium-dense soils or compacted fill should be placed against the footing. These recommended values incorporate safety factors of 1.5 and 2.0 applied to the estimated ultimate values for frictional and passive resistance, respectively.

Structural Fill

General: Fill placed beneath foundations, slabs-on-grade, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be suitably prepared as described in the **Site Preparation and Grading** subsection prior to beginning fill placement.

Materials: Structural fill should consist of good quality, granular soil, free of organics and other deleterious material, and be well graded to a maximum size of about three inches. If fill will be placed during wet weather or if wet conditions are present, the fill materials should contain no more than five percent fines (soil finer than U.S. No. 200 sieve, based on that fraction passing the U.S. 3/4-inch sieve). The use of some of the on-site soils as structural fill may be feasible, but this will be dependent on the moisture content of the material at the time construction takes place. Particles over 3.0 inches in diameter should be removed from material intended for use as structural fill. We should be retained to evaluate proposed structural fill material prior to placement.

Fill Placement: Following subgrade preparation, placement of structural fill may proceed. All fill placements should be accomplished in uniform lifts up to eight inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill underlying building areas and pavement subgrade should be compacted to a minimum of 95 percent of its maximum dry density. Maximum dry density, in this report, refers to that density as determined by the ASTM D-1557 Compaction Test procedure. The moisture content of the fill soils to be compacted should

be within about two percent of optimum so that a readily compactable condition exists. It may be necessary to over-excavate and remove wet soils in cases where drying to a compactable condition is not feasible. It may be necessary to add moisture to dry soil so that a readily compactable condition is achieved. All compaction should be accomplished by equipment of a type and size sufficient to attain the desired degree of compaction and should be tested.

Slab-on-Grade

Slabs-on-grade both exterior and interior should be supported on subgrade soils prepared as described in the **Site Preparation and Grading** subsection of this report. Due to the presence of potentially loose soil encountered in our explorations, we recommend the subgrade under all slab areas be compacted to a dense and unyielding state or over-excavated a minimum of 12 inches and backfilled with 2- to 4-inch rock spalls or railroad ballast. The crushed rock should be placed and compacted as structural fill. The exposed subgrade should be thoroughly compacted prior to placing the crushed rock. We recommend that all interior floor slabs be underlain by at least six inches of free-draining sand or gravel for use as a capillary break. A suitable vapor barrier, such as heavy plastic sheeting (6-mil minimum), should be placed over the capillary break material. An additional 2-inch-thick layer of sand may be used to cover the vapor barrier. This sand layer is optional and mainly intended to protect the vapor barrier membrane during construction. The subgrade of slab areas should be compacted to a firm and unyielding state prior to placing the capillary break layer.

Pavements

Pavement subgrade should be prepared as described in the **Site Preparation and Grading** subsection of this report. The pavement section is determined by expected loading conditions, traffic volume, and desired longevity of the parking lot, among other factors. For the expected traffic type and volume, the recommended pavement section should consist of 8 inches of 1 ¼-inch to 2-inch clean crushed aggregate overlain by 4 inches of hot mix asphalt (HMA). The pavement subgrade should be compacted to a firm condition, then proof rolled using a loaded dump truck prior to placing the crushed rock. Areas observed to pump or weave during the proof roll test should be over-excavated and replaced with crushed rock.

Site Drainage

Surface Drainage: Water should not be allowed to collect in any area where footings are to be constructed. Final site grades should allow for drainage away from the structures. We suggest that the finished ground be sloped at a gradient of three percent minimum for a distance of at least 10 feet away from the structures and site slopes. Surface water should be collected by permanent catch basins and

drain lines and be discharged to a suitable outlet. Surface drains should be maintained separately and not be interconnected with foundation or wall drains. The drains should consist of a minimum 4-inch diameter rigid, slotted, or perforated PVC pipe surrounded by free-draining material wrapped in a filter fabric. The drain should discharge into a tightline leading to an appropriate collection and discharge point with convenient cleanouts.

Subsurface Drainage: If groundwater seepage is encountered or if excessive rainfall or snowmelt occurs during construction, we recommend that the contractor slope the bottom of the excavations and direct the water to ditches and small sump pits. The collected water can then be pumped to a suitable discharge point. We recommend the use of footing drains around structures. Footing drains should be installed at least one foot below planned finished floor elevation. The drains should consist of a minimum 4-inch-diameter, rigid, slotted or perforated, PVC pipe surrounded by free-draining material wrapped in a filter fabric. We recommend that the free-draining material consist of an 18-inch-wide zone of clean (less than three-percent fines), granular material placed along the back of walls, extending up the wall to one foot below finished grade. Washed rock is an acceptable drain material or drainage composite may be used instead. The top foot of soil should consist of low permeability soil placed over plastic sheeting or building paper to minimize the migration of surface water or silt into the footing drain. Footing drains should discharge into tightlines leading to an appropriate collection and discharge point with convenient cleanouts to prolong the useful life of the drains. Roof drains should not be connected to wall or footing drains.

USE OF THIS REPORT

NGA has prepared this report for **Helion Energy**, and their agents, for use in the planning and design of the project planned on this site only. The scope of our work does not include services related to construction safety precautions and our recommendations are not intended to direct the contractors' methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. There are possible variations in subsurface conditions between the explorations and also with time. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions. A contingency for unanticipated conditions should be included in the budget and schedule.

We recommend that NGA be retained to review project plans and consult with the design team during final design. We also recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during

the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this report was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

o-o-o

We appreciate the opportunity to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Chris Ward-Guthrie, GIT
Project Geologist

KHALED M. SHAWISH
STATE OF WASHINGTON
35215
REGISTERED
PROFESSIONAL ENGINEER

11/1/24

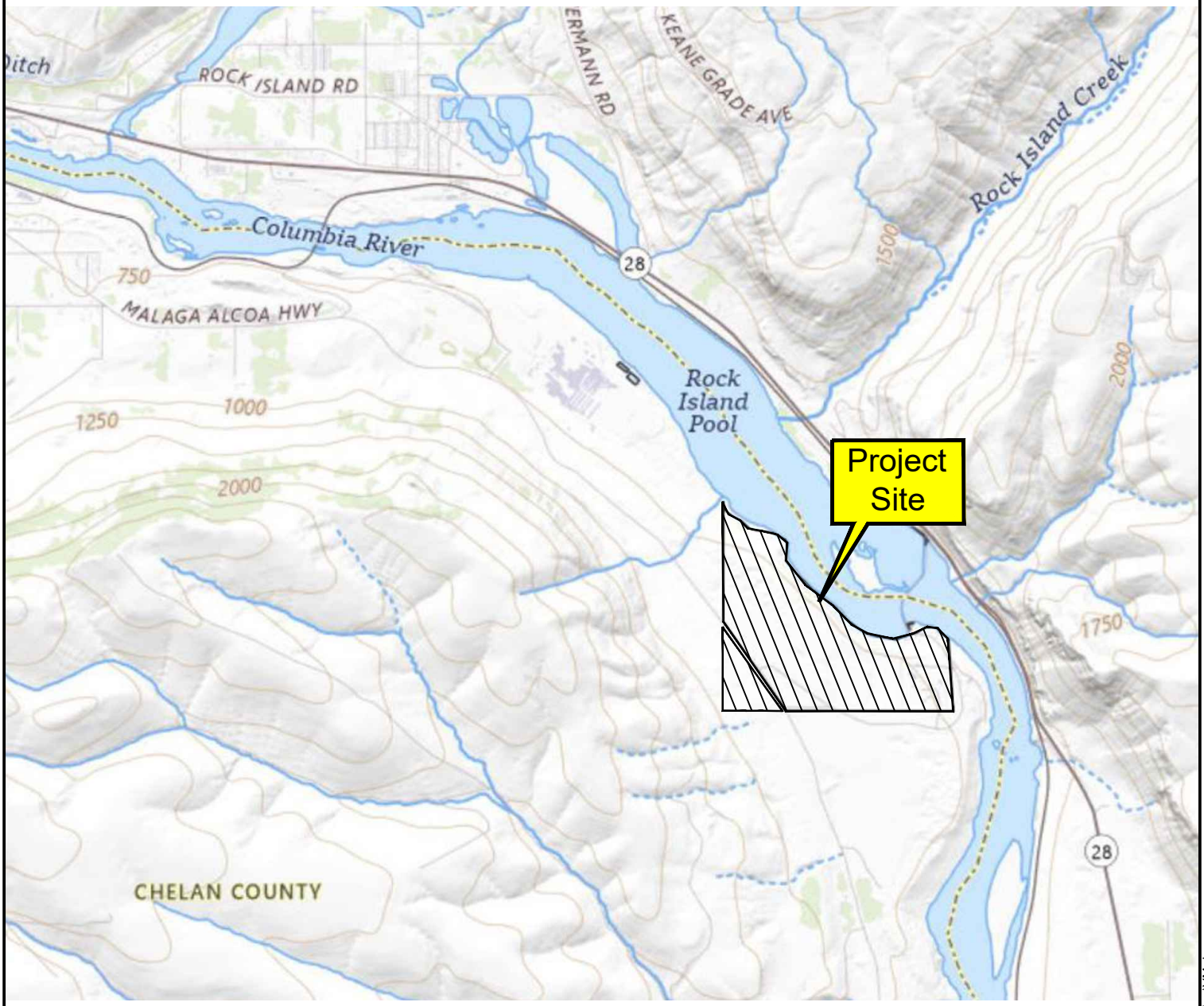
Khaled M. Shawish, PE
Principal

CWG:ABR:KMS:as

Eight Figures Attached

VICINITY MAP

Not to Scale



Chelan County, WA

Project Number 1549124	Helion Energy Power Plant Facility Vicinity Map	NELSON GEOTECHNICAL ASSOCIATES, INC	No.	Date	Revision	By	CK
Figure 1			1	10/17/24	Original	CWG	ABR

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Site Plan

NOT TO SCALE

N

LEGEND

Property line

B-1

Number and approximate location of borings

0 600 1200

Approximate Scale: 1 inch = 600 feet

Reference: Site Plan based on Google Earth imagery, dated June 27, 2022.

Project Number	Helion Energy Power Plant Facility Site Plan	NELSON GEOTECHNICAL ASSOCIATES, INC	No.	Date	Revision	By	CK
1549124			1	10/17/24	Original	CWG	ABR
Figure 2		

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UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE - GRAINED SOILS MORE THAN 50 % RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE - GRAINED SOILS MORE THAN 50 % PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.
2) Soil classification using laboratory tests is based on ASTM D 2488-93.
3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water.

Wet - Visible free water or saturated, usually soil is obtained from below water table

Project Number 1549124	Helion Energy Power Plant Facility Soil Classification Chart	NELSON GEOTECHNICAL ASSOCIATES, INC
Figure 3		

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BORING LOG

B-1

Approximate Ground Surface Elevation:

Logged by: CWG on 10/11/2024

Soil Profile: Description	Graphic Log	Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location (Depth in feet)	Penetration Resistance (Blows/foot - ●) / Moisture Content (Percent - ■) 10 20 30 40 50 50+	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Light brown, GRAVEL with sand and trace silt (very dense, dry)		GM	50-4"				
Gray, GRAVEL with medium to coarse sand (very dense, dry)		GP	85-9"	5			5
- Becomes moist			50-1"	10			10
Dark brown, SILT with some sand (very hard, moist)		ML	50-5"	15			15
- No sample recovery							
Gray, GRAVEL with coarse sand (very dense, moist)		GP	97-9	20			20
- No sample recovery							
Gray, GRAVEL with sand and silt (very dense, moist)		GM	50-4"	25			25
Gray, GRAVEL with coarse sand (very dense, moist)							

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- ✱ Liquid Limit
- \+ Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M	Moisture Content
A	Atterberg Limits
G	Grain-size Analysis
DS	Direct Shear
PP	Pocket Penetrometer Readings, tons/ft
P	Sample Pushed
T	Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Project Number	Helion Energy Power Plant Boring Log
1549124	
Figure 4	
Page 1 of 2	

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BORING LOG

B-1 (cont.)

Logged by: CWG on 10/11/2024

Soil Profile: Description	Graphic Log	Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location (depth in feet)	Penetration Resistance (Blows/foot - ●) / Moisture Content (Percent - ■)	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
- No sample recovery		GP	50-5"				
			50-3"				
- Increasing gravel size - No sample recovery			50-3"				
- No sample recovery			58-12"				
Boring completed at 51.5 feet below existing grade on 10/11/2024. No groundwater seepage was encountered during drilling.							

10 20 30 40 50 50+

35 40 45 50 55

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- ✱ Liquid Limit
- \+ Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M	Moisture Content
A	Atterberg Limits
G	Grain-size Analysis
DS	Direct Shear
PP	Pocket Penetrometer Readings, tons/ft
P	Sample Pushed
T	Triaxial

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Project Number	Helion Energy Power Plant Boring Log
1549124	
Figure 4	
Page 2 of 2	

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BORING LOG

B-2

Approximate Ground Surface Elevation:

Soil Profile			Sample Data		Penetration Resistance (Blows/foot - ●) 10 20 30 40 50 50+ / Moisture Content (Percent - ■) 10 20 30 40 50 50+	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Description	Graphic Log	Group Symbol	Blow Count	Sample Location (Depth in feet)			
Brown, GRAVEL with silty fine sand (very dense, dry)		GM					
- No sample recovery			58	5			5
Brown, GRAVEL with fine sand and silt (very dense, dry)		GM					
- No sample recovery			50-3"	10			10
Brown, GRAVEL with fine sand (very dense, dry)		GP	50-6"	15			15
Brown, GRAVEL with fine silty sand (very dense, dry)		GM	50-4"	20			20
			50-2"	25			25
Boring completed at 25.5 feet below existing grade on 10/11/2024. No groundwater seepage was encountered during drilling.							

Logged by: CWG on 10/11/2024

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LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- Liquid Limit
- Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M	Moisture Content
A	Atterberg Limits
G	Grain-size Analysis
DS	Direct Shear
PP	Pocket Penetrometer Readings, tons/ft
P	Sample Pushed
T	Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Project Number	Helion Energy Power Plant Boring Log
1549124	
Figure 5	
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BORING LOG

B-3

Approximate Ground Surface Elevation:

Logged by: CWG on 10/11/2024

Soil Profile: Description	Graphic Log	Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location (Depth in feet)	Penetration Resistance (Blows/foot - ●) / Moisture Content (Percent - ■) 10 20 30 40 50 50+	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Brown, GRAVEL with silt and sand (very dense, dry)		GM		5			5
- No sample due to severe caving							
Gray, GRAVEL with medium to coarse sand (very dense, dry)		GP	50-3"	10			10
- Little sample recovery							
Gray, silty GRAVEL with sand (very dense, dry)		GM	50-5"	15			15
- Little sample recovery							
Gray, silty GRAVEL (very dense, dry)		GP	50-4"	20			20
Gray, GRAVEL (very dense, moist)		GM	50-2"	25			25
- No sample recovery							
Boring completed at 25.5 feet below existing grade on 10/11/2024. No groundwater seepage was encountered during drilling.							

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- * Liquid Limit
- + Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M	Moisture Content
A	Atterberg Limits
G	Grain-size Analysis
DS	Direct Shear
PP	Pocket Penetrometer Readings, tons/ft
P	Sample Pushed
T	Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Project Number	Helion Energy Power Plant Boring Log
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Figure 6	
Page 1 of 1	

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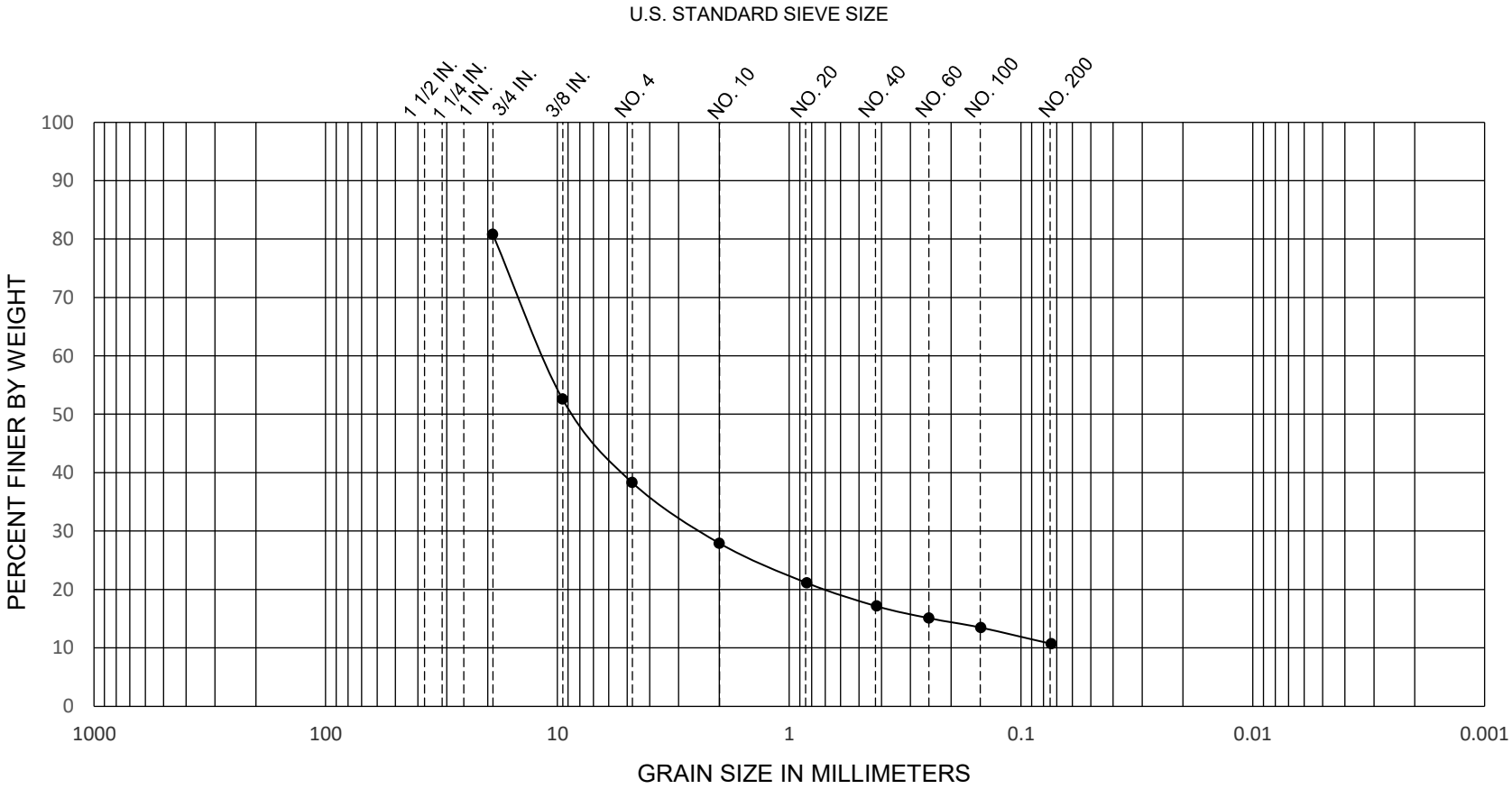

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

USCS SYMBOL	EXPLORATION NUMBER	SAMPLE DEPTH	SOIL DESCRIPTION	SOIL DISTRIBUTION
GP-GM	B-3	20.0 feet	Grey, poorly graded GRAVEL with some sand and trace silt	Gravel = 61.7% Sand = 27.6% Fines = 10.7%

Helion Energy Power Plant Facility
Infiltration Sieve Analysis

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Project Number
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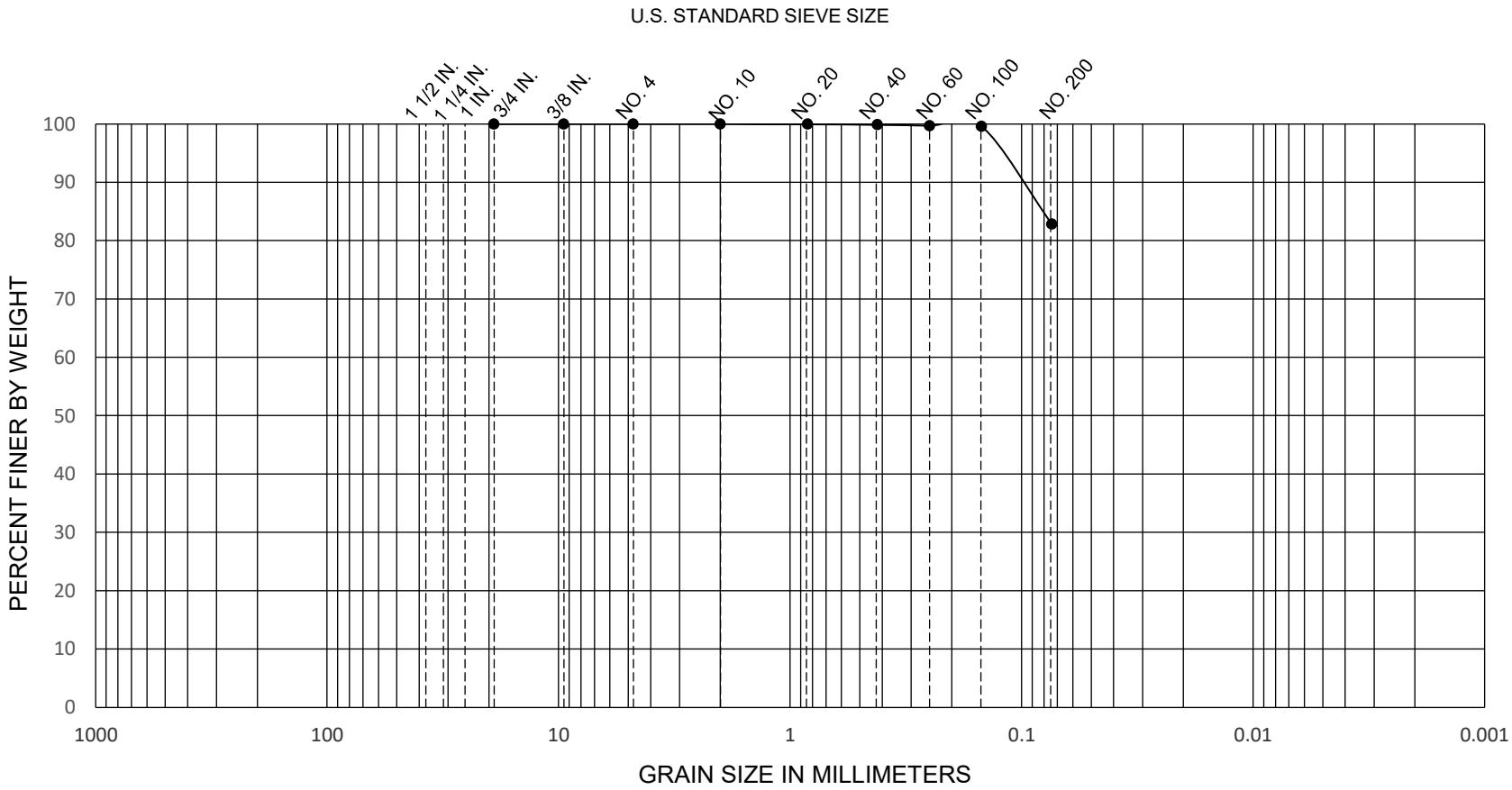
Figure 7



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

USCS SYMBOL	EXPLORATION NUMBER	SAMPLE DEPTH	SOIL DESCRIPTION	SOIL DISTRIBUTION
ML	B-1	13.0 feet	Dark brown, SILT with some sand	Gravel = 0.0% Sand = 17.2% Fines = 82.8%

Helion Energy Power Plant Facility
Sieve Analysis

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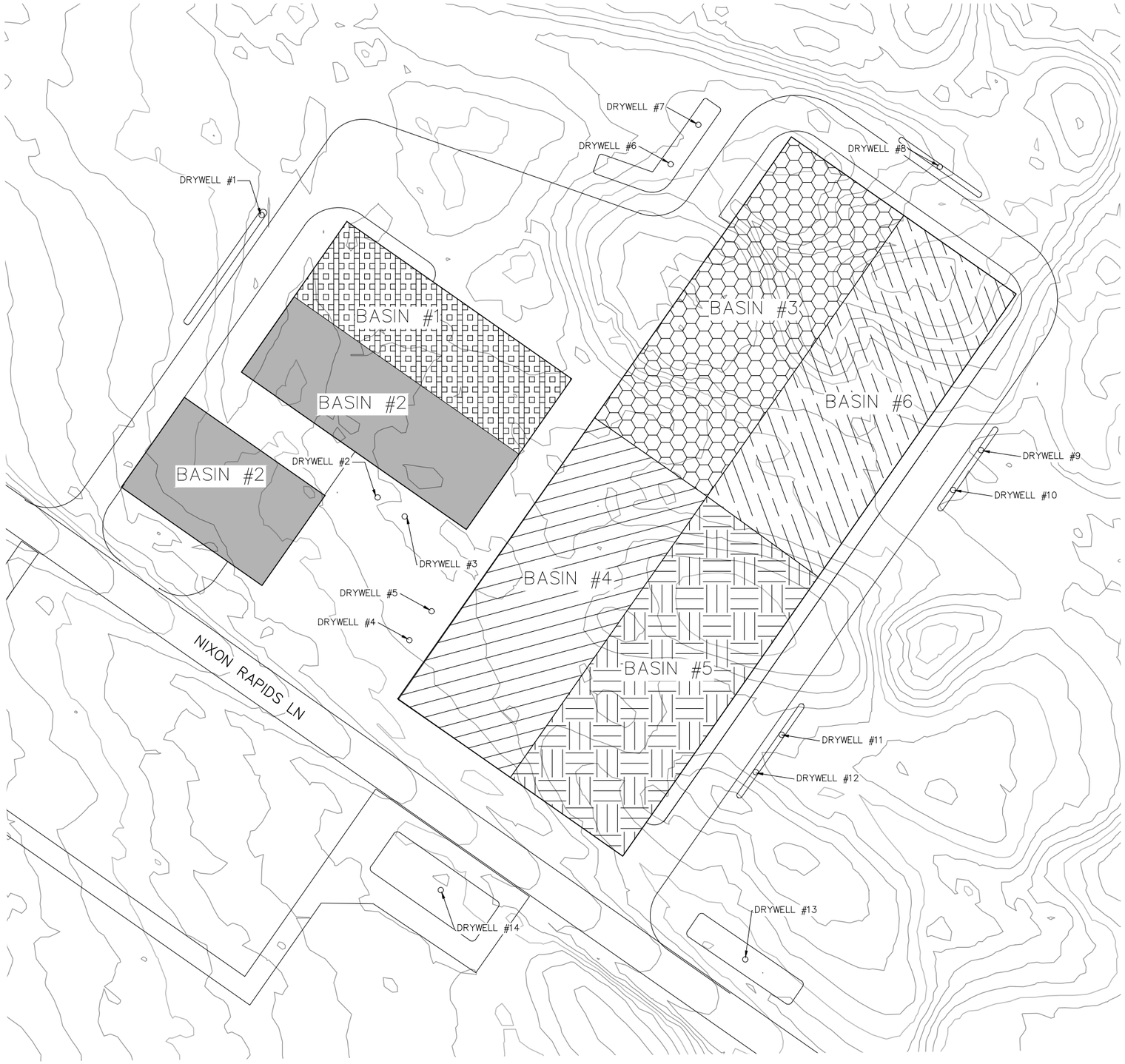
Figure 8

APPENDIX C – STORMWATER FACILITY CALCULATIONS



N

80 40 0 80 160

SCALE IN FEET

LEGEND:

BASIN #1
IMPERVIOUS SURFACE
13,400 SF, 0.86 AC
ROUTED TO DRYWELL #1

BASIN #2
IMPERVIOUS SURFACE
20,264 SF, 0.465 AC
ROUTED TO DRYWELL #2 AND #3

BASIN #3
FUTURE IMPERVIOUS SURFACE
(PHASE 2)
25,000 SF, 0.57 AC
ROUTED TO DRYWELL #6 AND #7

BASIN #4
FUTURE IMPERVIOUS SURFACE
(PHASE 2)
25,000 SF, 0.57 AC
ROUTED TO DRYWELL #4 AND #5

BASIN #5
FUTURE IMPERVIOUS SURFACE
(PHASE 2)
25,000 SF, 0.57 AC
ROUTED TO DRYWELL #11 AND #12

BASIN #6
FUTURE IMPERVIOUS SURFACE
(PHASE 2)
25,000 SF, 0.57 AC
ROUTED TO DRYWELL #9 AND #10

No.	DATE	BY	REVISION

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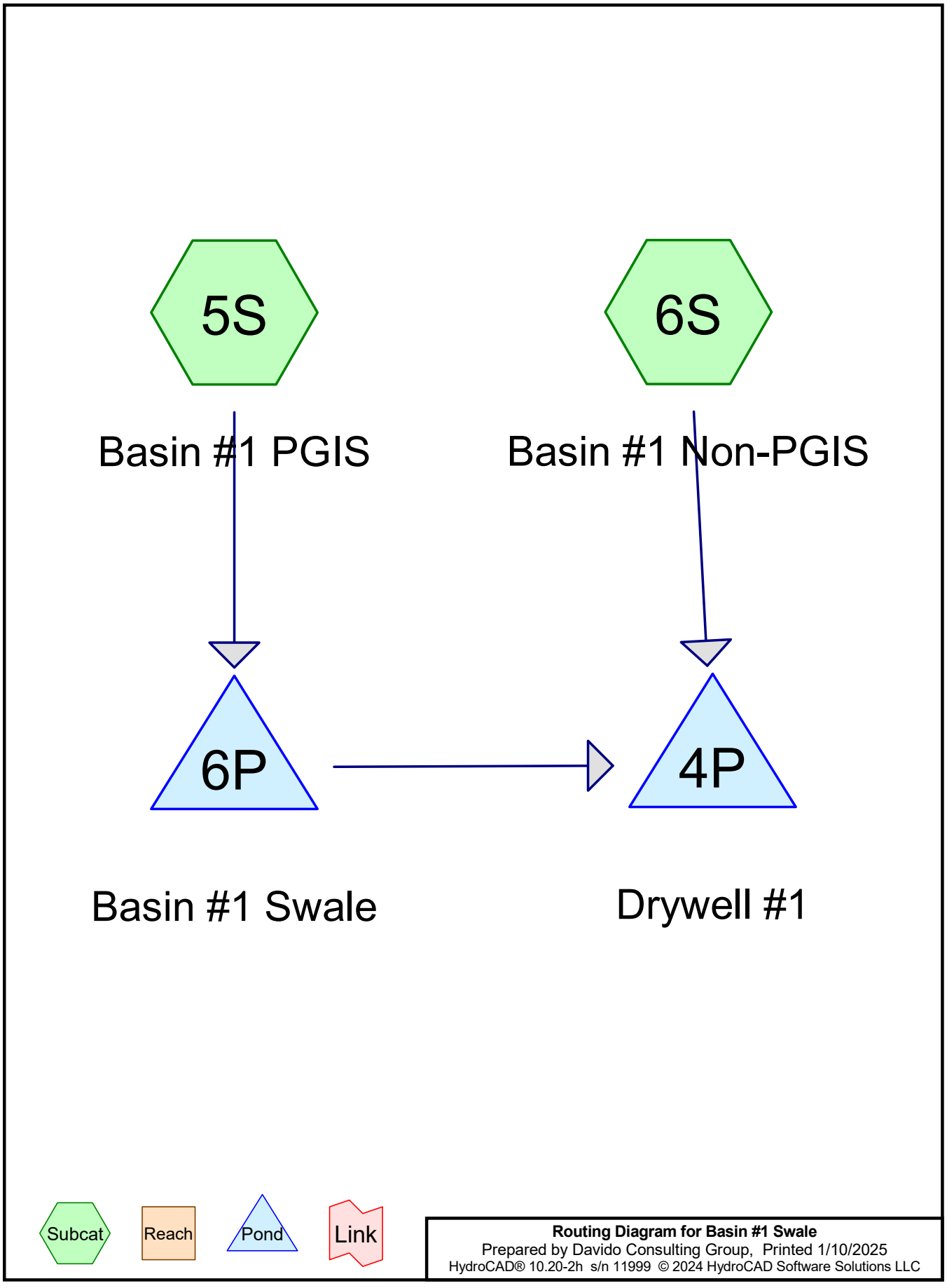
ROOF/NON-PGIS BASINS GRAPHIC

SCALE: 1" = 80'

DATE: 11/13/2024



Routing Diagram for Basin #1 Swale
Prepared by Davido Consulting Group, Printed 1/10/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.308	98	Half of Assembly Building Roof (6S)
0.017	98	Off-Site PGIS (5S)
0.157	98	On-Site PGIS (5S)
0.482	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.482	Other	5S, 6S
0.482		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.308	0.308	Half of Assembly Building Roof	6S
0.000	0.000	0.000	0.000	0.017	0.017	Off-Site PGIS	5S
0.000	0.000	0.000	0.000	0.157	0.157	On-Site PGIS	5S
0.000	**0.000**	**0.000**	**0.000**	**0.482**	**0.482**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Basin #1 PGIS Runoff Area=7,579 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.10 cfs 0.033 af

Subcatchment 6S: Basin #1 Non-PGIS Runoff Area=13,400 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.18 cfs 0.058 af

Pond 4P: Drywell #1 Peak Elev=99.44' Storage=0.010 af Inflow=0.18 cfs 0.058 af
Outflow=0.06 cfs 0.058 af

Pond 6P: Basin #1 Swale Peak Elev=100.22' Storage=0.003 af Inflow=0.10 cfs 0.033 af
Discarded=0.04 cfs 0.033 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.033 af

Total Runoff Area = 0.482 ac Runoff Volume = 0.091 af Average Runoff Depth = 2.27"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.482 ac

Summary for Subcatchment 5S: Basin #1 PGIS

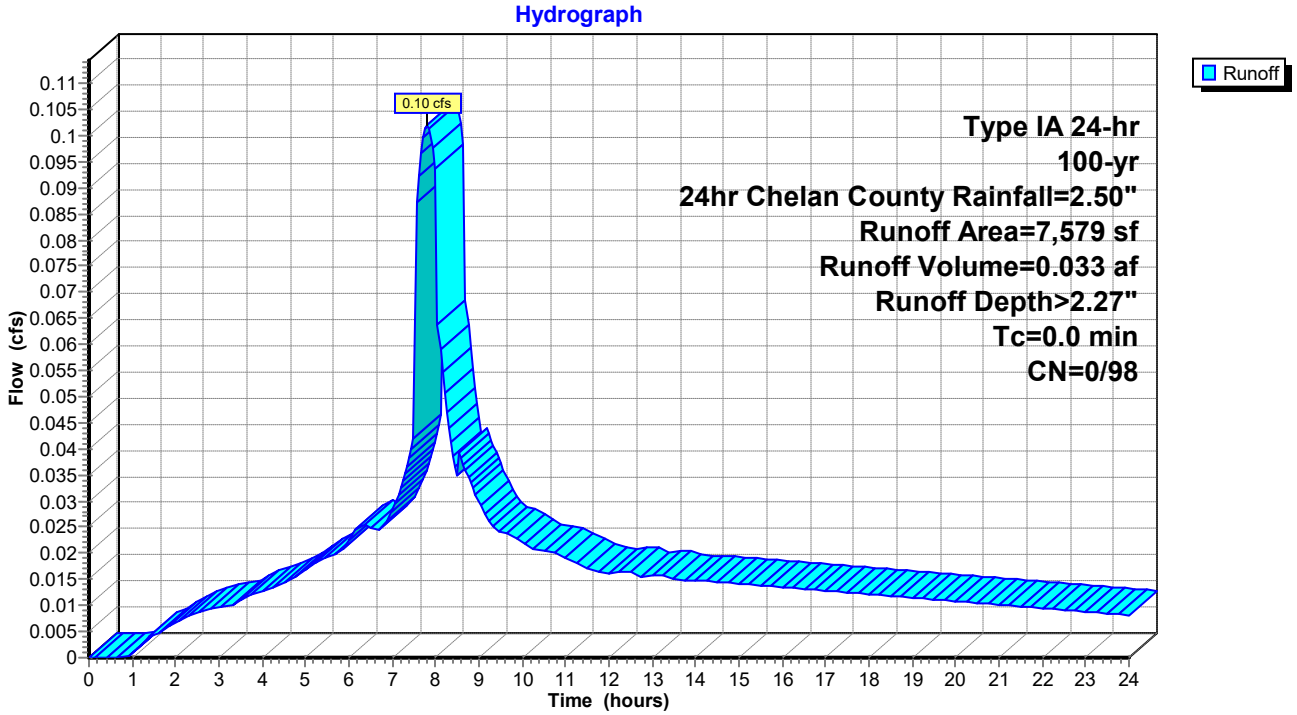
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.10 cfs @ 7.81 hrs, Volume= 0.033 af, Depth> 2.27"
Routed to Pond 6P : Basin #1 Swale

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	6,822	98	On-Site PGIS
*	757	98	Off-Site PGIS
	7,579	98	Weighted Average
	7,579	98	100.00% Impervious Area

Subcatchment 5S: Basin #1 PGIS



Summary for Subcatchment 6S: Basin #1 Non-PGIS

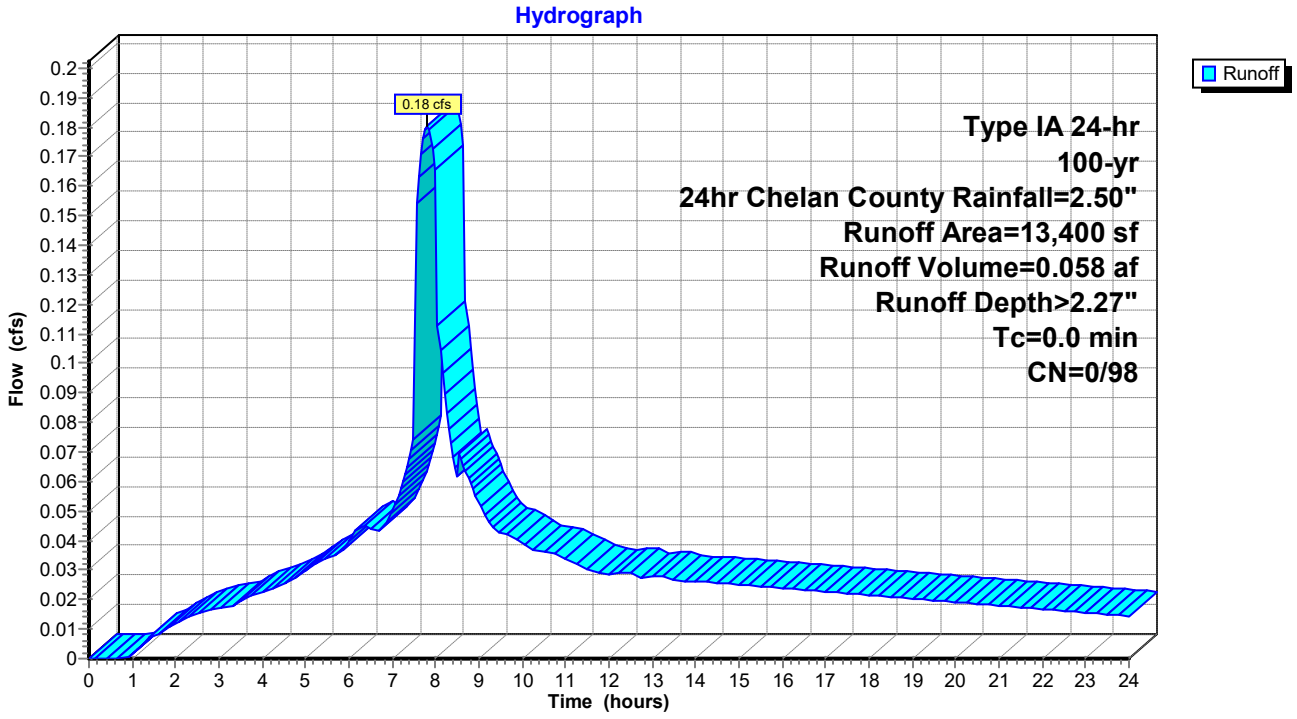
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.18 cfs @ 7.81 hrs, Volume= 0.058 af, Depth> 2.27"
Routed to Pond 4P : Drywell #1

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	13,400	98	Half of Assembly Building Roof
	13,400	98	100.00% Impervious Area

Subcatchment 6S: Basin #1 Non-PGIS



Summary for Pond 4P: Drywell #1

Inflow Area = 0.482 ac,100.00% Impervious, Inflow Depth > 1.45" for 100-yr, 24hr Chelan County event
Inflow = 0.18 cfs @ 7.81 hrs, Volume= 0.058 af
Outflow = 0.06 cfs @ 8.88 hrs, Volume= 0.058 af, Atten= 69%, Lag= 64.3 min
Discarded = 0.06 cfs @ 8.88 hrs, Volume= 0.058 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 99.44' @ 8.88 hrs Surf.Area= 0.006 ac Storage= 0.010 af

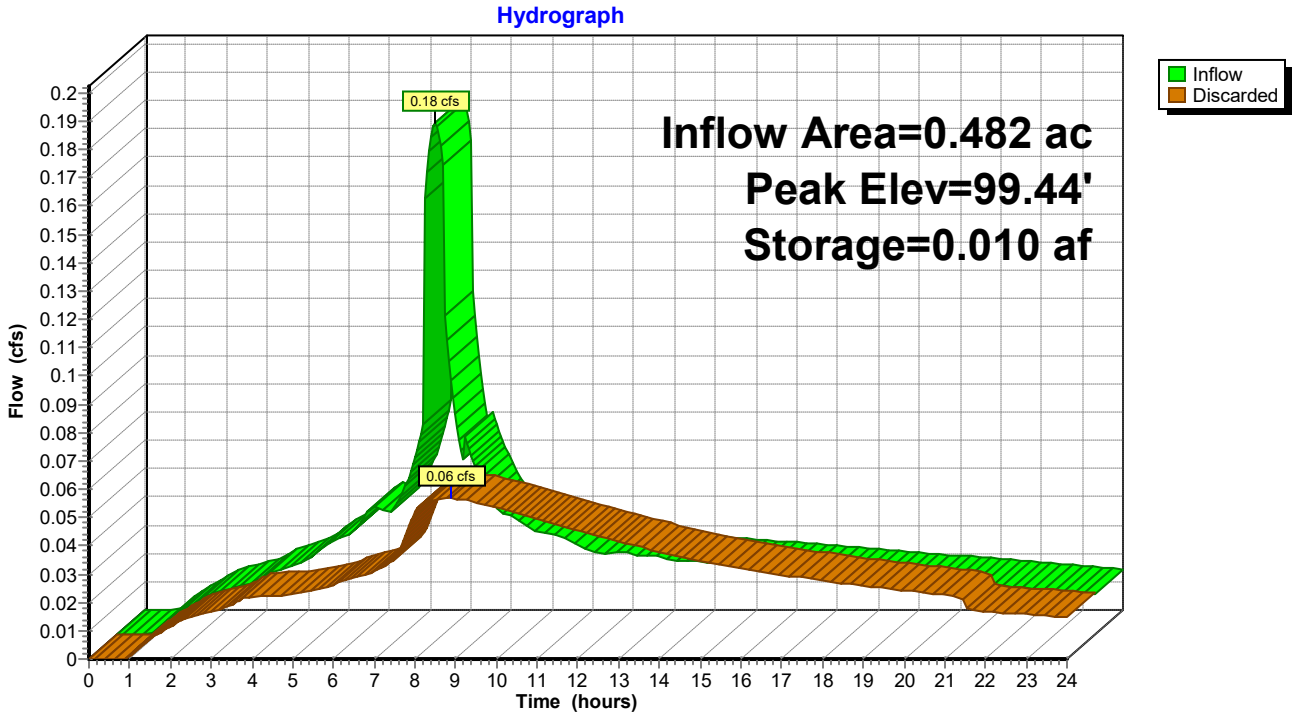
Plug-Flow detention time= 70.5 min calculated for 0.058 af (100% of inflow)
Center-of-Mass det. time= 69.7 min (738.5 - 668.8)

Volume	Invert	Avail.Storage	Storage Description
#1	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #2 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#2	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
		0.013 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	92.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00'

Discarded OutFlow Max=0.06 cfs @ 8.88 hrs HW=99.44' (Free Discharge)
1=Exfiltration (Controls 0.06 cfs)

Pond 4P: Drywell #1



Summary for Pond 6P: Basin #1 Swale

Inflow Area = 0.174 ac,100.00% Impervious, Inflow Depth > 2.27" for 100-yr, 24hr Chelan County event
Inflow = 0.10 cfs @ 7.81 hrs, Volume= 0.033 af
Outflow = 0.04 cfs @ 8.29 hrs, Volume= 0.033 af, Atten= 56%, Lag= 29.1 min
Discarded = 0.04 cfs @ 8.29 hrs, Volume= 0.033 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 4P : Drywell #1

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 100.22' @ 8.29 hrs Surf.Area= 0.015 ac Storage= 0.003 af

Plug-Flow detention time= 13.4 min calculated for 0.033 af (100% of inflow)
Center-of-Mass det. time= 12.1 min (680.9 - 668.8)

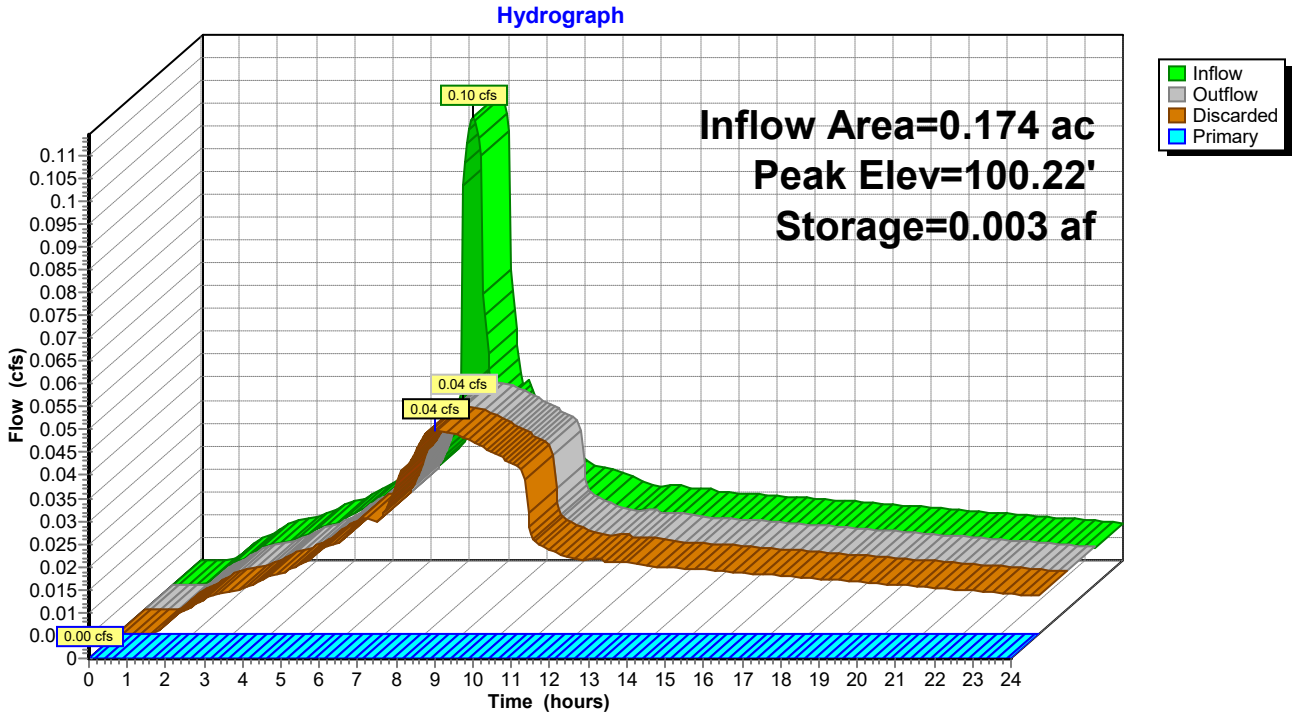
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	0.054 af	**5.00'W x 100.00'L x 2.00'H Prismatoid Z=3.0**

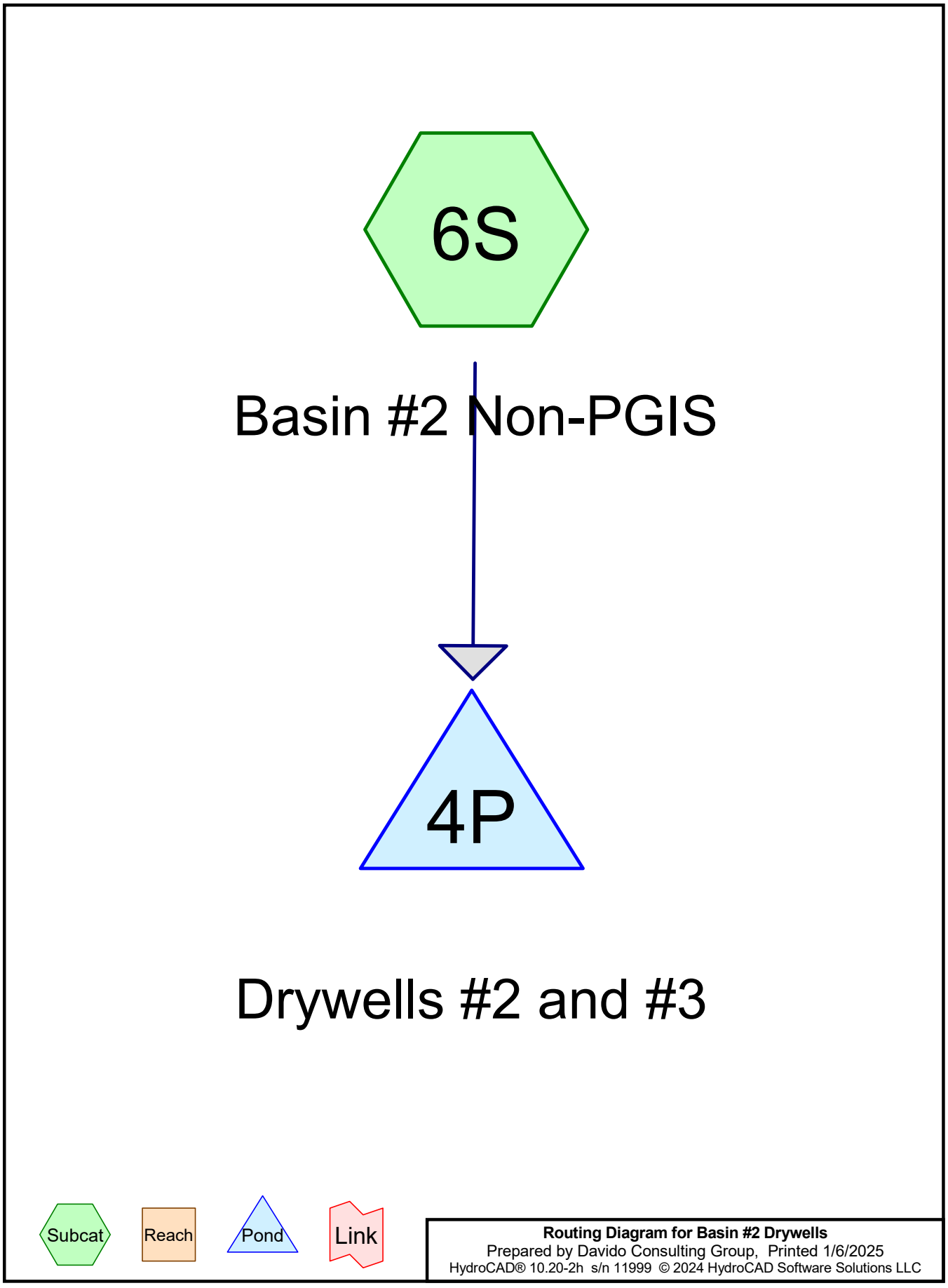
Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	100.50'	**5.0" Horiz. Orifice/Grate X 7.00 columns** X 7 rows C= 0.600 in 48.0" Grate (53% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 8.29 hrs HW=100.22' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=100.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Basin #1 Swale





Routing Diagram for Basin #2 Drywells
Prepared by Davido Consulting Group, Printed 1/6/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.465	98	Half Assembly Roof + Office Roof (6S)
0.465	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.465	Other	6S
0.465		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchmer Numbers
0.000	0.000	0.000	0.000	0.465	0.465	Half Assembly Roof + Office Roof	
0.000	**0.000**	**0.000**	**0.000**	**0.465**	**0.465**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Basin #2 Non-PGIS Runoff Area=20,264 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.27 cfs 0.088 af

Pond 4P: Drywells #2 and #3 Peak Elev=97.53' Storage=0.013 af Inflow=0.27 cfs 0.088 af
Outflow=0.09 cfs 0.088 af

Total Runoff Area = 0.465 ac Runoff Volume = 0.088 af Average Runoff Depth = 2.27"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.465 ac

Summary for Subcatchment 6S: Basin #2 Non-PGIS

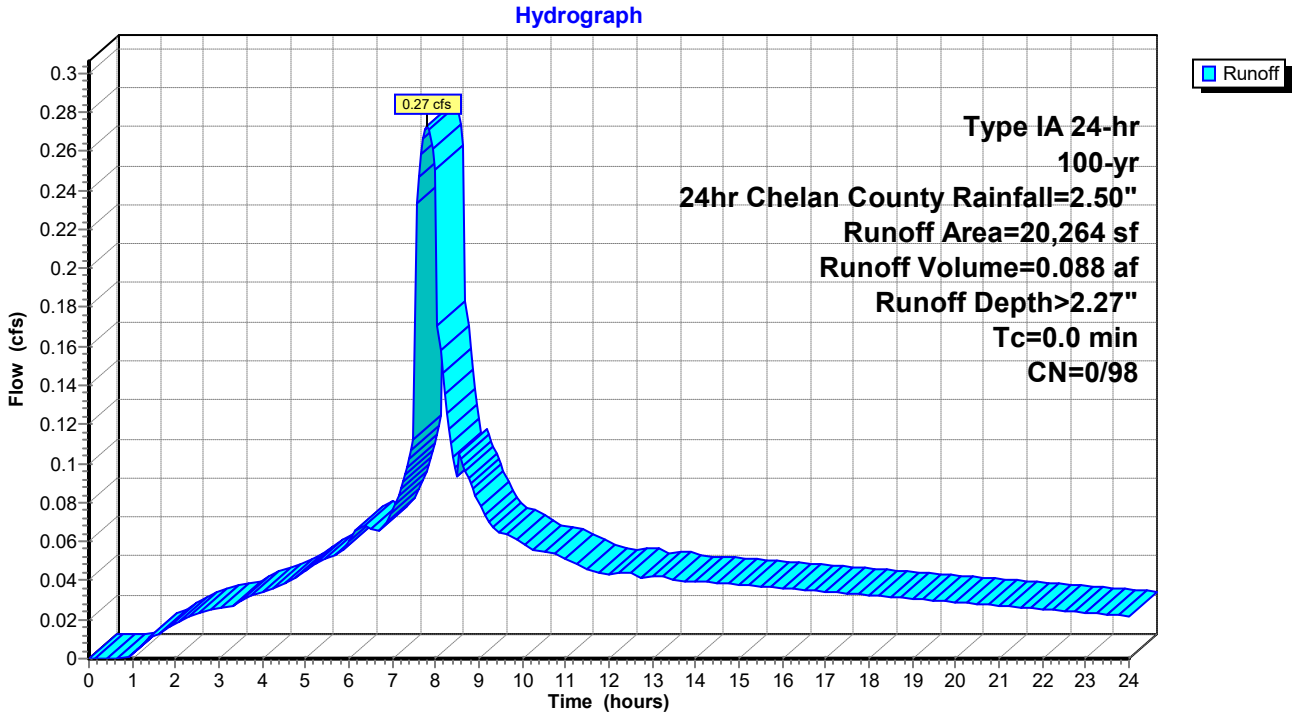
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.27 cfs @ 7.81 hrs, Volume= 0.088 af, Depth> 2.27"
Routed to Pond 4P : Drywells #2 and #3

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	20,264	98	Half Assembly Roof + Office Roof
	20,264	98	100.00% Impervious Area

Subcatchment 6S: Basin #2 Non-PGIS



Summary for Pond 4P: Drywells #2 and #3

Inflow Area = 0.465 ac,100.00% Impervious, Inflow Depth > 2.27" for 100-yr, 24hr Chelan County event
Inflow = 0.27 cfs @ 7.81 hrs, Volume= 0.088 af
Outflow = 0.09 cfs @ 8.79 hrs, Volume= 0.088 af, Atten= 67%, Lag= 58.7 min
Discarded = 0.09 cfs @ 8.79 hrs, Volume= 0.088 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 97.53' @ 8.79 hrs Surf.Area= 0.010 ac Storage= 0.013 af

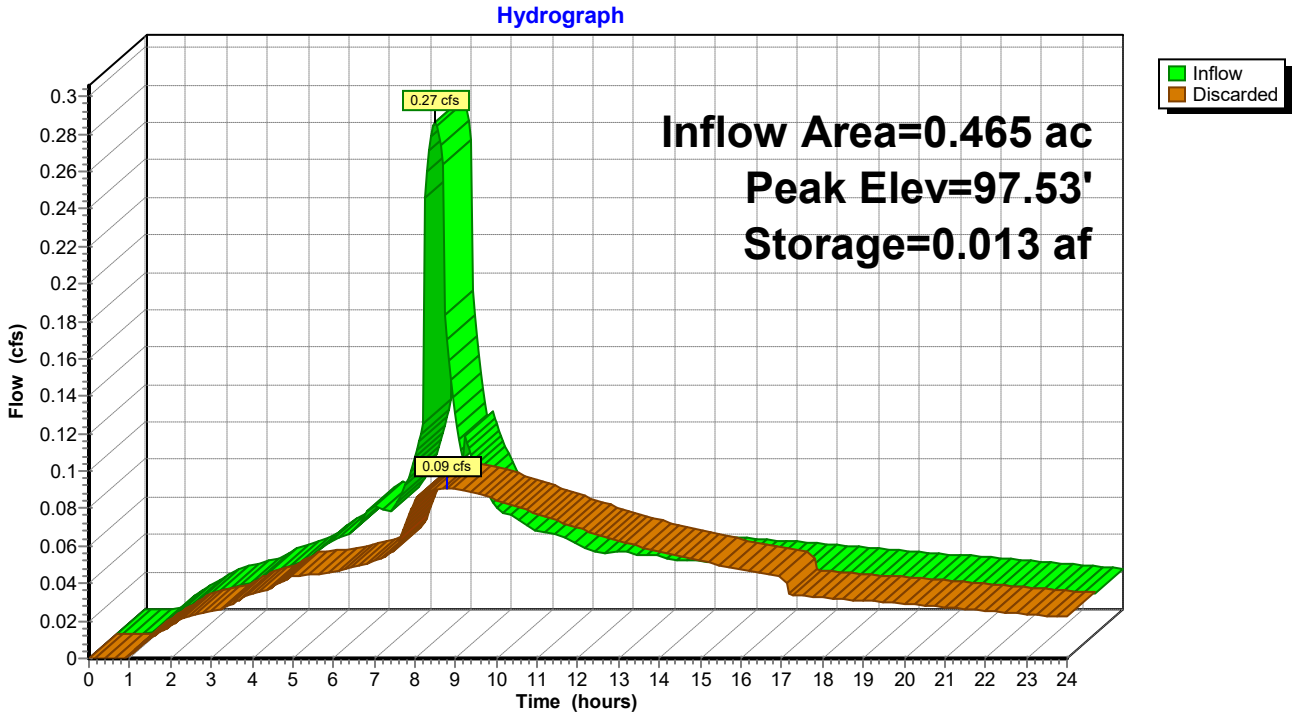
Plug-Flow detention time= 46.0 min calculated for 0.088 af (100% of inflow)
Center-of-Mass det. time= 45.2 min (714.0 - 668.8)

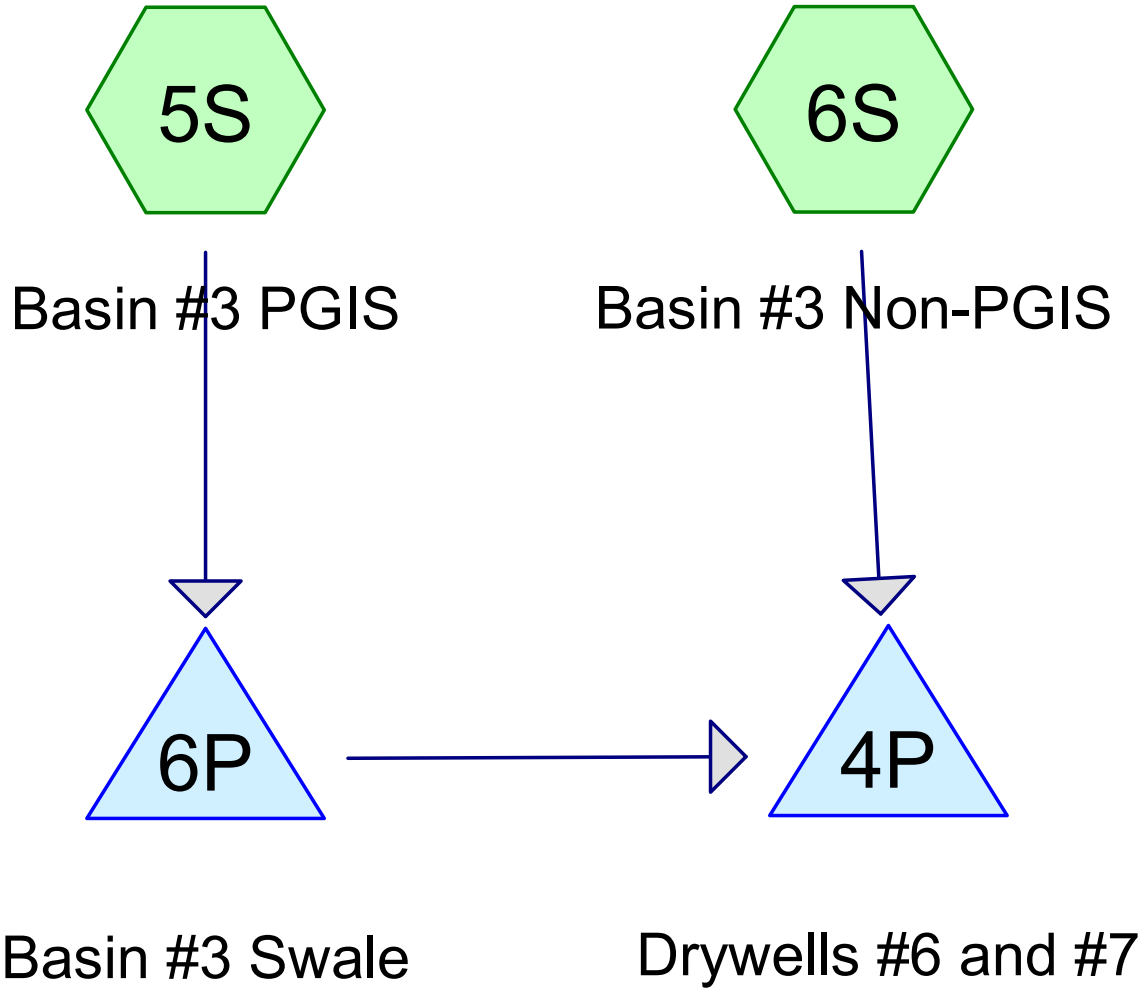
Volume	Invert	Avail.Storage	Storage Description
#1	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #3 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#2	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #4 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#3	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
#4	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
		0.025 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	92.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00'

Discarded OutFlow Max=0.09 cfs @ 8.79 hrs HW=97.53' (Free Discharge)
↑**1=Exfiltration** (Controls 0.09 cfs)

Pond 4P: Drywells #2 and #3





Subcat Reach Pond Link

Routing Diagram for Basin #3 Swale
Prepared by Davido Consulting Group, Printed 1/10/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.574	98	25% of Future Building (6S)
0.721	98	On-Site PGIS (5S)
1.295	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
1.295	Other	5S, 6S
1.295		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.574	0.574	25% of Future Building	6S
0.000	0.000	0.000	0.000	0.721	0.721	On-Site PGIS	5S
0.000	**0.000**	**0.000**	**0.000**	**1.295**	**1.295**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Basin #3 PGIS Runoff Area=31,416 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.42 cfs 0.136 af

Subcatchment 6S: Basin #3 Non-PGIS Runoff Area=25,000 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.34 cfs 0.109 af

Pond 4P: Drywells #6 and #7 Peak Elev=98.94' Storage=0.019 af Inflow=0.34 cfs 0.109 af
Outflow=0.11 cfs 0.109 af

Pond 6P: Basin #3 Swale Peak Elev=100.37' Storage=0.016 af Inflow=0.42 cfs 0.136 af
Discarded=0.14 cfs 0.136 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.136 af

Total Runoff Area = 1.295 ac Runoff Volume = 0.245 af Average Runoff Depth = 2.27"
0.00% Pervious = 0.000 ac 100.00% Impervious = 1.295 ac

Summary for Subcatchment 5S: Basin #3 PGIS

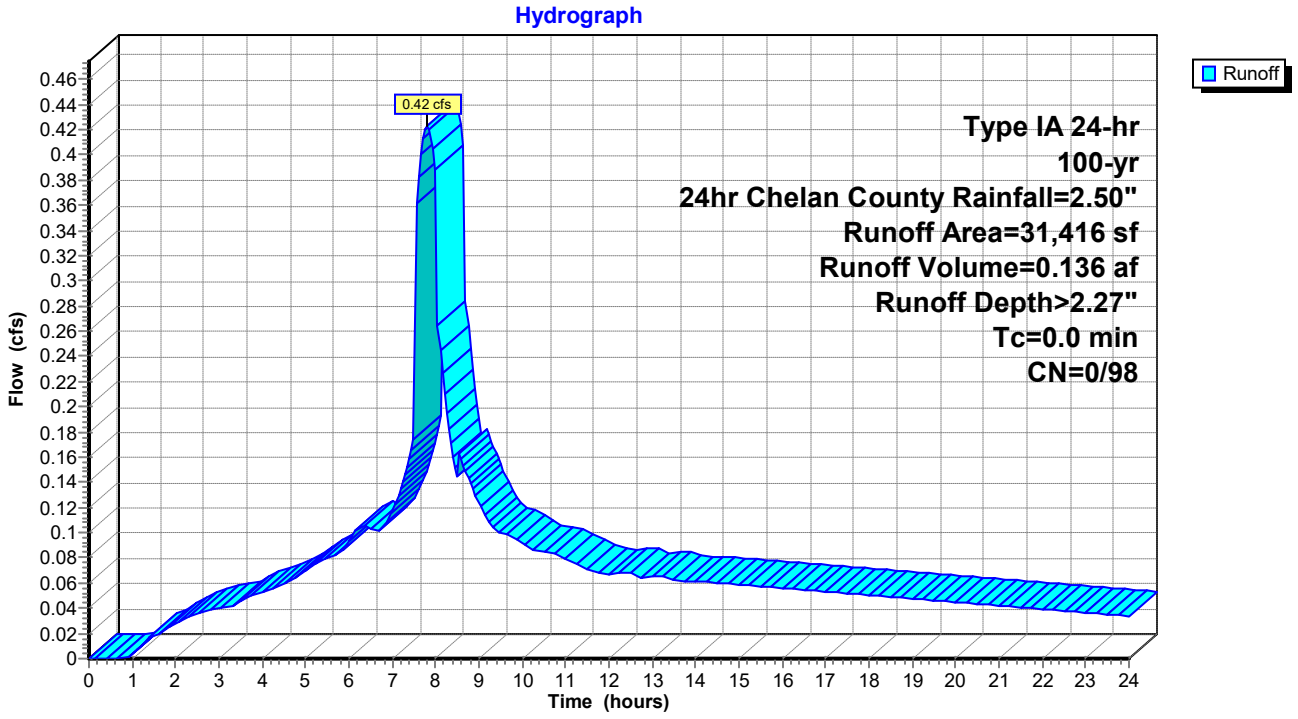
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.42 cfs @ 7.81 hrs, Volume= 0.136 af, Depth> 2.27"
Routed to Pond 6P : Basin #3 Swale

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	31,416	98	On-Site PGIS
	31,416	98	100.00% Impervious Area

Subcatchment 5S: Basin #3 PGIS



Summary for Subcatchment 6S: Basin #3 Non-PGIS

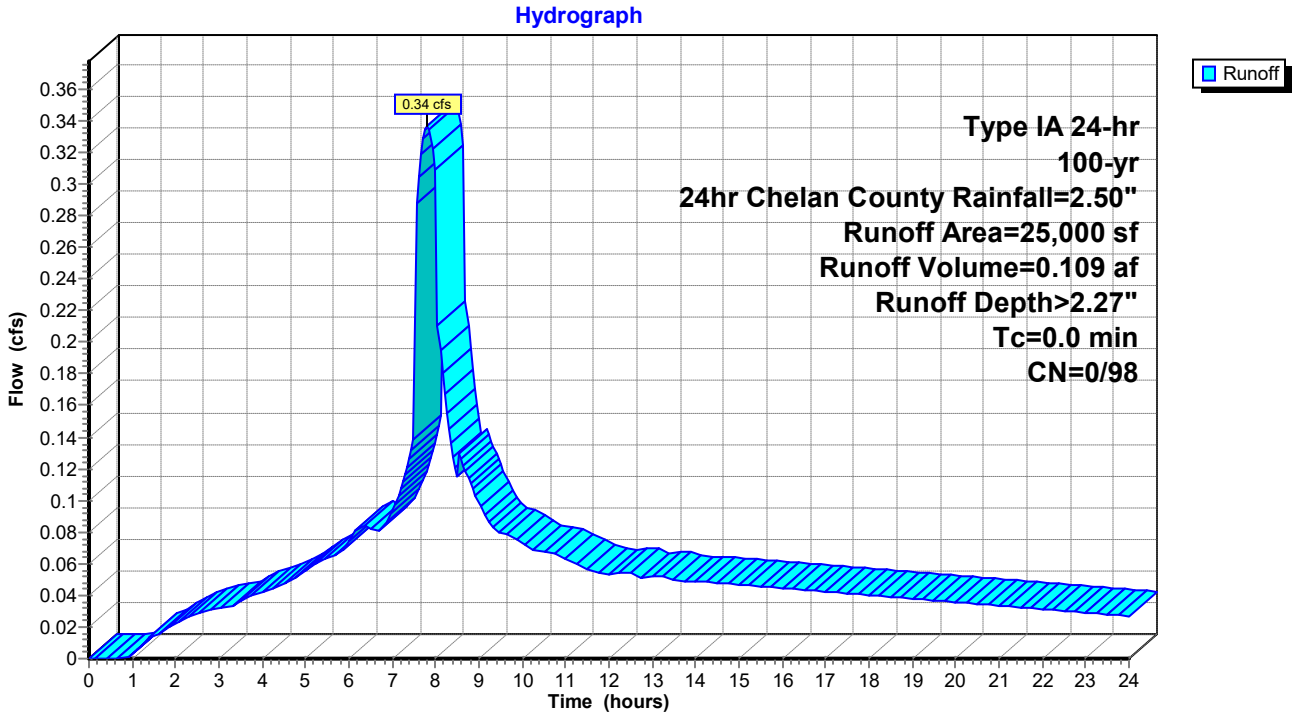
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.34 cfs @ 7.81 hrs, Volume= 0.109 af, Depth> 2.27"
Routed to Pond 4P : Drywells #6 and #7

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	25,000	98	25% of Future Building
	25,000	98	100.00% Impervious Area

Subcatchment 6S: Basin #3 Non-PGIS



Summary for Pond 4P: Drywells #6 and #7

Inflow Area = 1.295 ac,100.00% Impervious, Inflow Depth > 1.01" for 100-yr, 24hr Chelan County event
Inflow = 0.34 cfs @ 7.81 hrs, Volume= 0.109 af
Outflow = 0.11 cfs @ 8.86 hrs, Volume= 0.109 af, Atten= 68%, Lag= 63.0 min
Discarded = 0.11 cfs @ 8.86 hrs, Volume= 0.109 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 98.94' @ 8.86 hrs Surf.Area= 0.012 ac Storage= 0.019 af

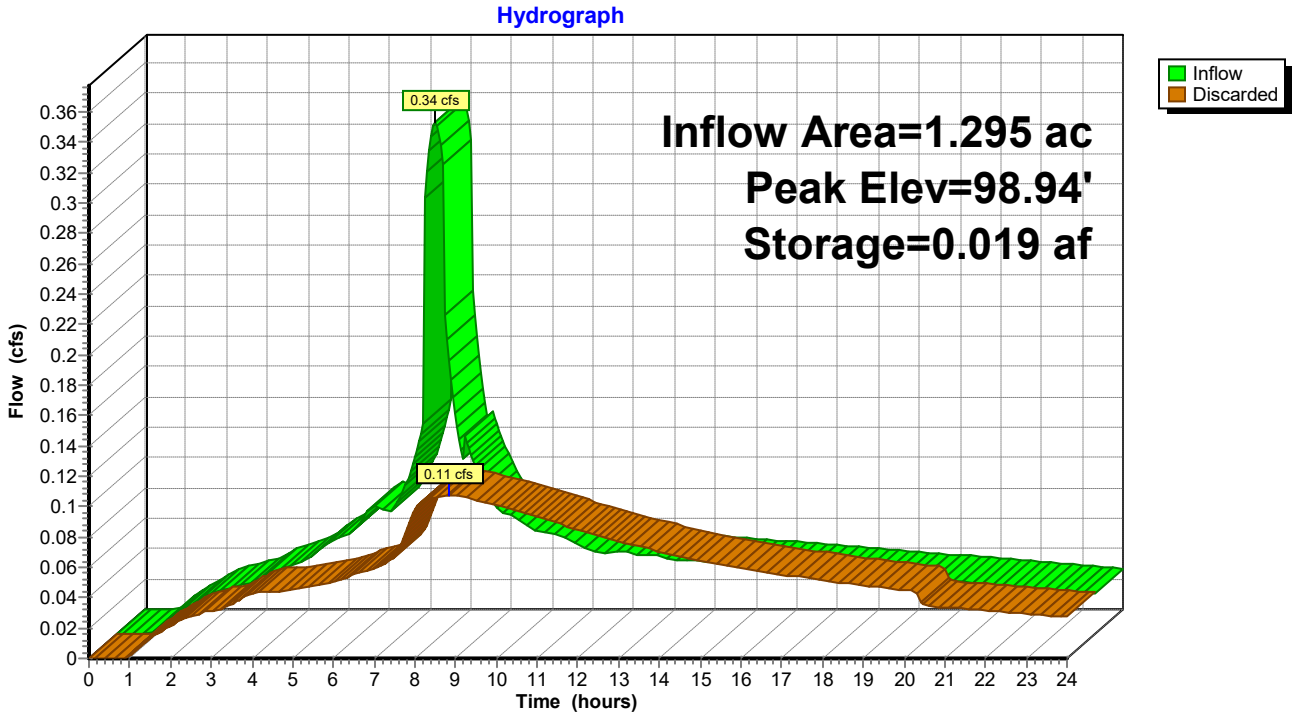
Plug-Flow detention time= 63.7 min calculated for 0.109 af (100% of inflow)
Center-of-Mass det. time= 63.1 min (731.9 - 668.8)

Volume	Invert	Avail.Storage	Storage Description
#1	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #3 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#2	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #4 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#3	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
#4	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
		0.025 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	92.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00'

Discarded OutFlow Max=0.11 cfs @ 8.86 hrs HW=98.94' (Free Discharge)
1=Exfiltration (Controls 0.11 cfs)

Pond 4P: Drywells #6 and #7



Summary for Pond 6P: Basin #3 Swale

Inflow Area = 0.721 ac,100.00% Impervious, Inflow Depth > 2.27" for 100-yr, 24hr Chelan County event
Inflow = 0.42 cfs @ 7.81 hrs, Volume= 0.136 af
Outflow = 0.14 cfs @ 8.78 hrs, Volume= 0.136 af, Atten= 67%, Lag= 58.1 min
Discarded = 0.14 cfs @ 8.78 hrs, Volume= 0.136 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 4P : Drywells #6 and #7

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 100.37' @ 8.78 hrs Surf.Area= 0.047 ac Storage= 0.016 af

Plug-Flow detention time= 28.9 min calculated for 0.136 af (99% of inflow)
Center-of-Mass det. time= 26.3 min (695.1 - 668.8)

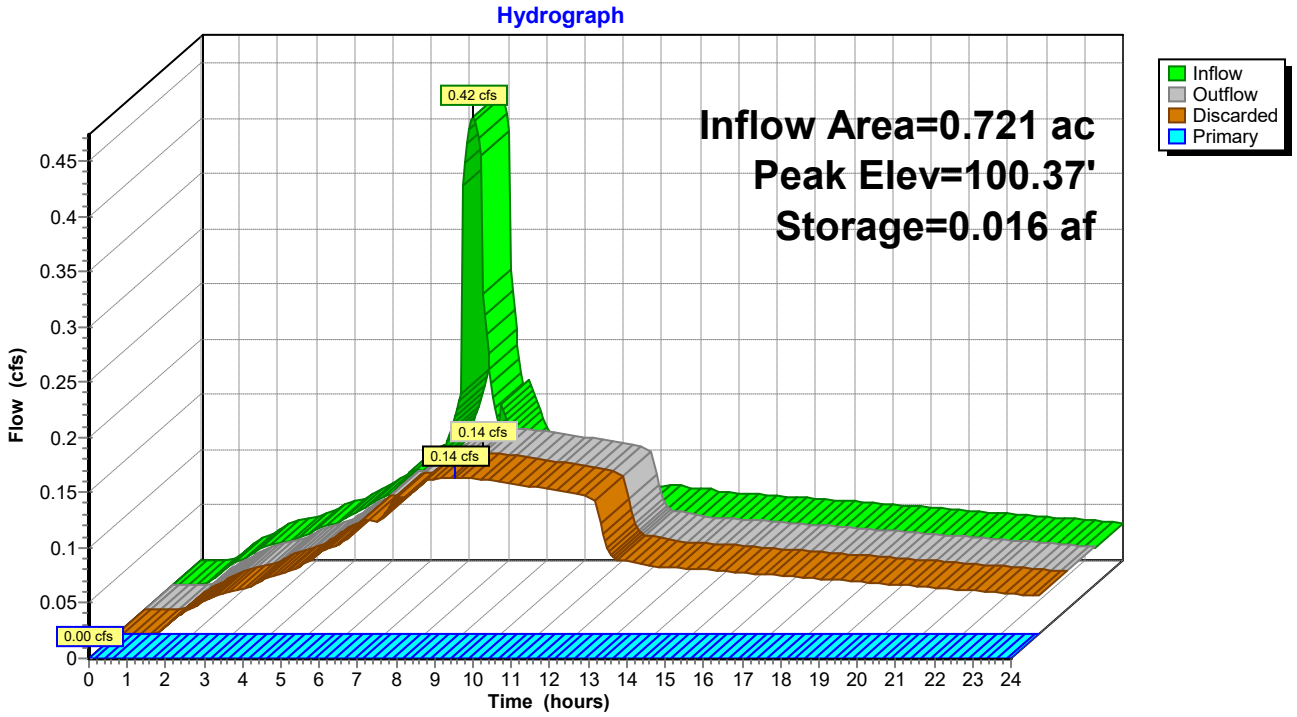
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	0.322 af	**15.00'W x 116.00'L x 4.00'H Prismatoid Z=3.0**

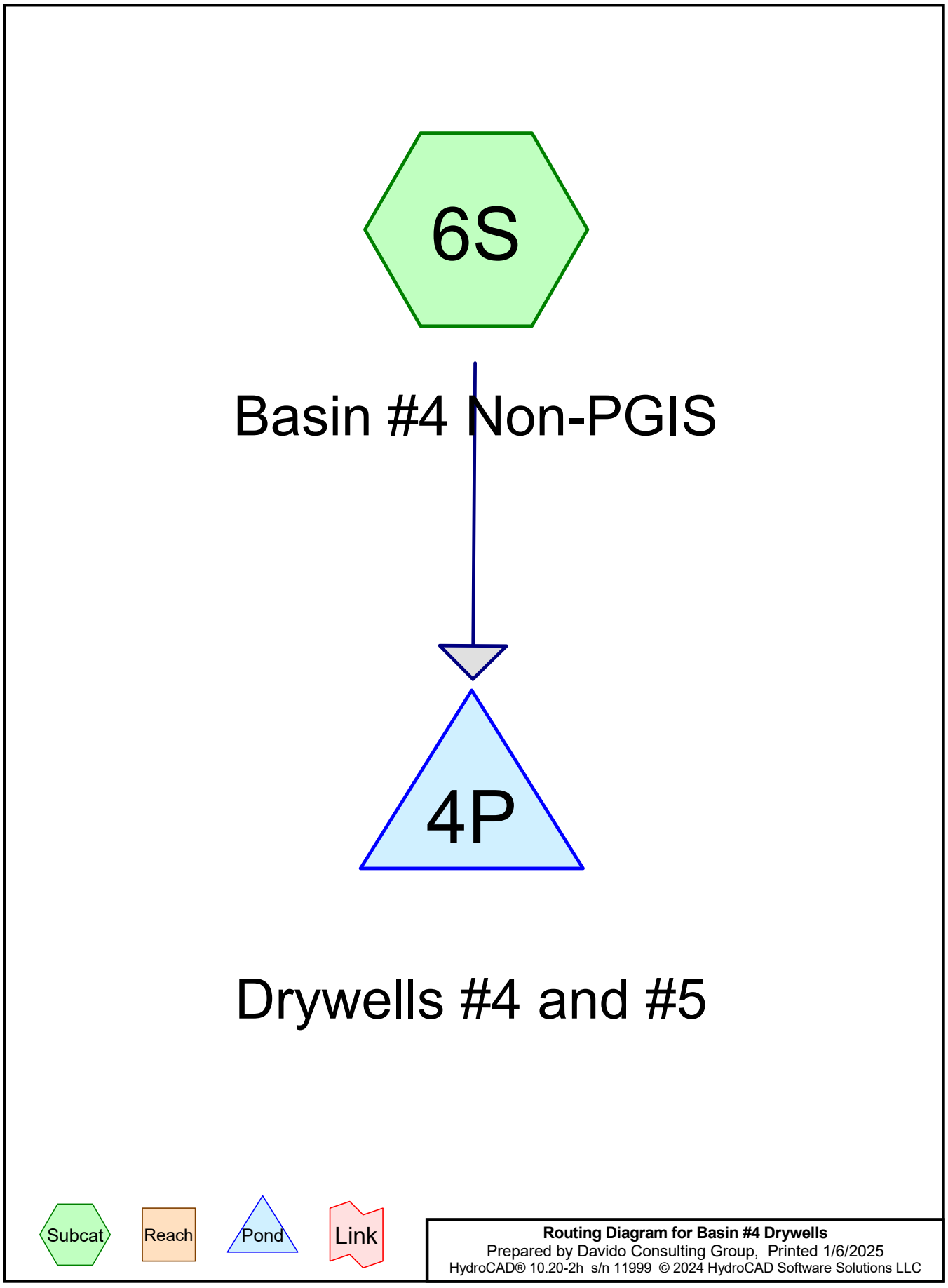
Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	100.50'	**5.0" Horiz. Orifice/Grate X 7.00 columns** X 7 rows C= 0.600 in 48.0" Grate (53% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.14 cfs @ 8.78 hrs HW=100.37' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=100.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Basin #3 Swale





Routing Diagram for Basin #4 Drywells
Prepared by Davido Consulting Group, Printed 1/6/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.574	98	25% of Future Building (6S)
0.574	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.574	Other	6S
0.574		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.574	0.574	25% of Future Building	6S
0.000	**0.000**	**0.000**	**0.000**	**0.574**	**0.574**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Basin #4 Non-PGIS Runoff Area=25,000 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.34 cfs 0.109 af

Pond 4P: Drywells #4 and #5 Peak Elev=98.94' Storage=0.019 af Inflow=0.34 cfs 0.109 af
Outflow=0.11 cfs 0.109 af

Total Runoff Area = 0.574 ac Runoff Volume = 0.109 af Average Runoff Depth = 2.27"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.574 ac

Summary for Subcatchment 6S: Basin #4 Non-PGIS

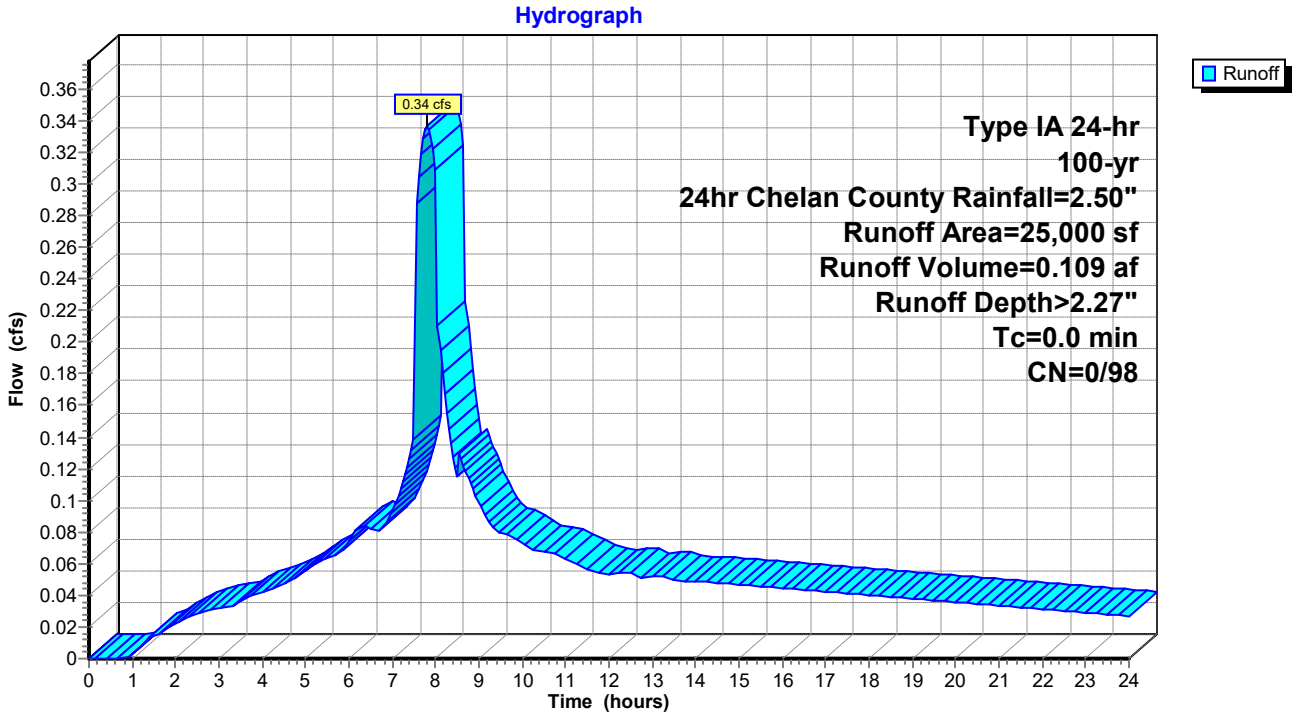
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.34 cfs @ 7.81 hrs, Volume= 0.109 af, Depth> 2.27"
Routed to Pond 4P : Drywells #4 and #5

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	25,000	98	25% of Future Building
	25,000	98	100.00% Impervious Area

Subcatchment 6S: Basin #4 Non-PGIS



Summary for Pond 4P: Drywells #4 and #5

Inflow Area = 0.574 ac,100.00% Impervious, Inflow Depth > 2.27" for 100-yr, 24hr Chelan County event
Inflow = 0.34 cfs @ 7.81 hrs, Volume= 0.109 af
Outflow = 0.11 cfs @ 8.86 hrs, Volume= 0.109 af, Atten= 68%, Lag= 63.0 min
Discarded = 0.11 cfs @ 8.86 hrs, Volume= 0.109 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 98.94' @ 8.86 hrs Surf.Area= 0.012 ac Storage= 0.019 af

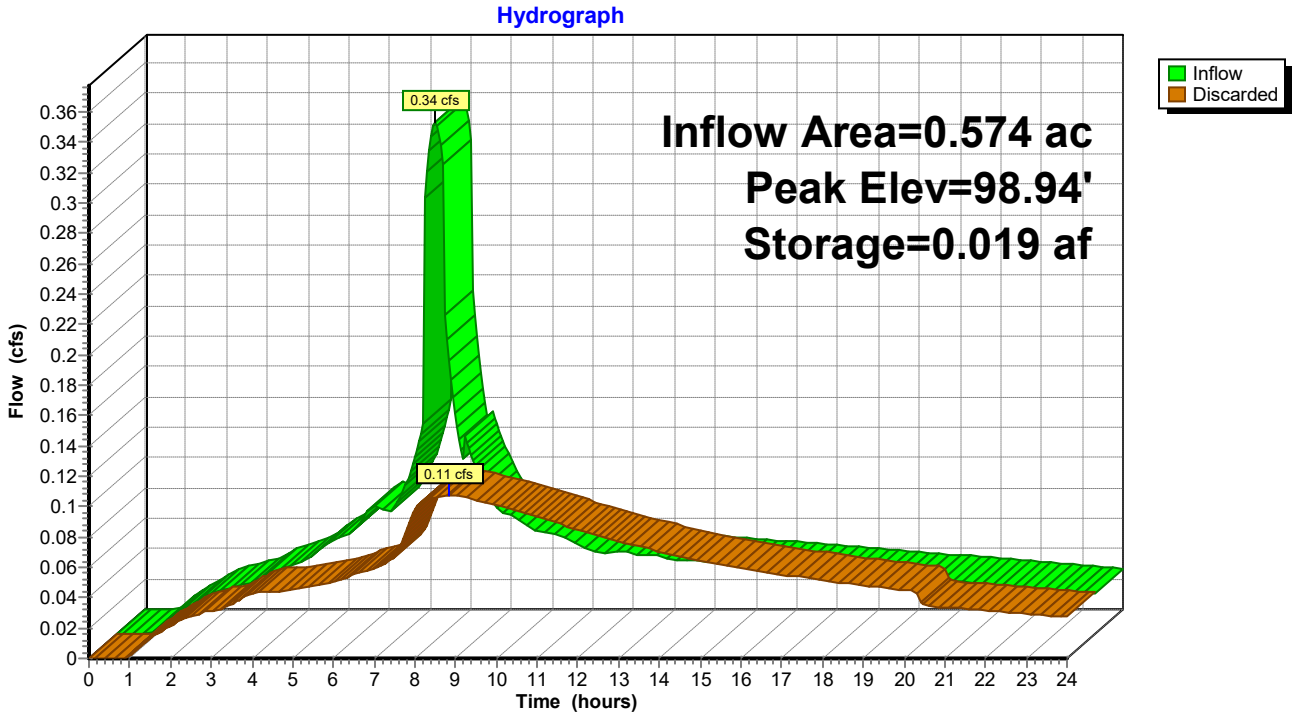
Plug-Flow detention time= 63.7 min calculated for 0.109 af (100% of inflow)
Center-of-Mass det. time= 63.1 min (731.9 - 668.8)

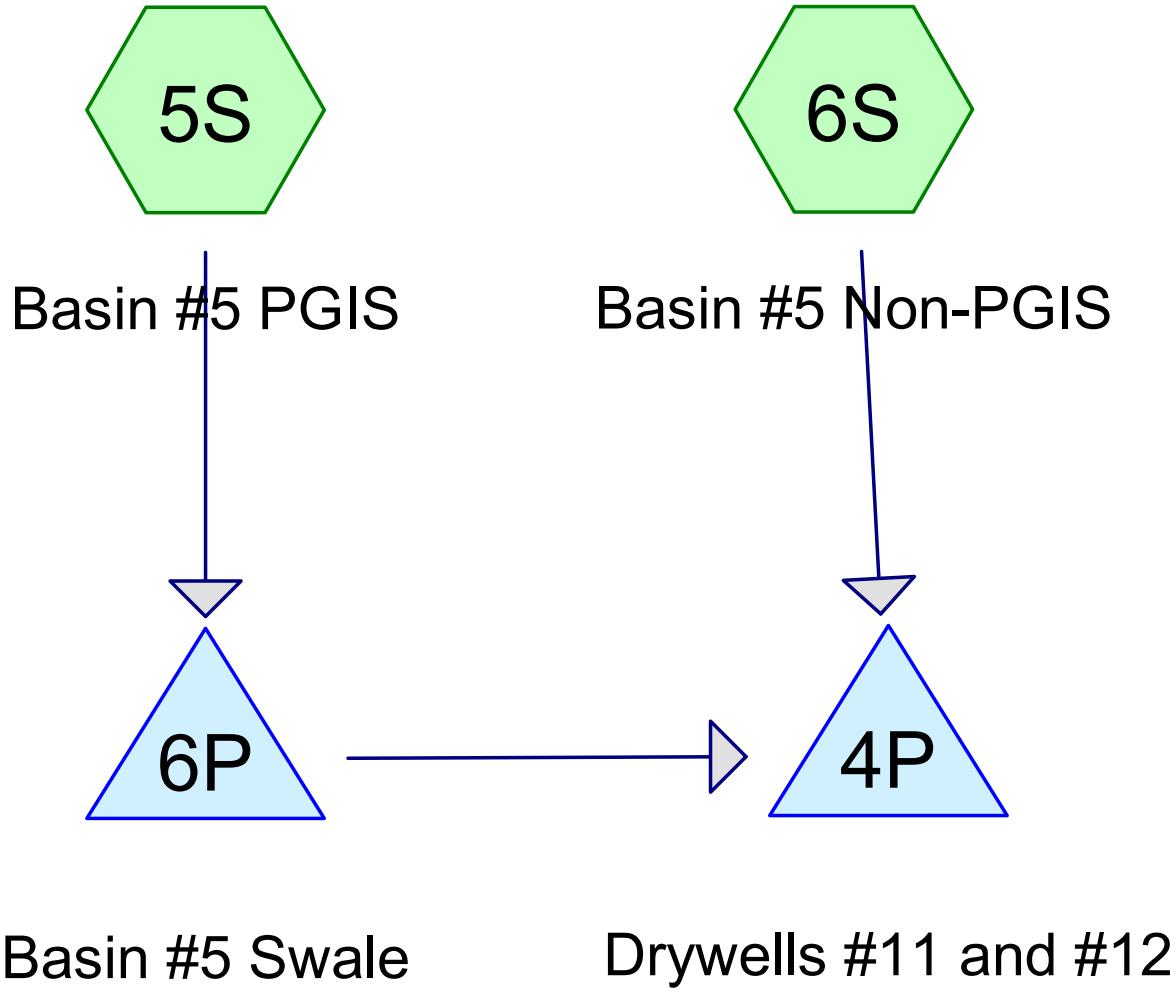
Volume	Invert	Avail.Storage	Storage Description
#1	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #3 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#2	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #4 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#3	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
#4	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
		0.025 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	92.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00'

Discarded OutFlow Max=0.11 cfs @ 8.86 hrs HW=98.94' (Free Discharge)
↑**1=Exfiltration** (Controls 0.11 cfs)

Pond 4P: Drywells #4 and #5





Subcat Reach Pond Link

Routing Diagram for Basin #5 Swale
Prepared by Davido Consulting Group, Printed 1/10/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.574	98	25% of Future Building (6S)
0.178	98	On-Site PGIS (5S)
0.752	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.752	Other	5S, 6S
0.752		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.574	0.574	25% of Future Building	6S
0.000	0.000	0.000	0.000	0.178	0.178	On-Site PGIS	5S
0.000	**0.000**	**0.000**	**0.000**	**0.752**	**0.752**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Basin #5 PGIS Runoff Area=7,749 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.10 cfs 0.034 af

Subcatchment 6S: Basin #5 Non-PGIS Runoff Area=25,000 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.34 cfs 0.109 af

Pond 4P: Drywells #11 and #12 Peak Elev=98.94' Storage=0.019 af Inflow=0.34 cfs 0.109 af
Outflow=0.11 cfs 0.109 af

Pond 6P: Basin #5 Swale Peak Elev=100.39' Storage=0.004 af Inflow=0.10 cfs 0.034 af
Discarded=0.04 cfs 0.034 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.034 af

Total Runoff Area = 0.752 ac Runoff Volume = 0.142 af Average Runoff Depth = 2.27"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.752 ac

Summary for Subcatchment 5S: Basin #5 PGIS

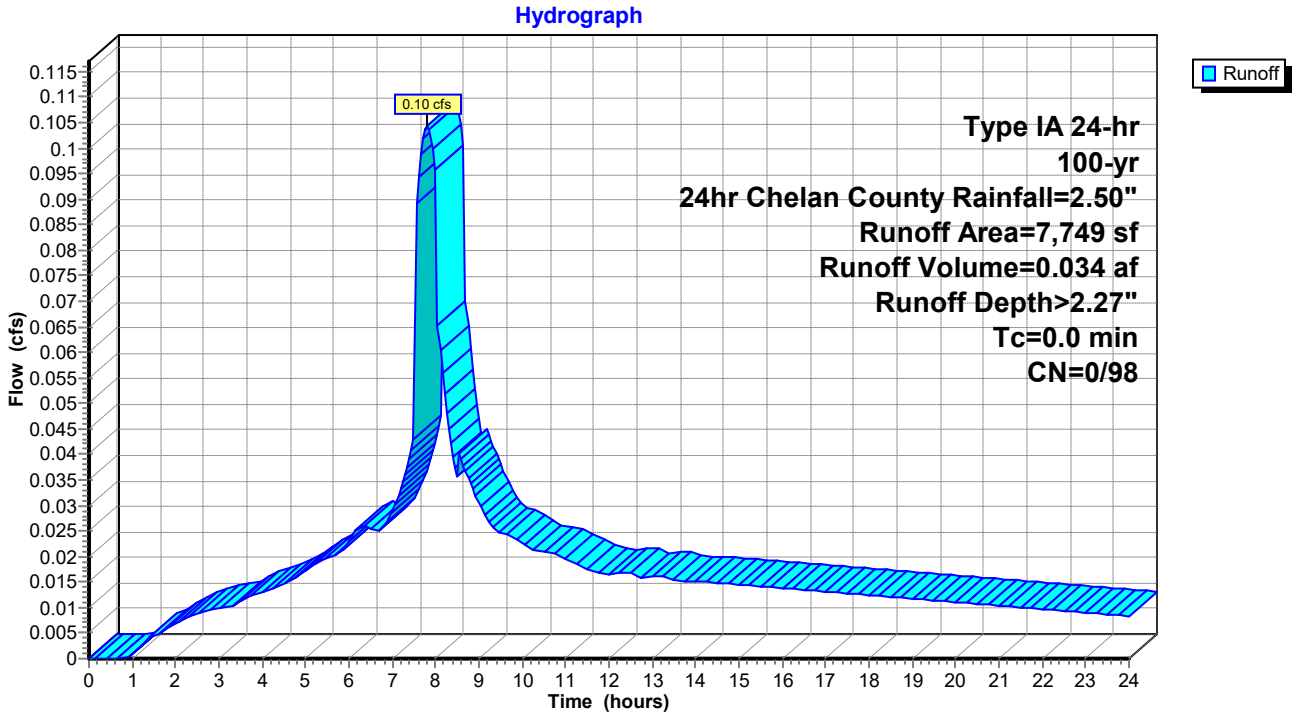
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.10 cfs @ 7.81 hrs, Volume= 0.034 af, Depth> 2.27"
Routed to Pond 6P : Basin #5 Swale

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	7,749	98	On-Site PGIS
	7,749	98	100.00% Impervious Area

Subcatchment 5S: Basin #5 PGIS



Summary for Subcatchment 6S: Basin #5 Non-PGIS

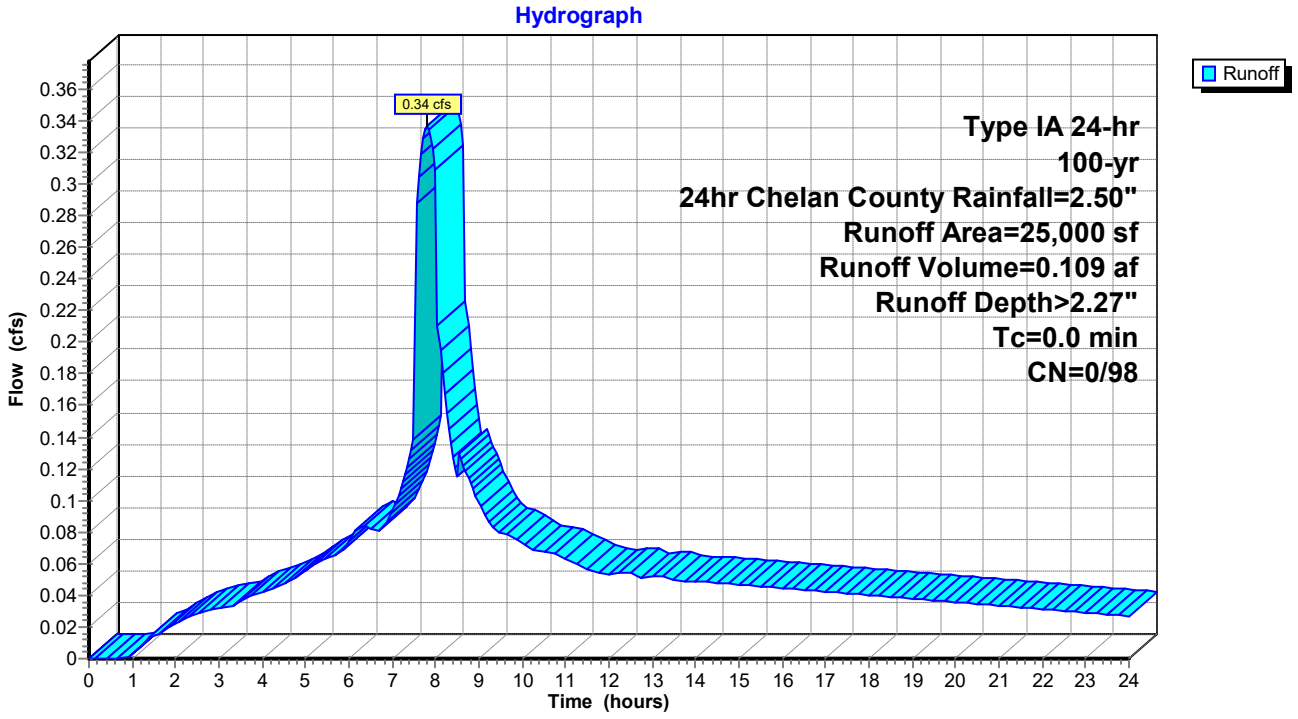
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.34 cfs @ 7.81 hrs, Volume= 0.109 af, Depth> 2.27"
Routed to Pond 4P : Drywells #11 and #12

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	25,000	98	25% of Future Building
	25,000	98	100.00% Impervious Area

Subcatchment 6S: Basin #5 Non-PGIS



Summary for Pond 4P: Drywells #11 and #12

Inflow Area = 0.752 ac,100.00% Impervious, Inflow Depth > 1.73" for 100-yr, 24hr Chelan County event
Inflow = 0.34 cfs @ 7.81 hrs, Volume= 0.109 af
Outflow = 0.11 cfs @ 8.86 hrs, Volume= 0.109 af, Atten= 68%, Lag= 63.0 min
Discarded = 0.11 cfs @ 8.86 hrs, Volume= 0.109 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 98.94' @ 8.86 hrs Surf.Area= 0.012 ac Storage= 0.019 af

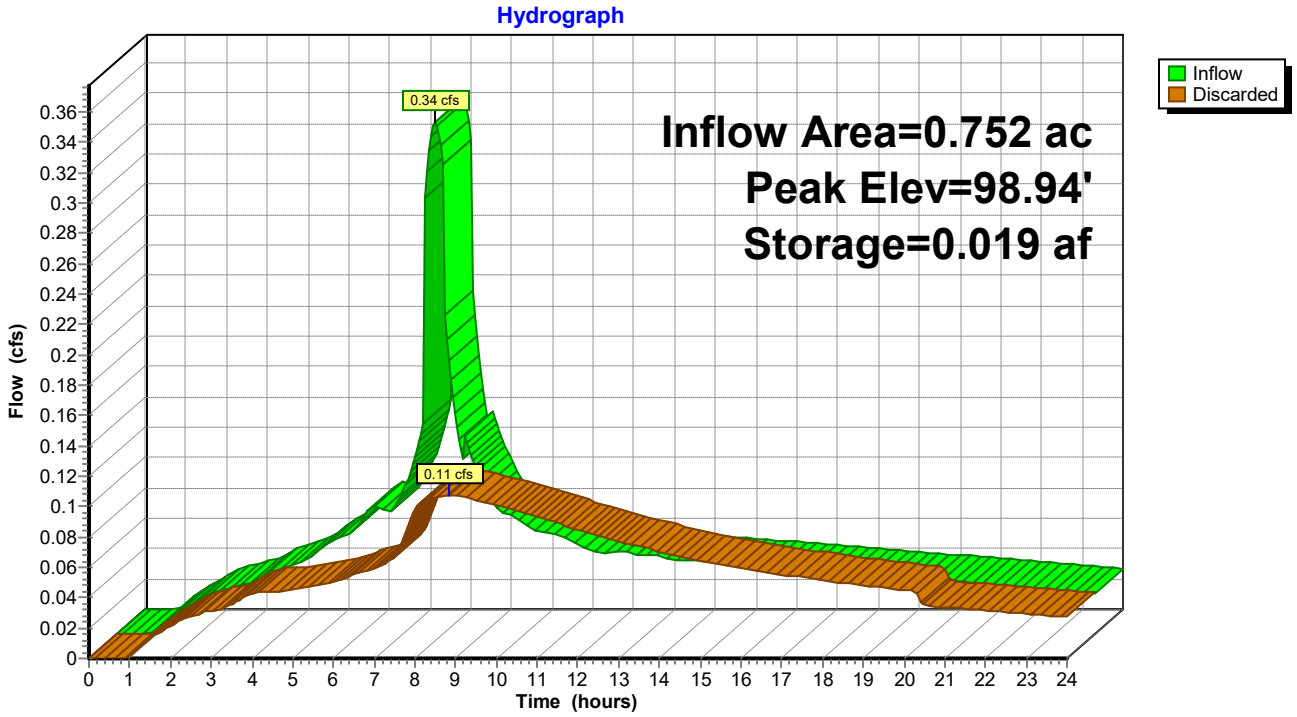
Plug-Flow detention time= 63.7 min calculated for 0.109 af (100% of inflow)
Center-of-Mass det. time= 63.1 min (731.9 - 668.8)

Volume	Invert	Avail.Storage	Storage Description
#1	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #3 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#2	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #4 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#3	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
#4	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
		0.025 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	92.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00'

Discarded OutFlow Max=0.11 cfs @ 8.86 hrs HW=98.94' (Free Discharge)
1=Exfiltration (Controls 0.11 cfs)

Pond 4P: Drywells #11 and #12



Summary for Pond 6P: Basin #5 Swale

Inflow Area = 0.178 ac,100.00% Impervious, Inflow Depth > 2.27" for 100-yr, 24hr Chelan County event
Inflow = 0.10 cfs @ 7.81 hrs, Volume= 0.034 af
Outflow = 0.04 cfs @ 8.65 hrs, Volume= 0.034 af, Atten= 64%, Lag= 50.7 min
Discarded = 0.04 cfs @ 8.65 hrs, Volume= 0.034 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 4P : Drywells #11 and #12

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 100.39' @ 8.65 hrs Surf.Area= 0.012 ac Storage= 0.004 af

Plug-Flow detention time= 24.7 min calculated for 0.034 af (100% of inflow)
Center-of-Mass det. time= 24.0 min (692.8 - 668.8)

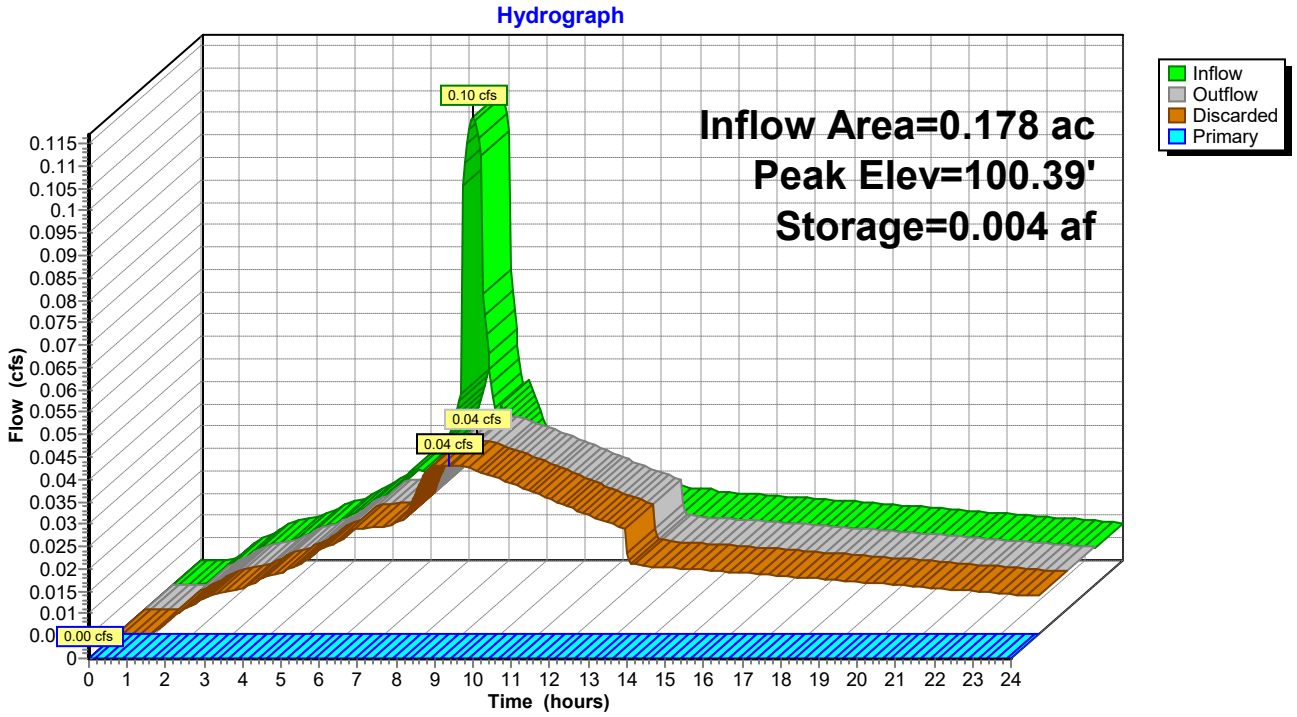
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	0.014 af	**4.00'W x 83.00'L x 1.00'H Prismatoid Z=3.0**

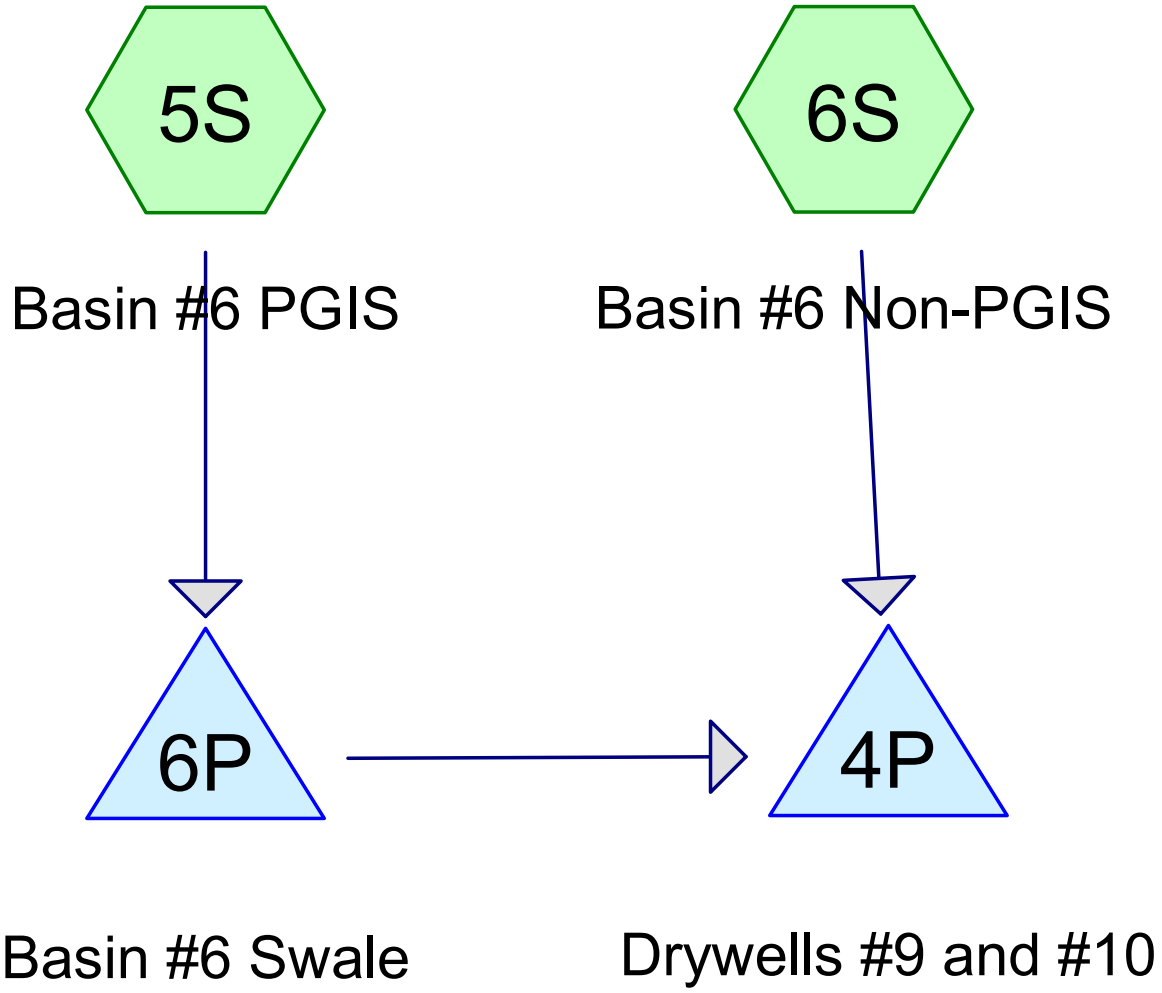
Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	100.50'	**5.0" Horiz. Orifice/Grate X 7.00 columns** X 7 rows C= 0.600 in 48.0" Grate (53% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 8.65 hrs HW=100.39' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=100.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Basin #5 Swale





Subcat Reach Pond Link

Routing Diagram for Basin #6 Swale
Prepared by Davido Consulting Group, Printed 1/10/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.574	98	25% of Future Building (6S)
0.176	98	On-Site PGIS (5S)
0.750	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.750	Other	5S, 6S
0.750		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.574	0.574	25% of Future Building	6S
0.000	0.000	0.000	0.000	0.176	0.176	On-Site PGIS	5S
0.000	**0.000**	**0.000**	**0.000**	**0.750**	**0.750**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Basin #6 PGIS Runoff Area=7,686 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.10 cfs 0.033 af

Subcatchment 6S: Basin #6 Non-PGIS Runoff Area=25,000 sf 100.00% Impervious Runoff Depth>2.27"
Tc=0.0 min CN=0/98 Runoff=0.34 cfs 0.109 af

Pond 4P: Drywells #9 and #10 Peak Elev=98.94' Storage=0.019 af Inflow=0.34 cfs 0.109 af
Outflow=0.11 cfs 0.109 af

Pond 6P: Basin #6 Swale Peak Elev=100.47' Storage=0.004 af Inflow=0.10 cfs 0.033 af
Discarded=0.04 cfs 0.033 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.033 af

Total Runoff Area = 0.750 ac Runoff Volume = 0.142 af Average Runoff Depth = 2.27"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.750 ac

Summary for Subcatchment 5S: Basin #6 PGIS

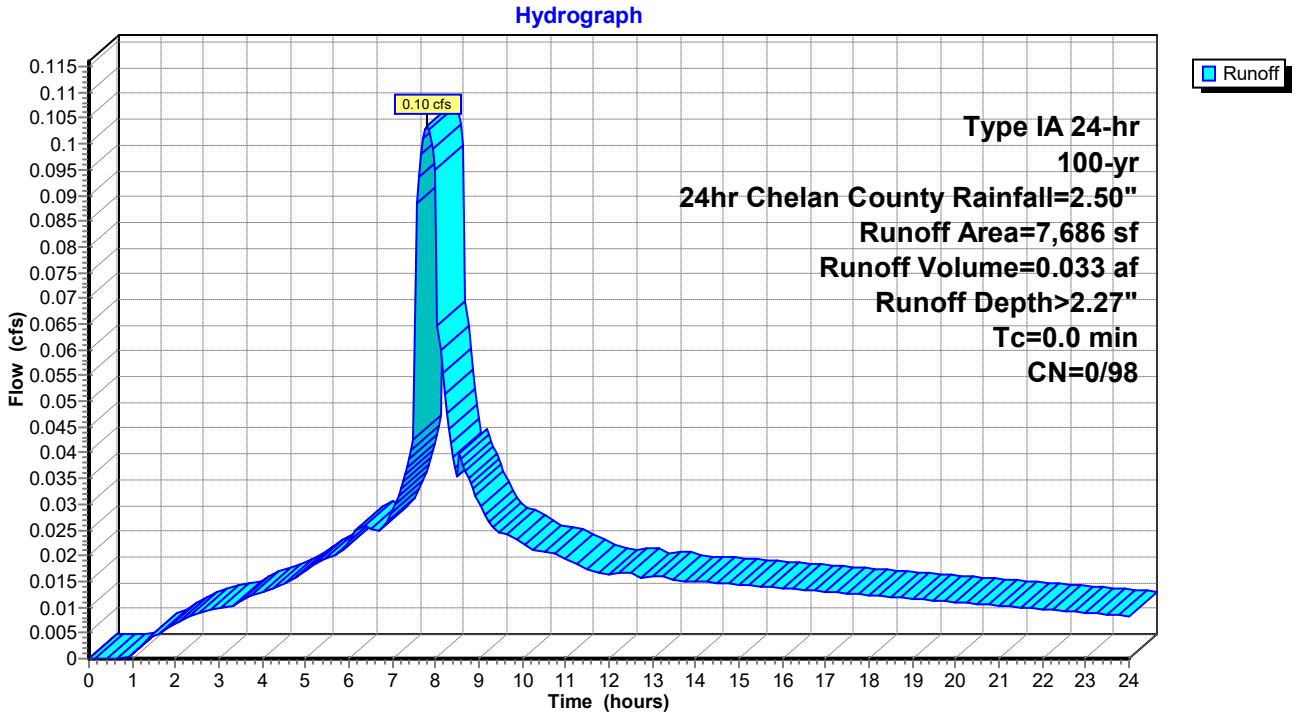
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.10 cfs @ 7.81 hrs, Volume= 0.033 af, Depth> 2.27"
Routed to Pond 6P : Basin #6 Swale

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	7,686	98	On-Site PGIS
	7,686	98	100.00% Impervious Area

Subcatchment 5S: Basin #6 PGIS



Summary for Subcatchment 6S: Basin #6 Non-PGIS

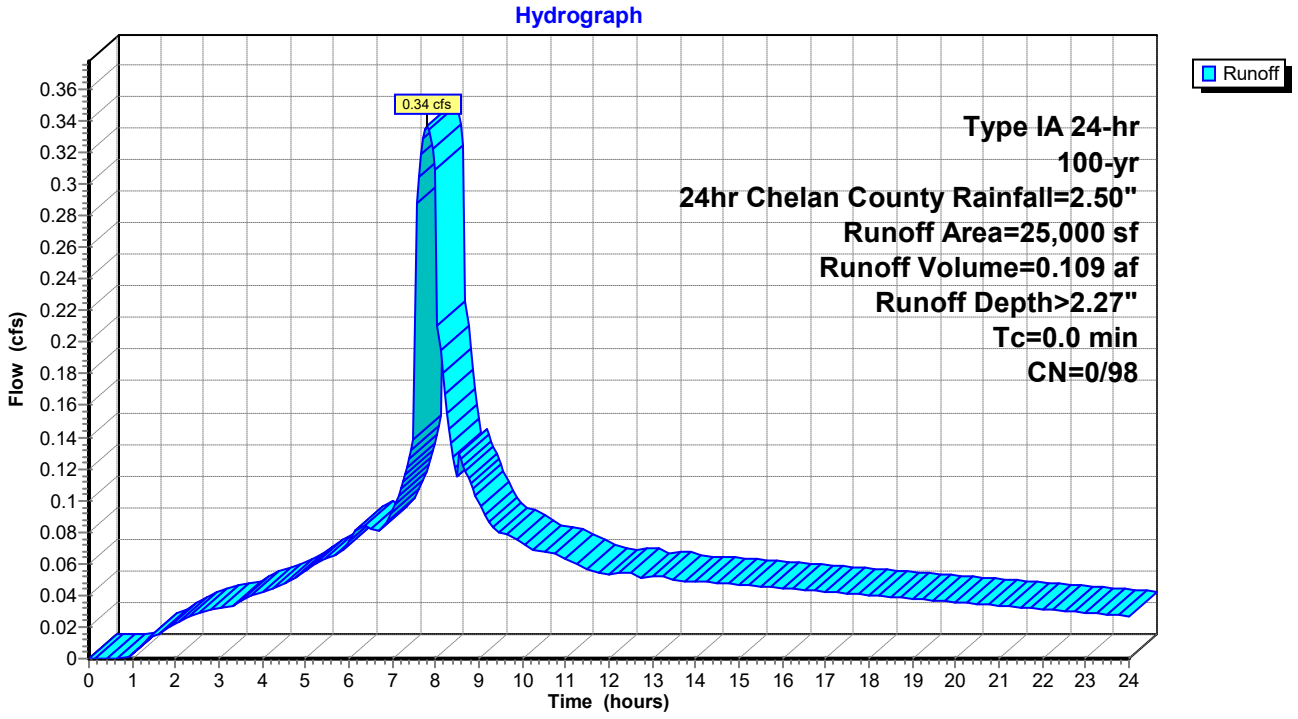
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.34 cfs @ 7.81 hrs, Volume= 0.109 af, Depth> 2.27"
Routed to Pond 4P : Drywells #9 and #10

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24hr Chelan County Rainfall=2.50"

	Area (sf)	CN	Description
*	25,000	98	25% of Future Building
	25,000	98	100.00% Impervious Area

Subcatchment 6S: Basin #6 Non-PGIS



Summary for Pond 4P: Drywells #9 and #10

Inflow Area = 0.750 ac,100.00% Impervious, Inflow Depth > 1.74" for 100-yr, 24hr Chelan County event
Inflow = 0.34 cfs @ 7.81 hrs, Volume= 0.109 af
Outflow = 0.11 cfs @ 8.86 hrs, Volume= 0.109 af, Atten= 68%, Lag= 63.0 min
Discarded = 0.11 cfs @ 8.86 hrs, Volume= 0.109 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 98.94' @ 8.86 hrs Surf.Area= 0.012 ac Storage= 0.019 af

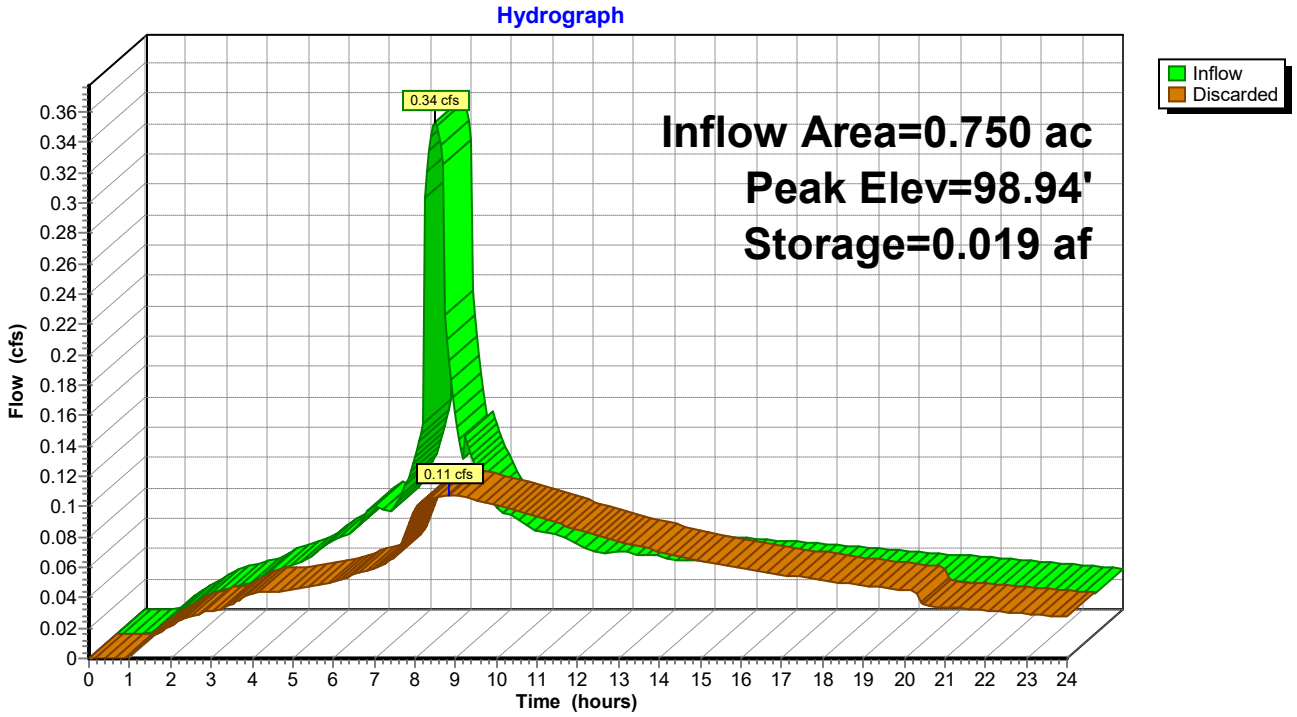
Plug-Flow detention time= 63.7 min calculated for 0.109 af (100% of inflow)
Center-of-Mass det. time= 63.1 min (731.9 - 668.8)

Volume	Invert	Avail.Storage	Storage Description
#1	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #3 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#2	92.50'	0.002 af	**4.00'D x 8.00'H concrete** Inside #4 0.003 af Overall - 4.0" Wall Thickness = 0.002 af
#3	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
#4	92.50'	0.010 af	**12.00'D x 8.00'H Rock Z=0.5** 0.038 af Overall - 0.003 af Embedded = 0.035 af x 30.0% Voids
		0.025 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	92.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00'

Discarded OutFlow Max=0.11 cfs @ 8.86 hrs HW=98.94' (Free Discharge)
1=Exfiltration (Controls 0.11 cfs)

Pond 4P: Drywells #9 and #10



Summary for Pond 6P: Basin #6 Swale

Inflow Area = 0.176 ac,100.00% Impervious, Inflow Depth > 2.27" for 100-yr, 24hr Chelan County event
Inflow = 0.10 cfs @ 7.81 hrs, Volume= 0.033 af
Outflow = 0.04 cfs @ 8.72 hrs, Volume= 0.033 af, Atten= 65%, Lag= 54.8 min
Discarded = 0.04 cfs @ 8.72 hrs, Volume= 0.033 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 4P : Drywells #9 and #10

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 100.47' @ 8.72 hrs Surf.Area= 0.012 ac Storage= 0.004 af

Plug-Flow detention time= 31.2 min calculated for 0.033 af (100% of inflow)
Center-of-Mass det. time= 30.5 min (699.3 - 668.8)

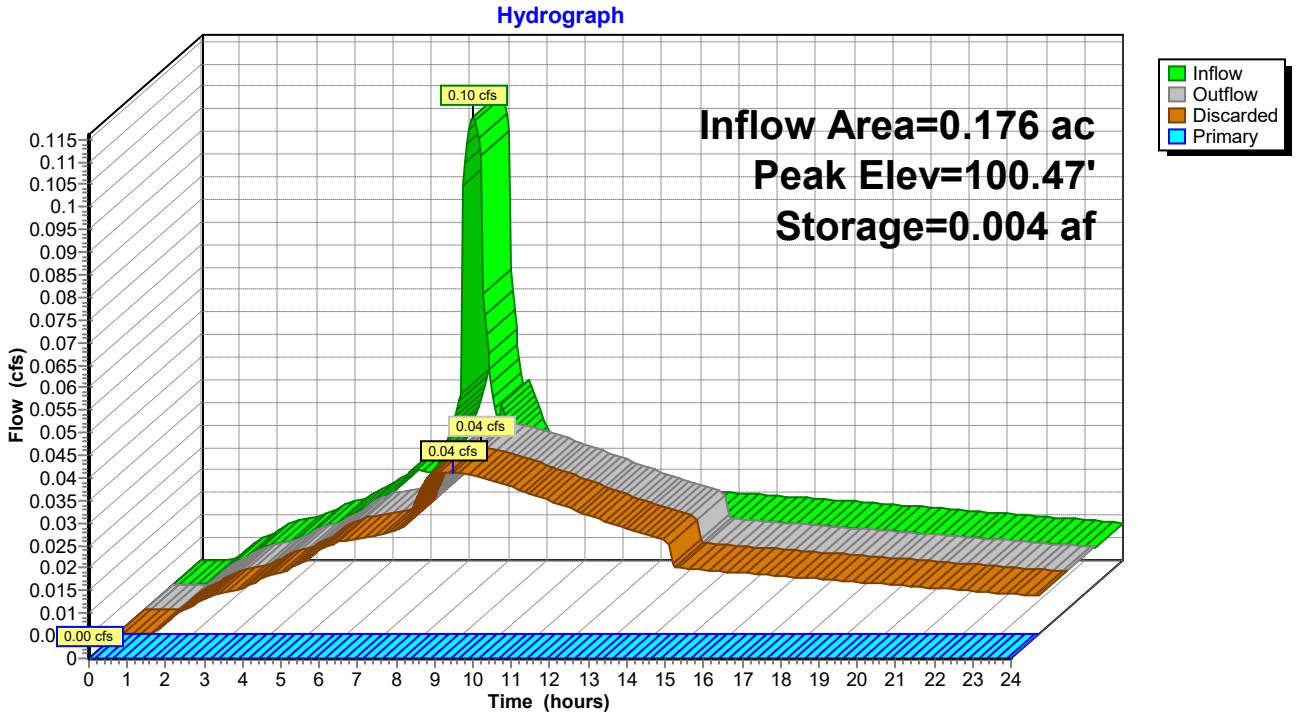
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	0.012 af	**4.00'W x 73.00'L x 1.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	100.50'	**5.0" Horiz. Orifice/Grate X 7.00 columns** X 7 rows C= 0.600 in 48.0" Grate (53% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 8.72 hrs HW=100.47' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=100.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Basin #6 Swale



Stormwater Treatment Calculations

BMP T5.21: Infiltration Swales from The Manual states that the soil depth must be 18 inches or greater to meet the basic, metals, and phosphorus BMP performance goals. Each infiltration swale on-site will use 18" of bioretention soil as shown on the civil plans.

Method 1 from The Manual has been chosen to size each of the four infiltration swales. As the design infiltration rate for the soils was found to be 8.27" per hour, Table 6.24 has been used to size each infiltration swale. To estimate the 2-Year 24-hour precipitation in the left column of the table, the Precipitation-Frequency Atlas of the Western United States, Volume IX-Washington has been used. The following page shows the site location and the estimated 2-year 24-hour precipitation (approximately 1.10 inches). Therefore, the proposed infiltration swale volume must be at least 27.9 cubic feet per 1,000 SF of tributary area.

See the PGIS Figure following this page which shows the PGIS areas on the site and which swale the runoff from these surfaces will be routed to. Below is a summary of each swale and their sizing calculations:

Note that all swales consist of side slopes at 3'H:1'V and have a ponding depth of 6".

Basin #1 Swale (4' bottom width):
Total PGIS tributary to infiltration swale #1: 9,400 SF
Total volume required: 9,400 / 1,000 x 27.9 = 262 CF
Infiltration swale volume provided: 100' L x 2.75 SF cross section = 275 CF

Basin #2 Swale (22' bottom width):
Total PGIS tributary to infiltration swale #2: 41,392 SF
Total volume required: 41,392 / 1,000 x 27.9 = 1,155 CF
Infiltration swale volume provided: 100' L x 11.75 SF cross section = 1,175 CF

Basin #3 Swale (15' bottom width):
Total PGIS tributary to infiltration swale #3: 31,416 SF
Total volume required: 31,416 / 1,000 x 27.9 = 877 CF
Infiltration swale volume provided: 115' L x 8.25 SF cross section = 948 CF

Basin #4 Swale (4' bottom width):
Total PGIS tributary to infiltration swale #4: 6,572 SF
Total volume required: 6,572 / 1,000 x 27.9 = 183 CF
Infiltration swale volume provided: 72' L x 2.75 SF cross section = 198 CF

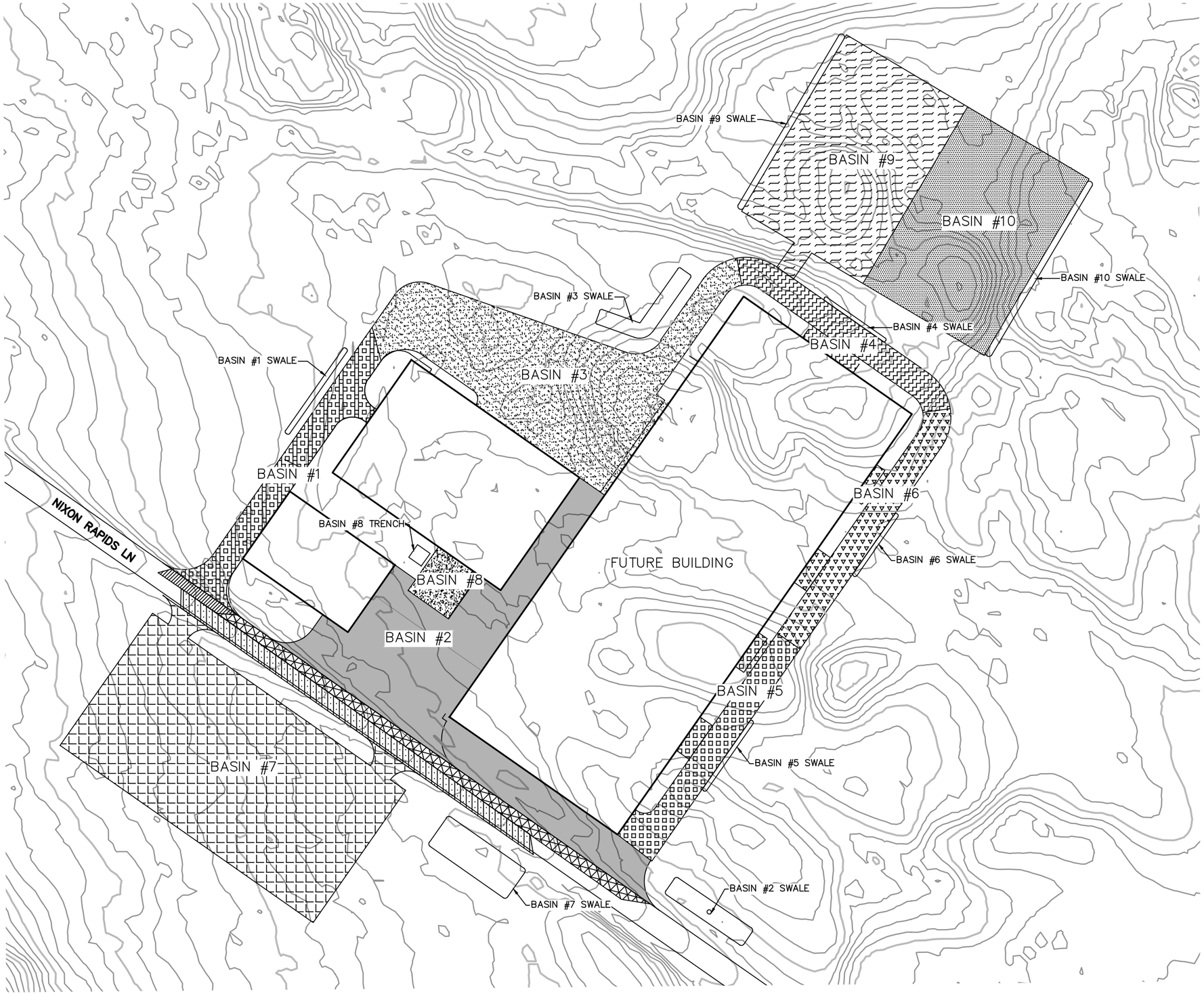
Basin #5 Swale (4' bottom width):
Total PGIS tributary to infiltration swale #5: 7,749 SF
Total volume required: 7,749 / 1,000 x 27.9 = 216 CF
Infiltration swale volume provided: 80' L x 2.75 SF cross section = 220 CF

Basin #6 Swale (4' bottom width):
Total PGIS tributary to infiltration swale #6: 7,686 SF
Total volume required: 7,686 / 1,000 x 27.9 = 214 CF
Infiltration swale volume provided: 80' L x 2.75 SF cross section = 220 CF

Basin #7 Swale (35' bottom width):
Total PGIS tributary to infiltration swale #7: 54,888 SF
Total volume required: 54,888 / 1,000 x 27.9 = 1,531 CF
Infiltration swale volume provided: 93' L x 18.25 SF cross section = 1,697 CF

Basin #9 Swale (6' bottom width):
Total PGIS tributary to infiltration swale #7: 28,100 SF
Total volume required: 28,100 / 1,000 x 27.9 = 784 CF
Infiltration swale volume provided: 200' L x 3.75 SF cross section = 750 CF

Basin #10 Swale (6' bottom width):
Total PGIS tributary to infiltration swale #7: 27,500 SF
Total volume required: 27,500 / 1,000 x 767 = CF
Infiltration swale volume provided: 200' L x 3.75 SF cross section = 750 CF



N

100 50 0 100 200

SCALE IN FEET

LEGEND:

BASIN #1
- PGIS 8,643 SF
- OFFSITE PGIS 757 SF

TOTAL BASIN #1 PGIS = 9,400 SF

BASIN #2
- PGIS 35,919 SF
- OFFSITE PGIS 5,473 SF

TOTAL BASIN #2 PGIS = 41,392 SF

BASIN #3
- PGIS 31,416 SF

BASIN #4
- PGIS 6,572 SF

BASIN #5
- PGIS 7,749 SF

BASIN #6
- PGIS 7,686 SF

BASIN #7
- PGIS 48,616 SF
- OFFSITE PGIS 6,272 SF

TOTAL BASIN #7 PGIS = 54,888 SF

BASIN #8
- PGIS 2,481 SF

BASIN #9
- PGIS 28,100 SF

BASIN #10
- PGIS 27,500 SF

No.	DATE	BY	REVISION

PGIS BASIN GRAPHIC

SCALE: 1" = 100'

DATE: 3/21/2025

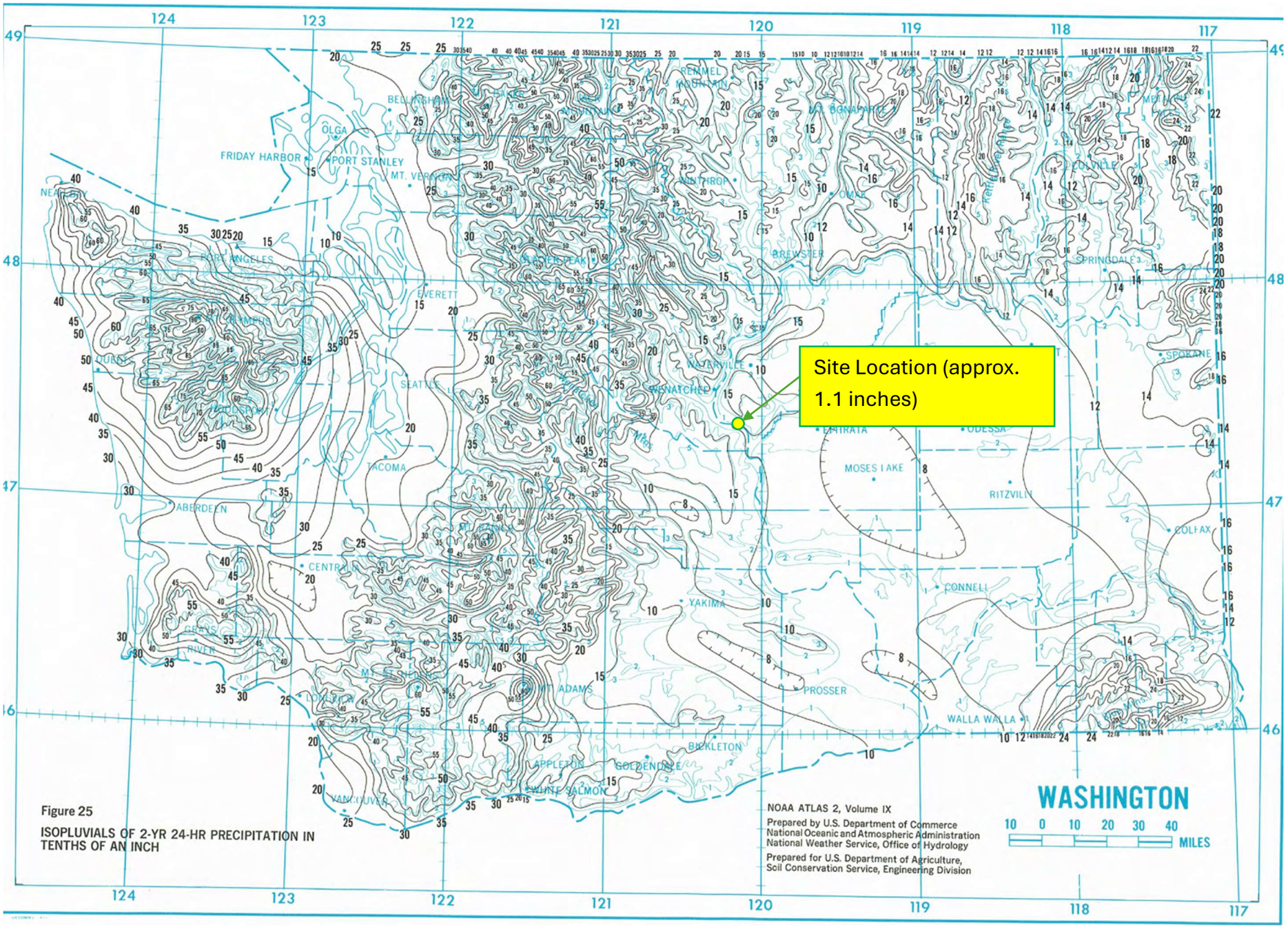


Figure 25

ISOPLUVIALS OF 2-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

Summary for Pond 6P: Basin #8 Gravel Trench

Inflow Area = 0.057 ac,100.00% Impervious, Inflow Depth > 2.27" for 100-yr, 24hr Chelan County event
Inflow = 0.03 cfs @ 7.81 hrs, Volume= 0.011 af
Outflow = 0.02 cfs @ 7.55 hrs, Volume= 0.011 af, Atten= 53%, Lag= 0.0 min
Discarded = 0.02 cfs @ 7.55 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 100.47' @ 8.24 hrs Surf.Area= 0.005 ac Storage= 0.001 af

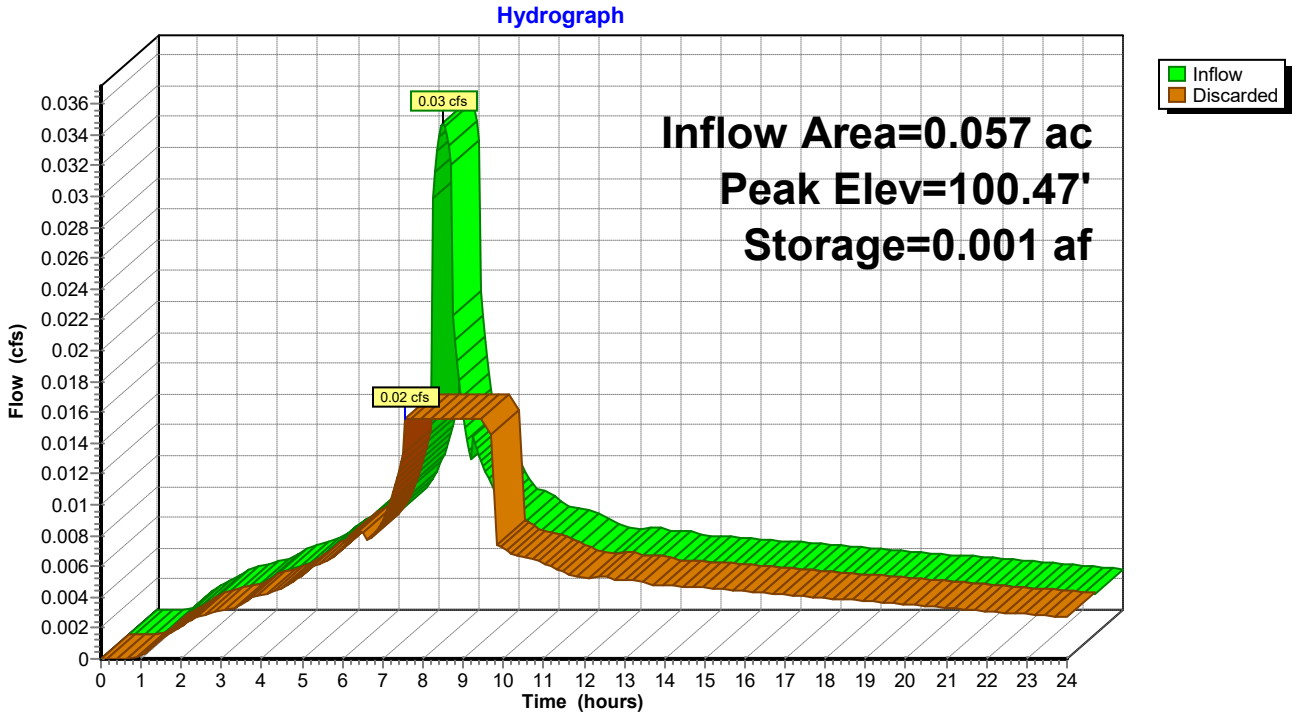
Plug-Flow detention time= 6.8 min calculated for 0.011 af (100% of inflow)
Center-of-Mass det. time= 6.4 min (675.2 - 668.8)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	0.003 af	**15.00'W x 15.00'L x 2.00'H Prismatoid** 0.010 af Overall x 30.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**3.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 7.55 hrs HW=100.03' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 6P: Basin #8 Gravel Trench



APPENDIX D – CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

January 31, 2025

Stormwater Pollution Prevention Plan (SWPPP)

for

Helion Energy

Nixon Rpds Ln

Chelan County, WA 98828

Prepared for:

The Washington State Department of Ecology

Permittee / Owner	Developer	Operator / Contractor
Helion Energy	TBD	TBD

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
TBD	TBD	TBD

SWPPP Prepared By

Name	Organization	Contact Phone Number
Ryan Yokum	Facet	206-523-0024

SWPPP Preparation Date

January 31, 2025

Project Construction Dates

Activity / Phase	Start Date	End Date
TBD	TBD	TBD

Certification of Professional Engineer

I hereby state that this Construction Stormwater Pollution Prevention Plan for the Nixon Rapids Ln in Chelan County project has been prepared by me, under my supervision, and meets the standards of care and expertise which is usual and customary in this community for professional engineers. I understand that Chelan County does not and will not assume liability for the sufficiency, suitability, or performance of Construction SWPPP BMP'S prepared by me.

Table of Contents

List of Tables

List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO_2	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

1 Project Information

Project/Site Name: Nixon Rapids Ln
Street/Location: Nixon Rapids Lane
County: Chelan State: WA Zip code: 98828

1.1 Existing Conditions

Total acreage (including support activities such as off-site equipment staging yards, material storage areas, borrow areas).

- Total acreage: 10.88 acres
- Disturbed acreage: 10.88 acres
- Existing structures: None
- Landscape topography: The site topography slopes moderately from west down to the east.
- Drainage patterns: Stormwater from sheet flows over existing vegetated areas and percolates into the existing soil.
- Existing Vegetation: The entire project site area is vegetation
- Critical Areas: (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes): None
- List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: None

1.2 Proposed Construction Activities

Description of site development:

The project involves the construction of a new 26,800 SF assembly building, a 6,864 SF office building, future Phase 2 development of a 100,000 SF generator building, access road located along the southern property line, and associated landscape and onsite parking areas. The project is located at Nixon Rpds Ln in Chelan County, WA (Parcel #212205000050). Improvements also include site grading, a new driveway, drainage, water, and sanitary sewer. Vehicular access to the site will be via driveways off of Nixon Rpds Ln. BMP T5.13 (Post-Construction Soil Quality and Depth) shall be utilized for all proposed landscaping areas on this project. Stormwater overflow from the temporary sediment pond will be dispersed across existing vegetated areas.

Description of Construction Activities:

- Site preparation
- Excavation
- Utility improvements
- Site grading
- Asphalt paving

Description of site drainage including flow from and onto adjacent properties:

The project will be comprised of three main phases, with different BMP's implemented in each phase as described below. (It is to be noted that these are general construction activities and actual BMP's are described in detail in the 13 Elements per Section 2 of this document.)

- Phase 1: Demolition
  Initial construction activities begin. Contractor shall setup pre-con meeting with the County, flag off clearing limits, and post sign on project site with name and phone number of TESC Supervisor. Contractor shall install construction fencing and inlet protection measures as well as temporary construction entrance to begin demolition work. Install perimeter protection (silt fencing) around project.

- Phase 2: Mass Excavation
  Monitor and modify existing BMP's as required for initial earthwork excavation. Cover an maintain slopes as required. Install the sediment pond, and interceptor swales to control flowrates within the project. Complete construction entrance. Maintain erosion control measures, including covering exposed dirt and stabilization of areas that reach final grade.

- Phase 3: Vertical Construction:
  Monitor and adjust existing BMP's as required. Stabilize soils that have reached final grade. Remove temporary sediment ponds and manage stormwater through alternative BMP's (wattles etc) as required. Remove all BMP's at the completion of the project.

Description of final stabilization:

No area of the site will be destabilized under final project conditions, and most of the site will consist of the proposed building footprint. Remaining areas outside of the building will be paved walking areas.

Contaminated Site Information:

To the best of our knowledge, there are no contimanants identified or located on-site.

2 Construction Stormwater Best Management Practices (BMPs)

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e. hand-written notes and deletions). Update the SWPPP when the CESCL has noted a deficiency in BMPs or deviation from original design.

2.1 The 13 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

The BMP listed below has been selected with the goal of minimizing the impact on native vegetation and soils. Natural vegetation will be cleared from the entire site, but clearing will be completed in phases so as to minimize the area being disturbed at once.

Native topsoil and soil from the duff layer should be retained and stockpiled on-site where feasible so that it can be reused for site grading and landscaping immediately after soils disturbances are completed.

List and describe BMPs:

- BMP C233: Silt Fence
  A Silt Fence will be installed around the perimeter of the site or work area prior to beginning site clearing/grading.

Installation Schedules:

- BMP C233: Silt Fence
  A Silt Fence will be installed around the perimeter of the site or work area prior to beginning site clearing/grading.

Inspection and Maintenance Plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff:

Project CESCL

2.1.2 Element 2: Establish Construction Access

A stabilized construction entrance/exit will be the primary means for minimizing dust generation and vehicles tracking sediment off-site. Street sweeping and street cleaning may be necessary as required to remove tracked sediment. If sediment is tracked off-site, public roads shall be cleaned thoroughly at the end of each day as a minimum, or more frequently during wet weather. Sediment shall be removed from roads by shoveling or sweeping, and be transported to a controlled sediment disposal area..

List and describe BMPs:

- BMP C105: Stabilized Construction Entrance/Exit
  A stabilized construction entrances/exits will be installed on-site, providing access from 106th St SW. The location(s) of construction access may be modified as necessary to accommodate phasing of the site work.
- BMP C107: Construction Road/Parking Area Stabilization
  On-site areas of frequent construction traffic and/or parking will be stabilized.

Installation Schedules:

- BMP C105: Stabilized Construction Entrance/Exit
  Construction access shall be established prior to beginning site clearing/grading activities.
- BMP C107: Construction Road/Parking Area Stabilization
  Construction Road/Parking Area Stabilization shall be provided prior to the beginning of construction traffic, and adjusted throughout the project as on-site parking becomes clearer.

Inspection and Maintenance plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff:

Project CESCL

2.1.3 Element 3: Control Flow Rates

Will you construct stormwater retention and/or detention facilities?

☐ Yes ☒ No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?

☐ Yes ☒ No

List and describe BMPs:

- BMP C207: Check Dams
  Check dams will be installed along the inceptor swale in order to reduce the velocity of stormwater flow.
- BMP C235: Wattles
  If necessary, staw wattles will be installed along theeastern perimeter of the site at the bottom of slopes or where erosion or flow is prevalent.
- Note: Contractor shall monitor site flows and incorporate temporary sediment tanks and/or interceptor swales as required to manage temporary stormwater flows.

Installation Schedules:

- BMP C207: Check Dams
  Check dams shall be implemented as needed during construction activities to control flow rates and sediment transport.
- BMP C235: Wattles
  Staw wattles shall be implemented as needed during construction activities to control flow rates and sediment transport.

Inspection and Maintenance plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff:

Project CESCL

2.1.4 Element 4: Install Sediment Controls

The BMP's listed below will be utilized to minimize sediment discharges from the site, and be installed prior to starting constructions activities. Silt fences will encircle the perimeter of the site, and serve to filter out sediment from stormwater runoff at the project limits. If the listed BMP's are deemed ineffective or inappropriate during construction, the CESCL should promptly initiate the implementation of one or more alternative BMP's listed in Vol II of the 2024 Stormwater Mangement Manual for Eastern Washington.

Sediment will be removed from paved areas in and adjacent to construction work areas manually or using mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site, and to minimize wash-off of sediments from adjacent streets in runoff. Whenever possible, sediment laden water shall be discharged into relatively level vegetated areas (BMP C236) located on site in areas that have yet to be cleared.

List and describe BMPs:

- BMP C233: Silt Fence
  A silt fence will be installed around the perimeter of the site to filter construction stormwater runoff.
- BMP C235: Wattles
  Staw wattles will be installed along site perimeter at the bottom of slopes or where erosion or flow is prevalent.
- BMP C241: Sediment Pond (Temporary)
  The temporary sediment pond will be installed at the low point of the site where construction stormwater can easily be routed to.

Installation schedules:

- BMP C233: Silt Fence
  Silt fence should be installed prior to beginning site clearing/grading activities.
- BMP C235: Wattles
  Staw wattles shall be implemented as needed during construction activities to control flow rates and sediment transport
- BMP C241: Sediment Pond (Temporary)
  A temporary sediment pond shall be implemented prior to beginning site clearing/grading activities.

Inspection and Maintenance plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff:

Project CESCL

2.1.5 Element 5: Stabilize Soils

Exposed soils that are anticipated to remain unworked for shorter periods of time shall be stabilized using the BMP's listed below.

West of the Cascade Mountains Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Soils must be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Anticipated project dates: Start date: TBD End date: TBD

Will you construct during the wet season?
☒ Yes ☐ No

List and describe BMPs:

- BMP C120: Temporary and Permanent Seeding
  Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion. Temporary seeding should be used to stabilize large areas of exposed soils that are anticipated to remain unworked for a long period of time.
- BMP C121: Mulching
  Mulching soils provides immediate temporary protection from erosion. Mulching is to be utilized in combination with other BMP's to stabilize exposed soils that are anticipated to remain unworked for a shorter period of time.
- BMP C122: Nets and Blankets
  Utilize nets and blankets in combination with other BMP's to stabilize stockpiles from erosion or to minimize the disturbance of steep slopes during excavation
- BMP C123: Plastic Covering
  Utilize plastic covering in combination with other BMP's to stabilize exposed soils that are anticipated to remain unworked for shorter periods of time. If plastic covering is used, ensure that the increase in runoff from plastic-covered areas can be accommodated by downstream sediment controls.

Installation Schedules:

Sediment control BMPs shall be installed on exposed soils in accordance with the schedule shown in the table above. Note that the requirement of stabilizing stockpiles also applies to any stockpiles of vegetation or other organic material.

Inspection and Maintenance plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff:

Project CESCL

2.1.6 Element 6: Protect Slopes

Destabilized steep slopes are not anticipated during construction. If temporary steep slopes are created during site grading activities or excavation, refer to the BMP listed in Section 2.1.5. In addition, the following BMPs may be employed:

Will steep slopes be present at the site during construction?

☐ Yes ☒ No

List and describe BMPs:

BMP C120: Temporary and Permanent Seeding

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion. Temporary seeding should be used to stabilize large areas of exposed soils that are anticipated to remain unworked for a long period of time.

BMP C121: Mulching

Mulching soils provides immediate temporary protection from erosion. Mulching is to be utilized in combination with other BMP's to stabilize exposed soils that are anticipated to remain unworked for a shorter period of time.

Installation Schedules:

Slope protection BMP's shall be installed on temporary steep slopes in accordance with the table in Section 2.1.5 if needed during clearing/grading or during construction phases.

Inspection and Maintenance Plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff

Project CESCL

2.1.7 Element 7: Protect Drain Inlets

All operable storm drain inlets will be protected throughout the course of the project. Inlet protection BMP's will be utilized in combination with sediment controls listed in Section 2.1.4 to minimize the amount of sediment that enters the stormwater conveyance system. Inlets will be inspected weekly at a minimum, and daily during storm events. Protection devices will be cleaned (or removed and replaced) when sediment has filled the device by one third (1/3), or as specified by the manufacturer.

List and describe BMPs:

- BMP C220: Storm Drain Inlet Protection
  Storm drain inlet protection shall be installed on all existing storm drain inlets in and around the project area, and on all proposed inlets once they have been installed. Refer to the project TESC plans for inlet protection locations.

Installation Schedules:

- BMP C220: Storm Drain Inlet Protection
  Inlet protection shall be installed on existing inlets within the project vicinity prior to beginning site clearing and grading activities. Inlet protection shall be installed on proposed inlets as soon as the inlets are installed. Alternatively, inlet protection installation for proposed inlets can be delayed until the inlets begin receiving runoff if all sediment is removed from the structure prior to operation.

Inspection and Maintenance plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff:

Project CESCL

2.1.8 Element 8: Stabilize Channels and Outlets

List and describe BMPs:

- BMP C207: Check Dams
  Check dams will be installed along the inceptor swale in order to reduce the velocity of stormwater flow (as shown on the TESC plan).
- Note: Contractor shall monitor site flows and incorporate temporary sediment tanks and/or interceptor swales as required to manage temporary stormwater flows.

Installation Schedules:

- BMP C207: Check Dams
  Check dams shall be implemented as needed during construction activities to control flow rates and sediment transport.

Inspection and Maintenance plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff:

Project CESCL

2.1.9 Element 9: Control Pollutants

The following pollutants are anticipated to be present on-site:

Table 1 – Pollutants

Pollutant (and source, if applicable)
Oil/gasoline (Construction equipment and traffic)
Chemicals (Fertilizer/pesticides, cleaning supplies)
Dust (Demolition activities and site grading)
Process water (Concrete removal and pouring)
Solid waste (Materials packaging)

All pollutants – including waste materials and demolition debris – that occur on-site shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well-organized, and free of debris.

List and describe BMPs:

- Demolition:
    - BMP C140: Dust Control
      Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures.
    - BMP C220: Storm Drain Inlet Protection
      Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (as described above in Section 3.1.7).
    - BMP C152: Sawcutting and Surfacing Pollution Prevention
      Process water and slurry resulting from sawcutting and surfacing operations will be prevented from entering the waters of the State by implementing sawcutting and Surfacing Pollution Prevention measures.
- Chemical storage:
    - BMP C153: Material Delivery, Storage, and Containment
      Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Vol IV of the Wasington State DOE Stormwater Manual for Eastern Washington (SWMMEW). All chemicals shall have cover, containment, and protection provided on site.
    - Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations for application procedures and rates shall be followed.
- Concrete and grout:
    - BMP C151: Concrete Handling

Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures.
    - A CO2 system will be implemented to mitigate any high pH water that may be encountered (requires DOE approval).
- Sanitary wastewater:
    - Portable sanitation facilities will be firmly secured, regularly maintained, and emptied when necessary.
- Solid Waste:
    - Solid waste will be stored in secure, clearly marked containers.
- Other BMP's administered as necessary to address any additional pollutant sources on site:
    - BMP C151: Concrete Handling
      This BMP shall be employed whenever concrete work is occurring.
    - BMP C152: Sawcutting and Surfacing Pollution Prevention
      This BMP shall be employed whenever sawcutting of existing pavement is occurring.
    - BMP C153: Material Delivery, Storage and Containment
      This BMP shall be employed throughout the life of the project for all materials.
    - BMP C154: Concrete Washout Area
      This BMP shall be employed in areas of washing of concrete equipment.

Installation Schedules:

Throughout course of construction.

Inspection and Maintenance plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff:

Project CESCL

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?
☒ Yes ☐ No

List and describe BMPs:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.
- On-site fueling tanks and petroleum product storage containers shall include secondary containment (if required).
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.
- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.

- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Installation Schedules:

BMP's concerning the maintenance, fueling, and repair of heavy equipment and vehicles will be implemented as needed throughout the course of the project.

Inspection and Maintenance plan:

See BMP details in Appendix B. A blank Site Inspection Form is available in Appendix C.

Responsible Staff:

Project CESCL

Will wheel wash or tire bath system BMPs be used during construction?
☐ Yes ☒ No

Will pH-modifying sources be present on-site?
☐ Yes ☒ No

2.1.10 Element 10: Control Dewatering

No dewatering is anticipated on-site. If perched groundwater is encountered during construction, the contractor shall immediately install BMPs in accordance with the Wasington State DOE Stormwater Manual for Eastern Washington (SWMMEW). The contractor also has the option of installing temporary sump pumps that route the perched groundwater to the temporary swale as shown on the TESC plan. The sump pumps shall be monitored 24/7 by the contractor and/or other qualified personnel. Pumps shall be immediately replaced in the event of a pump failure.

2.1.11 Element 11: Maintain BMPs

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Maintenance and repair shall be conducted in accordance with each particular BMP specification (see Vol II of the Wasington State DOE Stormwater Manual for Eastern Washington (SWMMEW).

Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.

All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.

Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

List and describe BMPs:

- BMP C150: Materials on Hand
  Keep quantities of erosion prevention and sediment control materials on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy rains.
- BMP C160: Certified Erosion and Sediment Control Lead
  The designated CESCL shall be responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements.

2.1.12 Element 12: Manage the Project

The project will be managed based on the following principles:

- Projects will be phased to the maximum extent practicable and seasonal work limitations will be taken into account.
- Inspection and monitoring:
    - Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
- Maintain an updated SWPPP.
    - The SWPPP will be updated, maintained, and implemented in accordance with the Manual

As site work progresses the SWPPP will be modified routinely to reflect changing site conditions. The SWPPP will be reviewed monthly to ensure the content is current.

Table 3 – Management

☒	Design the project to fit the existing topography, soils, and drainage patterns
☒	Emphasize erosion control rather than sediment control
☒	Minimize the extent and duration of the area exposed
☒	Keep runoff velocities low
☒	Retain sediment on-site
☒	Thoroughly monitor site and maintain all ESC measures
☒	Schedule major earthwork during the dry season
☐	Other (please describe)

List and describe BMPs:

- BMP C150: Materials on Hand
  Keep quantities of erosion prevention and sediment control materials on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy rains.
- BMP C160: Certified Erosion and Sediment Control Lead
  The designated CESCL shall be responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements.
- BMP C162: Scheduling
  The construction project shall be sequenced which reduces the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

2.1.13 Element 13: Protect Low Impact Development (LID) BMPs

LID BMPs are not being utilized on this project and therefore Element 13 does not apply.

3 Pollution Prevention Team

Table 5 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	TBD	TBD
Resident Engineer	Eric Schossow, PE	206.523.0024
Emergency Ecology Contact	TBD	TBD
Emergency Permittee/ Owner Contact	TBD	TBD
Non-Emergency Owner Contact	TBD	TBD
Monitoring Personnel	TBD	TBD
Ecology Regional Office	TBD	TBD

Appendices

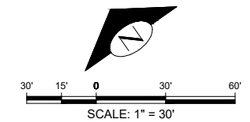
Appendix A - Site Map

Appendix B - BMP Details

Appendix C - Site Inspection Form

Appendix D – Engineering Calculations

Appendix A – Site Map



SCALE: 1" = 30'

NOTE:

1. CONTRACTOR SHALL ADJUST LOCATION OF TEMPORARY INTERCEPTOR SWALE AND CHECK DAMS NEEDED TO ROUTE STORMWATER TO TEMPORARY SEDIMENT POND.

LEGEND:

- STABILIZED CONSTRUCTION ENTRANCE
- PERIMETER PROTECTION
- APPROX CLEARING LIMITS
- STOCKPILE LOCATION
- INLET PROTECTION
- CHECK DAMN
- INTERCEPTOR SWALE

KEY NOTES:		
KEY	NOTE:	DETAIL/ SHEET
1	INSTALL APPROX 762 LF PERIMETER PROTECTION	5/C2.3
2	STABILIZED CONSTRUCTION ENTRANCE 100' MIN LENGTH x 15' MIN WIDTH	1/C2.3
3	TEMPORARY STORM DRAIN INLET PROTECTION SHALL BE INSTALLED IN ALL PROPOSED CATCH BASINS UNTIL PROJECT COMPLETION (TYP)	6/C2.3
4	INSTALL CHECK DAMS AS NEEDED TO CONTROL FLOW RATES. INSTALL ADDITIONAL CHECK DAMS IF EROSION IS OBSERVED ALONG FLOW LINE (TYP)	-
5	TEMPORARY INTERCEPTOR SWALE LOCATION SHOWN ON THIS SHEET IS SCHEMATIC & SUBJECT TO CHANGE BY CONTRACTOR DEPTH: 1' MIN WIDTH: 2' 2H:1V SIDE SLOPES	-
6	TEMPORARY SEDIMENT POND MIN REQUIRED PONDING AREA: 2,854 SF 3H:1V MAX SIDE SLOPES 1' FREEBOARD	2,3,4/C2.3
7	STORMWATER OVERFLOW FROM TEMPORARY SEDIMENT POND SHALL DISCHARGE TO THE SOUTHEAST	2,3,4/C2.3
8	PROVIDE TEMP. SUMP PUMPS AND DISCHARGE LINES FROM LOW AREAS TO PROPOSED SWALE AND/OR BAKER TANKS AS REQ'D	-
9	STOCKPILE LOCATION. CONTRACTOR TO ADJUST LOCATION AS NECESSARY	-
10	SEE SHEET C2.1 FOR PARKING LOT TESC PLAN	-

NIXON RPDS LN

NIXON RPDS LN

TESC PLAN

SCALE: 1" = 30'

FILE LOCATION: Z:\SHARED\PROJECTS\ACTIVE\2024\10\2410.0639.00_HELION ENERGY-CHELAN COUNTY\DRAWINGS\CAD-REVIT\ACTIVE\R-EH\HELION ENERGY - CIVIL PLANS.DWG - ORIGINAL SHEET SIZE: ARCH FULL BLEED D (36.00 X 24.00 INCHES) - LAST MODIFIED BY: MICHAEL PERNA

PRINCIPAL: ES PROJECT MANAGER: ES DESIGNED BY: RY DRAWN BY: RY CHECKED BY: ES

NO.	DATE	BY	REVISION

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS; FACET CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, AND ALL OTHER EXISTING FEATURES AND CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN AND/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT FACET PRIOR TO CONSTRUCTION.

FACET
P: 253.237.7770
www.facetnw.com
31620 23rd Ave S,
Suite 307
Federal Way, WA 98003
FEDERAL WAY | KIRKLAND | MOUNT VERNON | SEATTLE | SPOKANE | WHIDBEY ISLAND

ERIC D. SCHLOSSER
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER

Electronically signed by Eric Schlossw
Date: 2025.01.31 14:28:56 -08'00'

CALL 811
2 BUSINESS DAYS
BEFORE YOU DIG
(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

HELION ENERGY

NIXON RPDS LN
CHELAN COUNTY, WA 98828
2410.0639.00

PERMIT PLAN

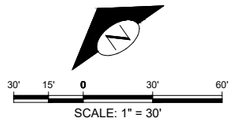
TESC PLAN

DATE: 1/31/2025

PLAN NUMBER:

C2.0

SHEET 3 OF 13



SCALE: 1" = 30'

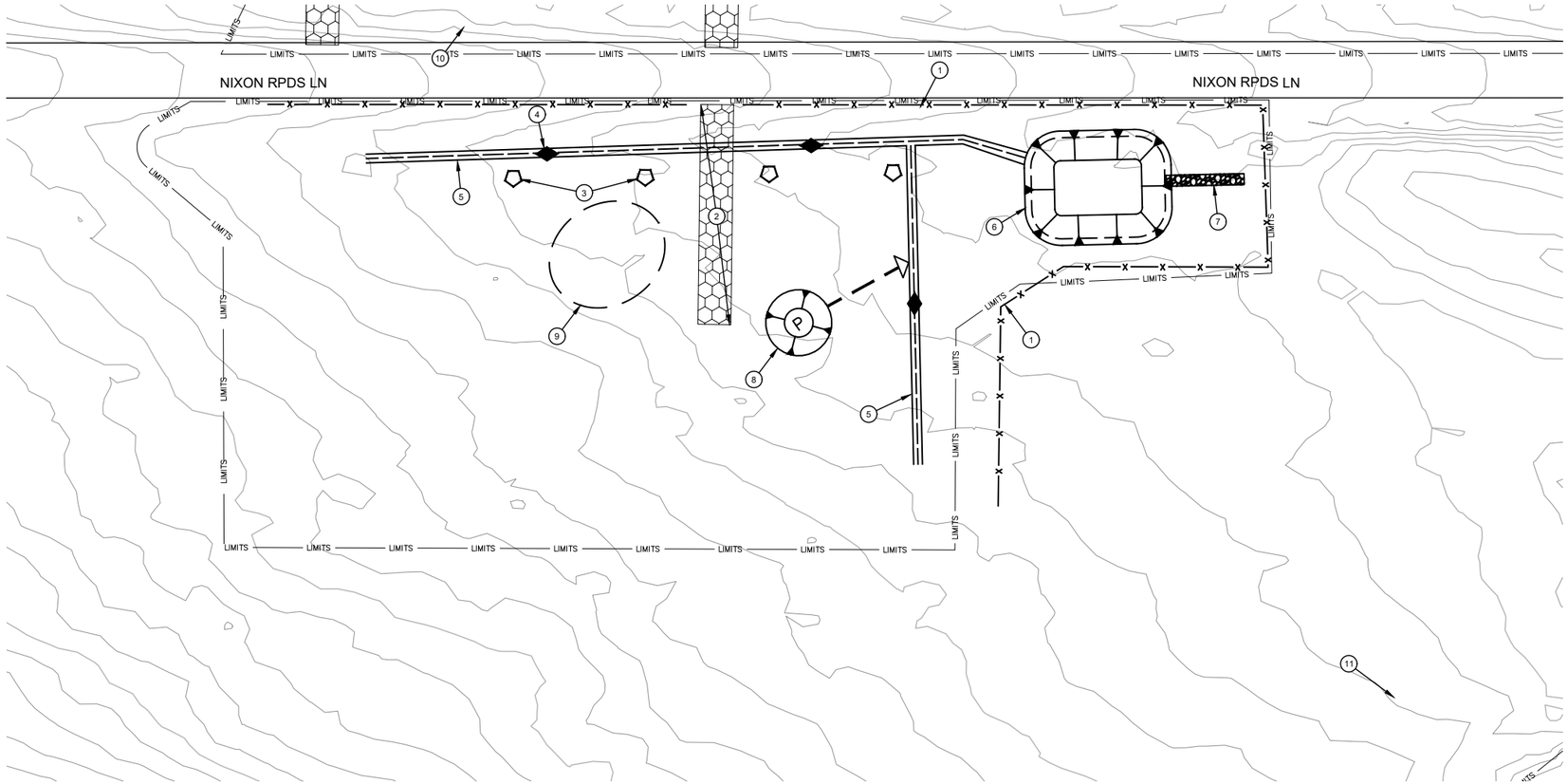
KEY NOTES:		
KEY	NOTE:	DETAIL/ SHEET
1	INSTALL APPROX 748 LF PERIMETER PROTECTION	5/C2.3
2	STABILIZED CONSTRUCTION ENTRANCE 100' MIN LENGTH x 15' MIN WIDTH	1/C2.3
3	TEMPORARY STORM DRAIN INLET PROTECTION SHALL BE INSTALLED IN ALL PROPOSED CATCH BASINS UNTIL PROJECT COMPLETION (TYP)	6/C2.3
4	INSTALL CHECK DAMS AS NEEDED TO CONTROL FLOW RATES. INSTALL ADDITIONAL CHECK DAMS IF EROSION IS OBSERVED ALONG FLOW LINE (TYP)	-
5	TEMPORARY INTERCEPTOR SWALE LOCATION SHOWN ON THIS SHEET IS SCHEMATIC & SUBJECT TO CHANGE BY CONTRACTOR DEPTH: 1' MIN WIDTH: 2' 2H:1V SIDE SLOPES	-
6	TEMPORARY SEDIMENT POND MIN REQUIRED PONDING AREA: 563 SF 3H:1V MAX SIDE SLOPES 1' FREEBOARD	2,3,4/C2.3
7	STORMWATER OVERFLOW FROM TEMPORARY SEDIMENT POND SHALL DISCHARGE TO THE SOUTHEAST	2,3,4/C2.3
8	PROVIDE TEMP. SUMP PUMPS AND DISCHARGE LINES FROM LOW AREAS TO PROPOSED SWALE AND/OR BAKER TANKS AS REQ'D	-
9	STOCKPILE LOCATION. CONTRACTOR TO ADJUST LOCATION AS NECESSARY	-
10	SEE SHEET C2.1 FOR SITE TESC PLAN	-
11	SEE SHEET C2.2 FOR ROAD TESC PLAN	-

NOTE:

1. CONTRACTOR SHALL ADJUST LOCATION OF TEMPORARY INTERCEPTOR SWALE AND CHECK DAMS NEEDED TO ROUTE STORMWATER TO TEMPORARY SEDIMENT POND.

LEGEND:

- STABILIZED CONSTRUCTION ENTRANCE
- PERIMETER PROTECTION
- APPROX CLEARING LIMITS
- STOCKPILE LOCATION
- INLET PROTECTION
- CHECK DAMN
- INTERCEPTOR SWALE



TESC PLAN

SCALE: 1" = 30'

NO.	DATE	BY	REVISION

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS; FACET CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, AND ALL OTHER EXISTING FEATURES AND CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN AND/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT FACET PRIOR TO CONSTRUCTION.

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P: 253.237.7770
www.facetnw.com
31620 23rd Ave S,
Suite 307
Federal Way, WA 98003
FEDERAL WAY | ASHLAND | MOUNT VERNON | SEATTLE | SPOKANE | WHIDBEY ISLAND

ERIC D. SCHLOSSER
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER
Electronically signed by Eric Schlossw
Date: 2025.01.31 11:28:55 -08'00'

CALL 811
2 BUSINESS DAYS
BEFORE YOU DIG
(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

HELION ENERGY
NIXON RPDS LN
CHELAN COUNTY, WA 98828
2410.0639.00

PERMIT PLAN

TESC PLAN

DATE: 1/31/2025

PLAN NUMBER:

C2.1

SHEET 4 OF 13

FILE LOCATION: Z:\SHARED\PROJECTS\ACTIVE\2024\1924\10_0639.00_HELION ENERGY-CHELAN COUNTY\DRAWINGS\CAD-REVIT\ACTIVEFILE\HELION ENERGY - CIVIL PLANS.DWG - ORIGINAL SHEET SIZE: ARCH FULL BLEED D (36.00 X 24.00 INCHES) - LAST MODIFIED BY: MICHAEL PERNA
PRINCIPAL: ES PROJECT MANAGER: ES DESIGNED BY: RY DRAWN BY: RY CHECKED BY: ES

30' 15' 0 30' 60'

SCALE: 1" = 30'

KEY NOTES:		
KEY	NOTE:	DETAIL/ SHEET
1	INSTALL STRAW WATTLES AS NEEDED	7/C2.3
2	STABILIZED CONSTRUCTION ENTRANCE 100' MIN LENGTH x 15' MIN WIDTH	1/C2.3

NOTE:

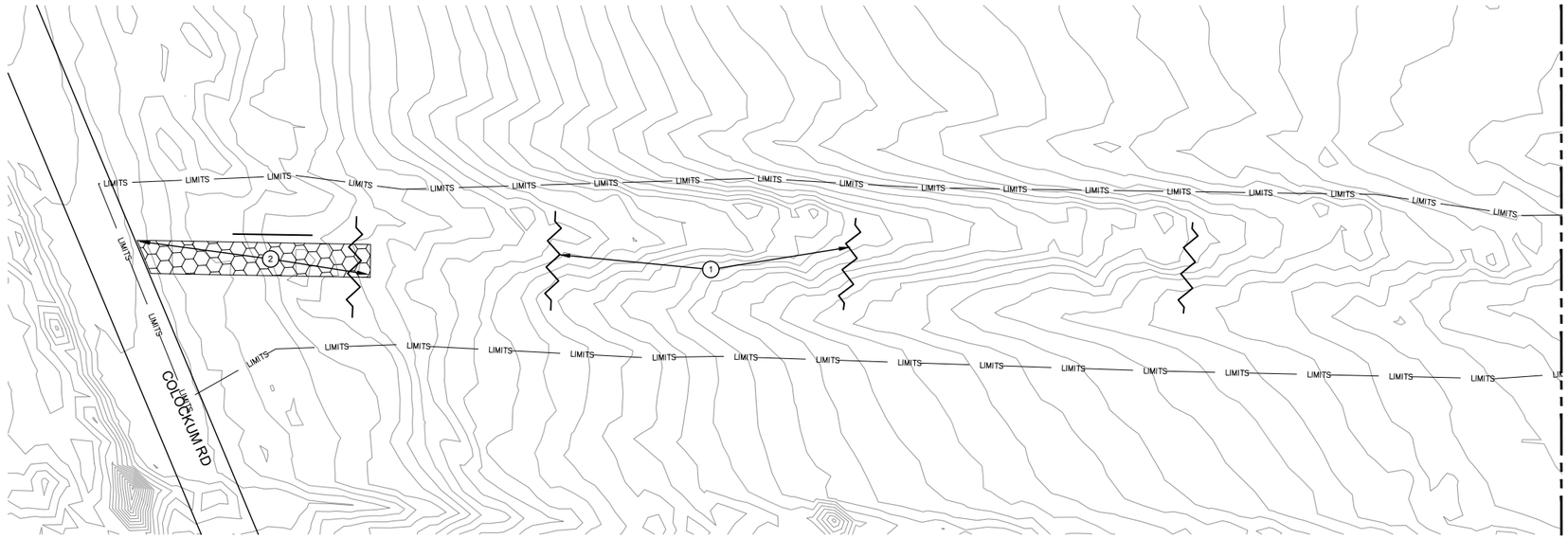
1. CONTRACTOR SHALL ADJUST LOCATION OF TEMPORARY STRAW WATTLE TO BETTER CAPTURE SEDIMENT FROM CONSTRUCTION STORMWATER AS REQ'D.

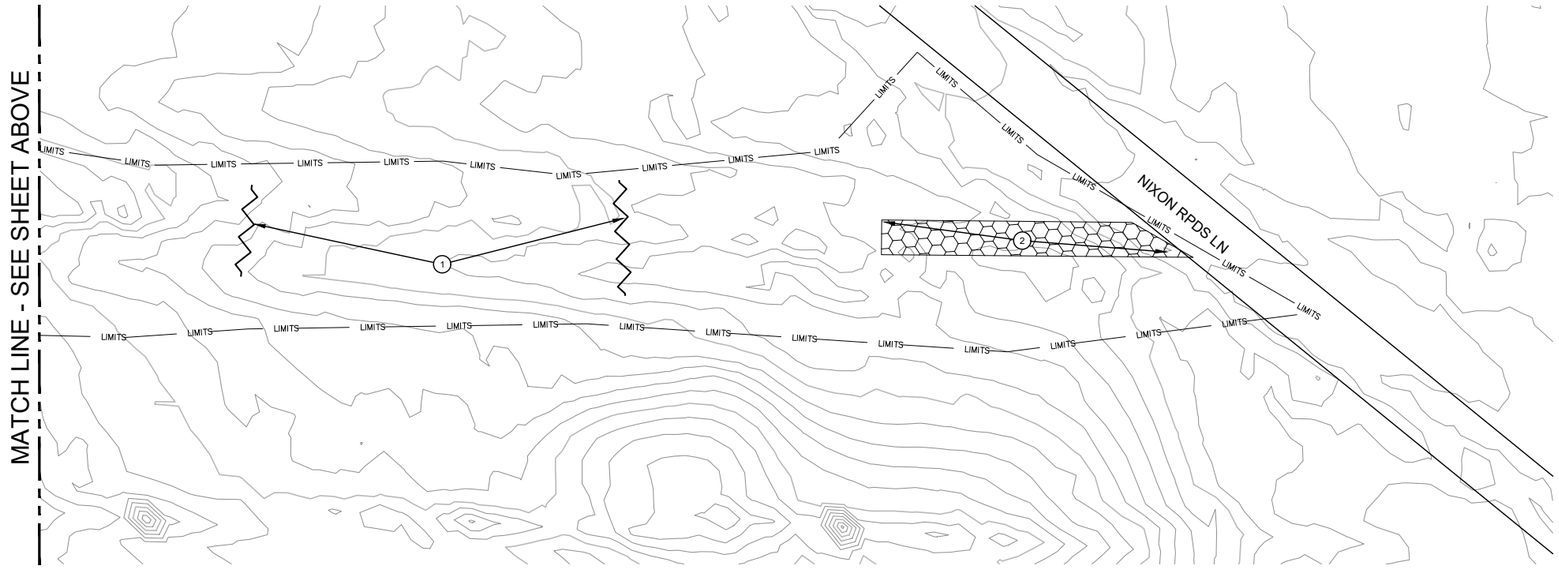
LEGEND:

STABILIZED CONSTRUCTION ENTRANCE

STRAW WATTLE

LIMITS APPROX CLEARING LIMITS





TESC PLAN (ROAD)

SCALE: 1" = 30'

NO.	DATE	BY	REVISION

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS. FACET CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, AND ALL OTHER EXISTING FEATURES AND CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN AND/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT FACET PRIOR TO CONSTRUCTION.

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ERIC D. SCHLOSSER — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

Electronically signed by Eric Schlossw
Date: 2025.01.31 11:28:56 -08'00'

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(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

HELION ENERGY
NIXON RPDS LN
CHELAN COUNTY, WA 98828
2410.0639.00

PERMIT PLAN

TESC PLAN (ROAD)

DATE: 1/31/2025

PLAN NUMBER:

C2.2

SHEET 5 OF 13

FILE LOCATION: Z:\SHARED\PROJECTS\ACTIVE\2024\10\2410.0639.00_HELION ENERGY-CHELAN COUNTY\09\ARKIGS\CAD-REVIT\ACTIVE\PLEHELION ENERGY - CIVIL PLANS.DWG - ORIGINAL SHEET SIZE: ARCH FULL BLEED D (36.00 X 24.00 INCHES) - LAST MODIFIED BY: MICHAEL PERNA

PRINCIPAL: ES PROJECT MANAGER: ES DESIGNED BY: RY DRAWN BY: RY CHECKED BY: ES

Appendix B – BMP Details

BMP C105: Stabilized Construction Access

Purpose

Stabilized construction accesses are established to reduce the amount of sediment transported onto paved roads outside the project site by vehicles or equipment. This is done by constructing a stabilized pad of quarry spalls at entrances and exits for project sites.

Conditions of Use

Construction accesses shall be stabilized wherever traffic will be entering or leaving a construction site if paved roads or other paved areas are within 1,000 feet of the site.

For residential subdivision construction sites, provide a stabilized construction access for each residence, rather than only at the main subdivision entrance. Stabilized surfaces shall be of sufficient length/width to provide vehicle access/parking, based on lot size and configuration.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized accesses not shown in the initial

Construction SWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

Design and Installation Specifications

- See Figure 7.2: Stabilized Construction Access for details. Note: the 100' minimum length of the access shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100').
- Construct stabilized construction accesses with a 12-inch thick pad of 4-inch to 8-inch quarry spalls, a 4-inch course of asphalt treated base (ATB), or use existing pavement. Do not use crushed concrete, cement, or calcium chloride for construction access stabilization because these products raise pH levels in stormwater and concrete discharge to waters of the State is prohibited.
- A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the standards listed in Table 7.2: Stabilized Construction Access Geotextile Standards.

Table 7.2: Stabilized Construction Access Geotextile Standards

Geotextile Property	Required Value
Grab Tensile Strength (ASTM D4751)	200 psi min.
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	No. 20 to No. 45 (U.S. standard sieve size)

- Consider early installation of the first lift of asphalt in areas that will be paved; this can be used as a stabilized access. Also consider the installation of excess concrete as a stabilized access. During large concrete pours, excess concrete is often available for this purpose.
- Fencing (see BMP C103: High-Visibility Fence) shall be installed as necessary to restrict traffic to the construction access.
- Whenever possible, the access shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.
- Construction accesses should avoid crossing existing sidewalks and back of walk drains if at all possible. If a construction access must cross a sidewalk or back of walk drain, the full length of the sidewalk and back of walk drain must be covered and protected from sediment leaving the site.

Alternative Material Specification

WSDOT has raised safety concerns about the quarry spall rock specified above. WSDOT observes that the 4-inch to 8-inch rock sizes can become trapped between dually truck tires, and

then released off-site at highway speeds. WSDOT has chosen to use a modified specification for the rock while continuously verifying that the stabilized construction access remains effective. To remain effective, the BMP must prevent sediment from migrating off site. To date, there has been no performance testing to verify operation of this new specification. Local jurisdictions may use the alternative specification, but must perform increased off-site inspection if they use, or allow others to use, it.

Stabilized construction accesses may use material that meets the requirements of WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Section 9-03.9(1) (WSDOT, 2016) for ballast except for the following special requirements.

The grading and quality requirements are listed in Table 7.3: Stabilized Construction Access Alternative Material Requirements.

Table 7.3: Stabilized Construction Access Alternative Material Requirements

Sieve Size	Percent Passing
2½″	99 to 100
2″	65 to 100
¾″	40 to 80
No. 4	5 max.
No. 100	0 to 2
% Fracture	75 min.

Notes:

1. All percentages are by weight.
2. The sand equivalent value and dust ratio requirements do not apply.
3. The fracture requirement shall be at least one fractured face and will apply the combined aggregate retained on the No. 4 sieve in accordance with FOP for AASHTO T 335.

Maintenance Standards

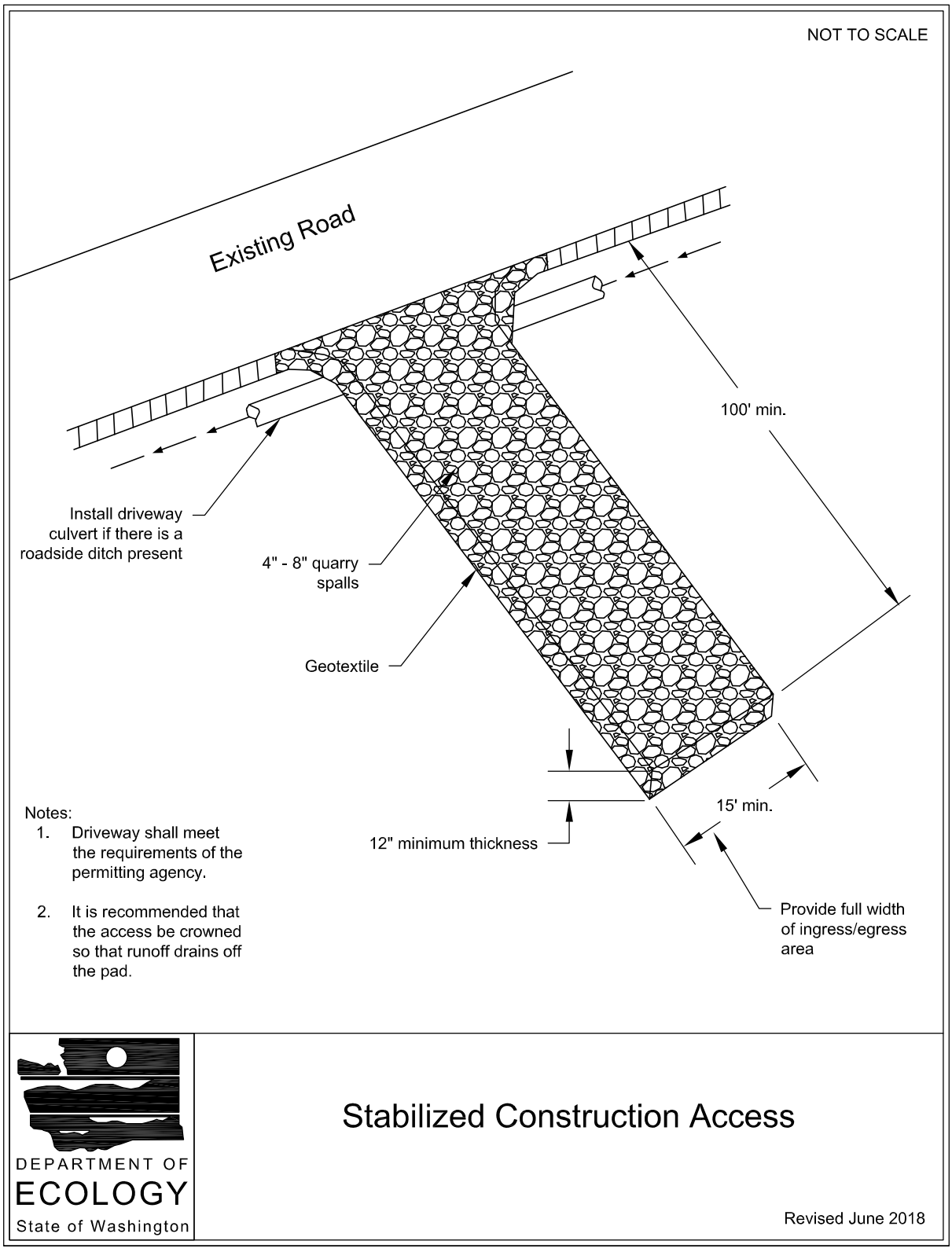
Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

- If the access is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include replacement/cleaning of the existing quarry spalls, street sweeping, an increase in the dimensions of the access, or the installation of BMP C106: Wheel Wash.
- Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The

pavement shall not be cleaned by washing down the street, except when sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump to contain the wash water shall be considered. The sediment would then be washed into the sump where it can be controlled.

- Perform street sweeping by hand or with a high efficiency sweeper. Do not use a non-high efficiency mechanical sweeper because this creates dust and throws soils into storm systems or conveyance ditches.
- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
- If vehicles are entering or exiting the site at points other than the construction access(es), BMP C103: High-Visibility Fence shall be installed to control traffic.
- Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

Figure 7.2: Stabilized Construction Access



Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C107: Construction Road / Parking Area Stabilization

Purpose

Stabilizing roads, parking areas, and other on-site vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or stormwater runoff.

Conditions of Use

Roads and parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.

BMP C103: High-Visibility Fence shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

Design and Installation Specifications

- On areas that will receive asphalt as part of the project, install the first lift as soon as possible.
- A 6-inch depth of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or utility installation. A 4-inch course of asphalt treated base (ATB) may also be used, or the road/parking area may be paved. It may also be possible to use cement or calcium chloride for soil stabilization. If cement or cement kiln dust is used for road base stabilization, pH monitoring and BMP C252: Treating and Disposing of High pH Water is necessary to evaluate and minimize the effects on stormwater. If the area will not be used for permanent roads, parking areas, or structures, a 6-inch depth of hog fuel may also be used, but this is likely to require more maintenance. Whenever possible, construction roads and parking areas shall be placed on a firm, compacted subgrade.
- Temporary road gradients shall not exceed 15 percent. Roadways shall be carefully graded to drain. Drainage ditches shall be provided on each side of the roadway in the case of a crowned section, or on one side in the case of a super-elevated section. Drainage ditches shall be directed to a sediment control BMP.
- Rather than relying on ditches, it may also be possible to grade the road so that runoff sheet flows into a heavily vegetated area with a well-developed topsoil. Landscaped areas are not adequate. If this area has at least 50 feet of vegetation that water can flow through, then it is generally preferable to use the vegetation to treat runoff, rather than a sediment pond or trap. The 50 feet shall not include wetlands or their buffers. If runoff is allowed to sheet flow through adjacent vegetated areas, it is vital to design the roadways and parking areas so that no concentrated runoff is created.
- Storm drain inlets shall be protected to prevent sediment-laden water entering the drainage system (see BMP C220: Inlet Protection).

Maintenance Standards

Inspect stabilized areas regularly, especially after large storm events.

Crushed rock, gravel base, etc., shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.

Following construction, these areas shall be restored to pre-construction condition or better to prevent future erosion.

Perform street cleaning at the end of each day or more often if necessary.

BMP C120: Temporary and Permanent Seeding

Purpose

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

Conditions of Use

- Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days. See 7.2.5 Element 5: Stabilize Soils for specific timelines for stabilizing exposed soils.
- See Table 7.4: Seeding Windows in Eastern Washington (continued) for appropriate seeding windows.
- Review all disturbed areas in late August to early September and complete all seeding by the end of April. Otherwise, vegetation will not establish itself enough to provide more than average protection.
- Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121: Mulching for specifications.
- Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See BMP F6.61: Post-Construction Soil Quality and Depth.

Table 7.4: Seeding Windows in Eastern Washington

Month	Seeding Recommendations
January	Acceptable seeding window
February	
March	
April	

Table 7.4: Seeding Windows in Eastern Washington (continued)

Month	Seeding Recommendations
May	Seeding permanent species is not recommended unless irrigation is conducted
June	
July	
August	
September	Acceptable seeding window
October	Optimum seeding window
November (First Half)	
November (Second Half)	Acceptable seeding window
December	

Design and Installation Specifications

General

- Install channels intended for vegetation before starting major earthwork and hydroseed with a Bonded Fiber Matrix (BFM). For vegetated channels that will have high flows, install erosion control blankets over the top of hydroseed. Before allowing water to flow in vegetated channels, establish a 50% vegetation cover. If vegetated channels cannot be established by seed before water flow, install sod or prevegetated mats in the channel bottom over top of hydromulch and erosion control blankets.
- Confirm the installation of all required stormwater control measures to prevent seed from washing away.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre (lb/acre) of mulch with 3% tackifier. See BMP C121: Mulching for specifications.
- Areas that will have seeding only, and not landscaping, may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Re-install native topsoil on the disturbed soil surface before application. See BMP F6.61: Post-Construction Soil Quality and Depth.
- When installing seed via hydroseeding operations, only about 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. To overcome this, consider increasing seed quantities by up to 50 percent.
- Vegetation establishment can be enhanced by one of the following two approaches:
    - Approach 1: Enhance vegetation establishment by dividing the hydromulch operation into two phases:

        - Phase 1 – Install all seed and fertilizer with 25% to 30% mulch and tackifier onto the soil in the first lift.
        - Phase 2 – Install the remaining mulch and tackifier over the first lift.
    - Approach 2: Vegetation can also be enhanced by:
        - Installing the mulch, seed, fertilizer, and tackifier in one lift;
        - Spreading or blowing straw over the top of the hydromulch at a rate of about 800 to 1,000 lb/acre; or
        - Holding straw in place with a standard tackifier.

    Both of these approaches (Approach 1 and Approach 2) will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

    - Irrigation,
    - Reapplication of mulch, and
    - Repair of failed slope surfaces.

    Either of these approaches can use standard hydromulch (1,500 lb/acre minimum) and BFM/mechanically bonded fiber matrix (MBFM) (3,000 lb/acre minimum).

- Seed may be installed by hand if it is:
    - Temporary and covered by straw, mulch, or topsoil; or
    - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- Consult the local suppliers and/or the local conservation district for their recommendations for appropriate seed mixes and application rates. The appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic.
- In addition to meeting erosion control functions and not hindering maintenance operations, selection of long-lived, successional growth native vegetation that can compete against or exclude weeds and grow with minimal maintenance after plant establishment is preferred. Provide diversity to the greatest extent possible and plan for a succession of flowering times to improve pollinator habitat.
- The seed mixes listed in Table 7.5: Temporary and Permanent Seed Mixes for Eastern Washington (continued) include recommended mixes for both temporary and permanent seeding. Alternative seed mixes approved by the local jurisdiction may also be used.

Table 7.5: Temporary and Permanent Seed Mixes for Eastern Washington

Seed Mix (percentages by weight)	Application Rate[1] (lb/acre)	Approx. Number of Seeds per Square Foot
Temporary Erosion Control Seed Mix Use for the temporary stabilization of disturbed areas until permanent vegetation or other long-term erosion control measures can be established. These annual plants will generally not survive more than one growing season.		
Mix "A" • (100%) Winter or spring wheat (I)	80	(not provided)
Mix "B" • (100%) Spring Barley (I)	80	(not provided)
Mix "C" • (100%) Regreen (I)[a] or triticale (I)	50	(not provided)
Mix "D" • (100%) Annual ryegrass (I)	15	(not provided)
Permanent Seed Mixes: Upland Areas with Less Than 12 Inches Precipitation		
Mix "A" • (70%) Crested or Siberian wheatgrass (droughty, coarse soils) (I) • (20%) Indian ricegrass (sandy soil) (N) • (10%) Big bluegrass (N) or needle and thread grass (N)	10	63
Mix "B" • (78%) Bluebunch wheatgrass (N) • (11%) Sheep fescue (I) • (11%) Big bluegrass (N) or needle and thread grass (N)	9	56
Mix "C"	9	64

Table 7.5: Temporary and Permanent Seed Mixes for Eastern Washington (continued)

Seed Mix (percentages by weight)	Application Rate[1] (lb/acre)	Approx. Number of Seeds per Square Foot
• (89%) Thickspike wheatgrass (N) • (11%) Sheep fescue (I)		
Permanent Seed Mixes: Upland Areas with 12 to 15 Inches Precipitation		
Mix "A" • (78%) Thickspike wheatgrass (N) • (22%) Indian ricegrass (sandy or sandy loam soils) (N)	9	53
Mix "B" • (80%) Bluebunch or beardless wheatgrass (N) • (10%) Sheep fescue (I) • (10%) Basin wildrye (N)	10	63
Mix "C" • (64%) Pubescent wheatgrass (I) • (18%) Thickspike wheatgrass (N) • (18%) Sheep fescue (I)	11	49
Permanent Seed Mixes: Upland Areas with 15 to 18 Inches Precipitation		
Mix "A" • (62%) Bluebunch wheatgrass (N) or beardless wheatgrass (N) • (15%) Hard fescue (I) or sheep fescue (I) • (15%) Native legume (N) • (8%) Big bluegrass (N)	13	70
Mix "B"	13	72

Table 7.5: Temporary and Permanent Seed Mixes for Eastern Washington (continued)

Seed Mix (percentages by weight)	Application Rate[1] (lb/acre)	Approx. Number of Seeds per Square Foot
• (62%) Pubescent wheatgrass (I) or intermediate wheatgrass (I) or thickspike wheatgrass (N) • (15%) Hard fescue (I) or sheep fescue (I) • (15%) Native legume (N) • (8%) Big bluegrass (N)		
Permanent Seed Mixes: Upland Areas with 18 to 24 Inches Precipitation		
Mix "A" • (58%) Slender wheatgrass (N) or sodar streambank wheatgrass • (17%) Hard fescue (I) • (17%) Native clover spp. (N) or milkvetch spp. (N) • (8%) Mountain brome (N)	12	64
Mix "B" • (66%) Blue wildrye (N) • (17%) Hard fescue (I) • (17%) Native lupine (N) or northern sweetvetch (N)	12	62
Mix "C" • (66%) Mountain brome (N) • (17%) Hard fescue (I) • (17%) White clover (I) or red clover (I)	12	76
Permanent Seed Mixes: Upland Areas with More Than 24 Inches Precipitation		
Mix "A" • (55%) Blue wildrye (N)	11	72

Table 7.5: Temporary and Permanent Seed Mixes for Eastern Washington (continued)

Seed Mix (percentages by weight)	Application Rate[1] (lb/acre)	Approx. Number of Seeds per Square Foot
• (18%) Mountain brome (N) • (18%) White clover (I) • (9%) Red fescue (I)		
Mix "B" • (33%) Mountain brome (N) • (33%) Slender wheatgrass (N) • (17%) Hard fescue (I) • (17%) Native legume (N)	12	61
Permanent Seed Mixes: Grassed Waterways with Fewer Than 15 Inches Precipitation		
Mix "A" • (78%) Thickspike wheatgrass (N) • (22%) Big bluegrass (N)	9	66
Mix "B" • (83%) Pubescent wheatgrass (I) • (17%) Sheep fescue (I)	12	48
Mix "C" • (78%) Streambank wheatgrass (N) • (22%) Sheep fescue (I)	9	56
Permanent Seed Mixes: Grassed Waterways with 15 to 18 Inches Precipitation		
Mix "A" • (83%) Tall wheatgrass (I) • (17%) Hard fescue (I) or sheep fescue (I)	12	46
Mix "B" • (83%) Pubescent wheatgrass	12	48

Table 7.5: Temporary and Permanent Seed Mixes for Eastern Washington (continued)

Seed Mix (percentages by weight)	Application Rate[1] (lb/acre)	Approx. Number of Seeds per Square Foot
(I), streambank wheatgrass (N), or intermediate wheatgrass (I) • (17%) Hard fescue (I) or sheep fescue (I)		
Mix "C" • (80%) Thickspike wheatgrass (N) • (20%) Hard fescue (I) or sheep fescue (I)	10	57
Permanent Seed Mixes: Grassed Waterways with More Than 18 Inches Precipitation		
Mix "A" • (71%) Intermediate wheatgrass (I) • (29%) Annual ryegrass (I) or perennial ryegrass (I)	14	40
Mix "B" • (83%) Mountain brome (N) or meadow brome • (17%) Hard fescue (I)	12	46
Mix "C" • (100%) Tall wheatgrass (I)	10	38
Permanent Seed Mixes: Stabilization of Ski Slopes and Subalpine Areas		
Mix "A" • (72%) Blue wildrye (N) or Idaho fescue (N) • (14%) Sheep fescue (I) • (14%) Lupine (N)	14	(not provided)
Mix "B" • (47%) Pubescent wheatgrass (I) or red fescue (I) • (29%) Hard fescue (I)	17	(not provided)

Table 7.5: Temporary and Permanent Seed Mixes for Eastern Washington (continued)

Seed Mix (percentages by weight)	Application Rate[1] (lb/acre)	Approx. Number of Seeds per Square Foot
• (12%) Sheep fescue (I) • (12%) White clover (I) or bentgrasses (I)		

Notes:

[a]Sterile wheat x wheatgrass hybrid

(N) = native plant species

(I) = introduced, nonnative plant species

1. For the permanent seed mixes, drilled seeding rates are given in lb/acre. Double the rates if the method of application is broadcast or hydroseed.
2. Consideration should be given to the traffic hazard for wildlife when selecting food species for roadside stabilization.
3. Mixtures are expressed as pure live seed (PLS).

Roughening and Rototilling

- The seedbed should be firm and rough. Roughen all soil no matter what the slope. Track walk slopes before seeding if engineering purposes require compaction. Backblading or smoothing of slopes greater than 4H:1V is not allowed if they are to be seeded.
- Restoration-based landscape practices require deeper incorporation than that provided by a simple, single-pass rototilling treatment. Wherever practical, initially rip the subgrade to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, permanent areas shall receive soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches, complete the rototilling process in multiple lifts, or prepare the soil amendments per the specifications and place to achieve the specified depth.

Fertilizers

- Conducting soil tests to determine the exact type and quantity of fertilizer needed is recommended. This will prevent the overapplication of fertilizer.
- Organic matter is the most appropriate form of fertilizer because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form.

- Always use slow-release fertilizers because they are more efficient and have fewer environmental impacts. Do not add fertilizer to the hydromulch machine, or agitate, more than 20 minutes before use. Too much agitation destroys the slow-release coating.
- There are numerous products available to take the place of chemical fertilizers, including several with seaweed extracts that are beneficial to soil microbes and organisms. If 100% cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal provides a good source of long-term, slow-release, available nitrogen.

Bonded Fiber Matrix and Mechanically Bonded Fiber Matrix

- On steep slopes, use Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products. Apply BFM/MBFM products at a minimum rate of 3,000 pounds per acre with approximately 10% tackifier. Achieve a minimum of 95% soil coverage during application. Numerous products are available commercially. Most products require 24-36 hours to cure before rainfall, and cannot be installed on wet or saturated soils. Generally, products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.
- Install products per manufacturer's instructions.
- BFMs and MBFMs provide good alternatives to blankets in most areas requiring vegetation establishment. Advantages over blankets include the following:
    - BFM and MBFMs do not require surface preparation.
    - Helicopters can assist in installing BFM and MBFMs in remote areas.
    - On slopes steeper than 2.5H:1V, blanket installers may require ropes and harnesses for safety.
    - Installing BFM and MBFMs can save at least $1,000 per acre compared to blankets.

Maintenance Standards

- Reseed any seeded areas that fail to establish at least 50% cover (100% cover for areas that receive sheet or concentrated flows) of all seeded areas after 3 months of active growth following germination during the growing season. If reseeding is ineffective, use an alternate method, such as sodding, mulching, or nets/blankets. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.
- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. If the erosion problem is drainage related, the problem shall be fixed and the eroded area reseeded and protected by mulch.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes runoff.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C121: Mulching

Purpose

Mulching soils provides immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. There are a variety of mulches that can be used. This section discusses only the most common types of mulch.

Conditions of Use

As a temporary cover measure, mulch should be used:

- For less than 30 days on disturbed areas that require cover.
- At all times for seeded areas, especially during the wet season and during the hot summer months.
- During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.

Mulch may be applied at any time of the year and must be refreshed periodically.

For seeded areas, mulch may be made up of 100 percent:

- Cottonseed meal;
- Fibers made of wood, recycled cellulose, hemp, or kenaf;
- Compost;
- Or blends of these.

Tackifier shall be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers.

Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

Recycled cellulose may contain polychlorinated biphenyl (PCBs). Ecology recommends that products should be evaluated for PCBs prior to use.

Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body.

Any mulch or tackifier product used shall be installed per the manufacturer's instructions.

Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table 7.7: Mulch Standards and Guidelines (continued). Consult with the local supplier or the local conservation district for their recommendations. Increase the application rate until the ground is 95% covered (i.e. not visible under the mulch layer). Note: Thickness may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

Where the option of "Compost" is selected, it should be a coarse compost that meets the size gradations listed in Table 7.6: Size Gradations of Compost as Mulch Material when tested in accordance with Test Method 02.02-B found in *Test Methods for the Examination of Composting and Compost* (Thompson, 2001).

Mulch used within the ordinary high-water mark of surface waters should be selected to minimize potential flotation of organic matter. Composted organic materials have higher specific gravities (densities) than straw, wood, or chipped material. Consult the Hydraulic Permit Authority (HPA) for mulch mixes if applicable.

Table 7.6: Size Gradations of Compost as Mulch Material

Sieve Size	Percent Passing
3"	100%
1"	90% - 100%
3/4"	70% - 100%
1/4"	40% - 100%

Table 7.7: Mulch Standards and Guidelines

Mulch Material	Guideline	Description
Straw	**Quality Standards**	Air-dried; free from undesirable seed and coarse material.
	Application Rates	2" to 3" thick; 5 bales per 1,000 sf or 2 to 3 tons per acre
	Remarks	Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas, straw must be held in place by crimping, using a tackifier, or covering with netting. Blown straw always has to be held in place with a tackifier because even light winds will blow it away. Straw, however, has several deficiencies that should be considered when selecting mulch

Table 7.7: Mulch Standards and Guidelines (continued)

Mulch Material	Guideline	Description
		materials. It often introduces and/or encourages the propagation of weed species, and it has no significant long-term benefits. Straw should only be used if mulches with long-term benefits are unavailable locally. It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	**Quality Standards**	No growth inhibiting factors.
	Application Rates	Approx. 35-45 lbs per 1,000 sf or 1,500 - 2,000 lbs per acre
	Remarks	Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at least doubled. Fibers longer than about 3/4 - 1 inch clog hydromulch equipment. Fibers should be kept to less than 3/4 inch.
Compost	**Quality Standards**	No visible water or dust during handling. Must be produced per WAC 173-350, Solid Waste Handling Standards, but may have up to 35% biosolids.
	Application Rates	2" thick minimum; approximately 100 tons per acre (approximately 750 lbs per cubic yard)
	Remarks	More effective control can be obtained by increasing thickness to 3". Compost makes an excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Compost used for mulch has a coarser size gradation than compost used for BMP C125: Topsoiling / Composting or BMP F6.61: Post-Construction Soil Quality and Depth. It is more stable and practical to use in wet areas and during rainy weather conditions. Do not use compost near wetlands if biosolids are included. Do not use compost near phosphorous impaired water bodies.
Chipped Site Vegetation	**Quality Standards**	Gradations from fines to 6 inches in length for texture, variation, and interlocking properties. Include a mix of various sizes so that the average size is between 2 and 4 inches.
	Application Rates	2" thick minimum.
	Remarks	This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above approximately 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If permanent seeding or planting is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment.

Table 7.7: Mulch Standards and Guidelines (continued)

Mulch Material	Guideline	Description
		Note: Thick application of this material over existing grass, herbaceous species, and some groundcovers could smother and kill vegetation.
Wood-Based Mulch	**Quality Standards**	No visible water or dust during handling. Must be purchased from a supplier with a Solid Waste Handling Permit or one exempt from solid waste regulations.
	Application Rates	2" thick minimum; approximately 100 tons per acre (approximately 750 lbs. per cubic yard).
	Remarks	This material is often called "wood straw" or "hog fuel". The use of mulch ultimately improves the organic matter in the soil. Special caution is advised regarding the source and composition of wood-based mulches. Its preparation typically does not provide any weed seed control, so evidence of residual vegetation in its composition or known inclusion of weed plants or seeds should be monitored and prevented (or minimized).
Wood Strand Mulch	**Quality Standards**	A blend of loose, long, thin wood pieces derived from native conifer or deciduous trees with high length-to-width ratio.
	Application Rates	2" thick minimum.
	Remarks	Cost-effective protection when applied with adequate thickness. A minimum of 95% of the wood strand shall have lengths between 2 and 10 inches, with a width and thickness between 1/16 and 0.5 inches. The mulch shall not contain resin, tannin, or other compounds in quantities that would be detrimental to plant life. Sawdust or wood shavings shall not be used as mulch. See specification 9-14.4(4) from the *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT, 2016)

Maintenance Standards

The thickness of the mulch cover must be maintained.

Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

BMP C122: Nets and Blankets

Purpose

Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In

addition, some nets and blankets can be used to permanently reinforce turf to protect drainage systems during high flows.

Nets (commonly called matting) are strands of material woven into an open, but high-tensile strength net (e.g. coconut fiber matting). Blankets are strands of material that are not tightly woven, but instead form a layer of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

Conditions of Use

Erosion control netting and blankets shall be made of natural plant fibers unaltered by synthetic materials.

Erosion control nets and blankets should be used:

- To aid permanent vegetated stabilization of slopes 2H:1V or greater and with more than 10 feet of vertical relief.
- For drainage ditches and swales (highly recommended). The application of appropriate netting or blanket to drainage ditches and swales can protect bare soil from channelized runoff while vegetation is established. Nets and blankets also can capture a great deal of sediment due to their open, porous structure. Nets and blankets can be used to permanently stabilize channels and may provide a cost-effective, environmentally preferable alternative to riprap.

Disadvantages of nets and blankets include:

- Surface preparation is required.
- On slopes steeper than 2.5H:1V, net and blanket installers may need to be roped and harnessed for safety.
- They cost at least $4,000 - $6,000 per acre installed.

Advantages of nets and blankets include:

- Installation without mobilizing special equipment.
- Installation by anyone with minimal training
- Installation in stages or phases as the project progresses.
- Installers can hand place seed and fertilizer as they progress down the slope.
- Installation in any weather.
- There are numerous types of nets and blankets that can be designed with various parameters in mind. Those parameters include: fiber blend, mesh strength, longevity, biodegradability, cost, and availability.

An alternative to nets and blankets in some limited conditions is BMP C202: Riprap Channel Lining. Ensure that BMP C202: Riprap Channel Lining is appropriate before using it as a substitute for nets and blankets.

Design and Installation Specifications

- See Figure 7.4: Channel Installation (Clackamas County et al., 2008) and Figure 7.5: Slope Installation for typical orientation and installation of nets and blankets used in channels and as slope protection. Note: these are typical only; all nets and blankets must be installed per manufacturer's installation instructions.
- Installation is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Install nets and blankets on slopes per the following steps:
    1. Complete final grade and track walk up and down the slope. Soils should be raked and uniform prior to installing nets or blankets. To be effective, nets and blankets must have good adhesion to the soil.
    2. Install hydromulch with seed and fertilizer.
    3. Dig a small trench, approximately 12 inches wide by 6 inches deep along the top of the slope.
    4. Install the leading edge of the net/blanket into the small trench and staple approximately every 18 inches.

       NOTE: Staples are metal, "U"-shaped, and a minimum of 6 inches long. Longer staples are used in sandy soils. Biodegradable stakes are also available.
    5. Roll the net/blanket slowly down the slope as the installer walks backward.

       NOTE: The net/blanket rests against the installer's legs. Staples are installed as the net/blanket is unrolled. It is critical that the proper staple pattern is used for the net/blanket being installed. The net/blanket is not to be allowed to roll down the slope on its own as this stretches the net/blanket, making it impossible to maintain soil contact. In addition, no one is allowed to walk on the net/blanket after it is in place.
    6. If the net/blanket is not long enough to cover the entire slope length, the trailing edge of the upper net/blanket should overlap the leading edge of the lower net/blanket and be stapled. On steeper slopes, this overlap should be installed in a small trench, stapled, and covered with soil.
- With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the designer consult the manufacturer's information and that a site visit takes place in order to ensure that the product specified is appropriate. Information is also available in WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Division 8-01 and Division 9-14 (WSDOT, 2016).
- Use jute matting in conjunction with mulch (BMP C121: Mulching). Excelsior, woven straw blankets and coir (coconut fiber) blankets may be installed without mulch. There are many

other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances.

- In general, most nets (e.g., jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Extremely steep, unstable, wet, or rocky slopes are often appropriate candidates for use of synthetic blankets, as are riverbanks, beaches and other high-energy environments. If synthetic blankets are used, the soil should be hydromulched first.
- 100 percent biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a paper or fiber mesh and stitching which may last up to a year.
- Most netting used with blankets is photodegradable, meaning it breaks down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.

Maintenance Standards

- Maintain good contact with the ground. Erosion must not occur beneath the net or blanket.
- Repair and staple any areas of the net or blanket that are damaged or not in close contact with the ground.
- Fix and protect eroded areas if erosion occurs due to poorly controlled drainage.

Figure 7.4: Channel Installation

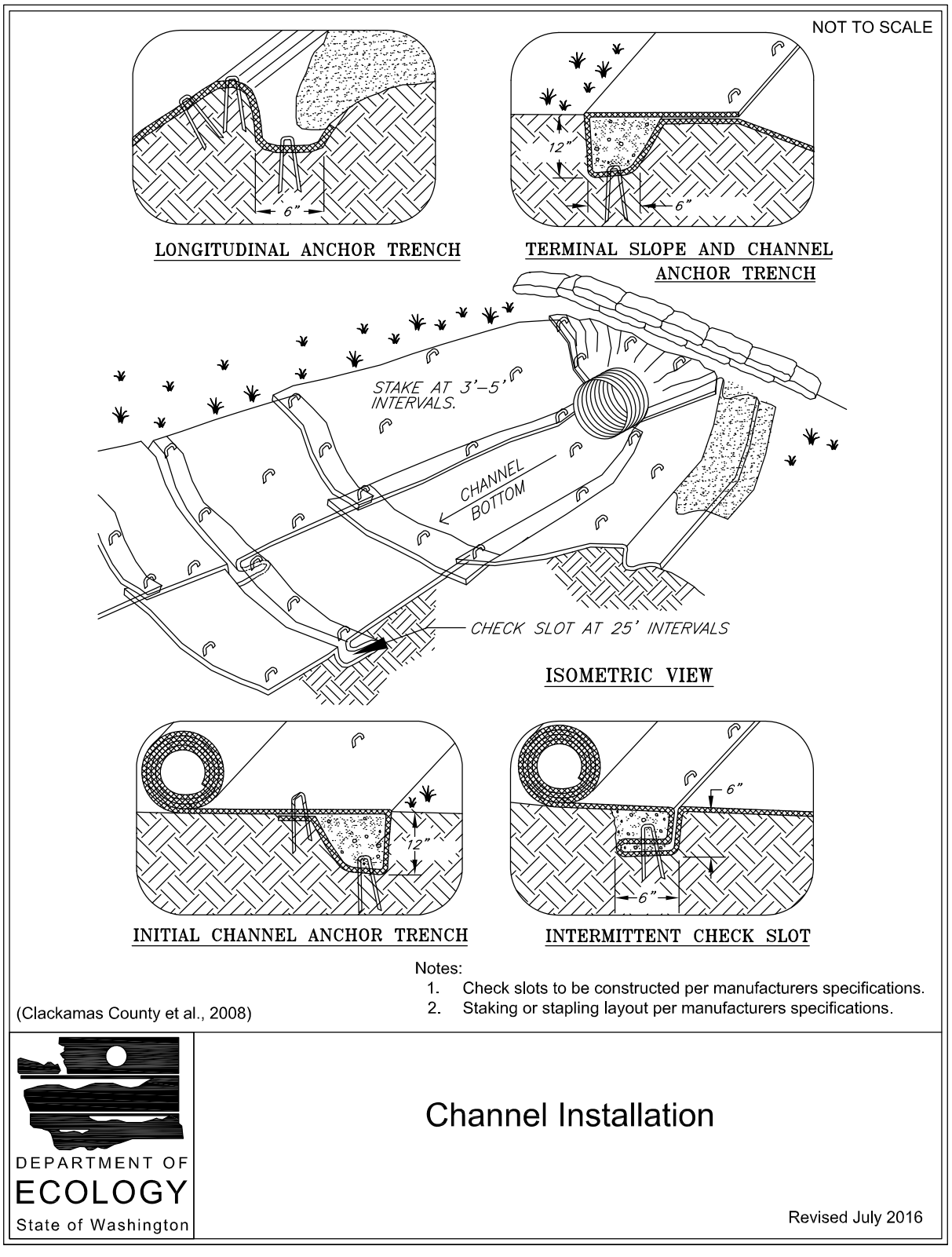
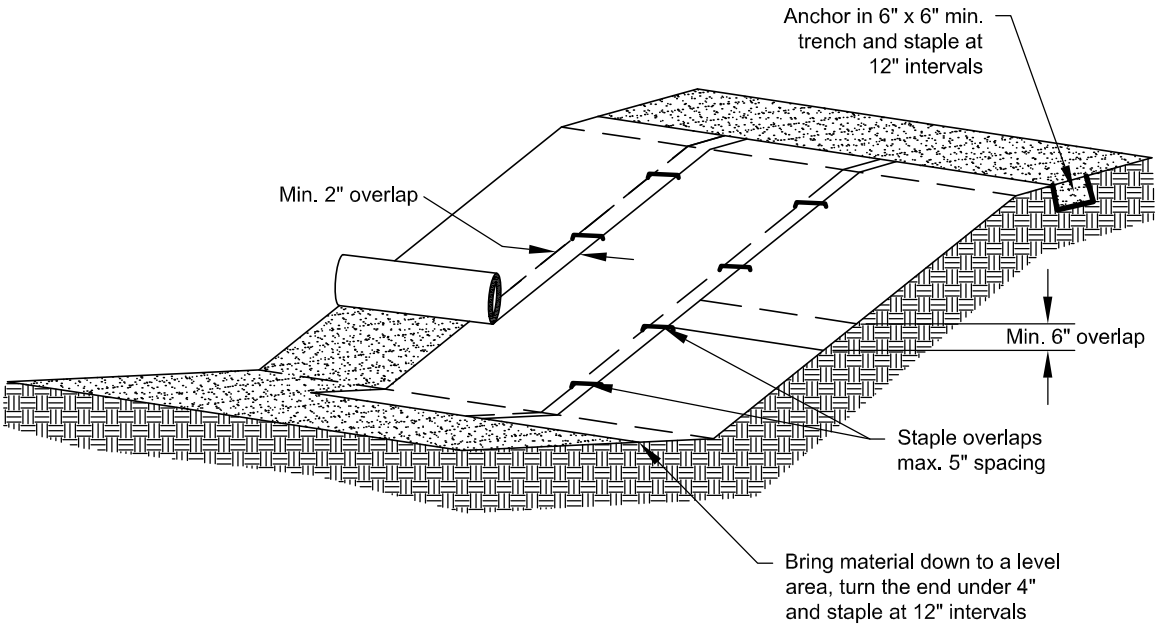


Figure 7.5: Slope Installation



Notes:

1. Slope surface shall be smooth before placement for proper soil contact.
2. Stapling pattern as per manufacturer's recommendations.
3. Do not stretch blankets/mattings tight - allow the rolls to mold to any irregularities.
4. For slopes less than 3H:1V, rolls may be placed in horizontal strips.
5. If there is a berm at the top of the slope, anchor upslope of the berm.
6. Lime, fertilize, and seed before installation. Planting of shrubs, trees, etc. should occur after installation.

NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Slope Installation

Revised June 2016

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.

- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. However, the relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for applications greater than six months.
- Due to rapid runoff caused by plastic covering, do not use this method upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- Plastic sheeting may result in increased runoff volumes and velocities, requiring additional on-site measures to counteract the increases. Creating a trough with wattles or other material can convey clean water away from these areas.
- To prevent undercutting, trench and backfill rolled plastic covering products.
- Although the plastic material is inexpensive to purchase, the cost of installation, maintenance, removal, and disposal add to the total costs of this BMP.
- Whenever plastic is used to protect slopes, install water collection measures at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to convey clean rainwater away from bare soil and disturbed areas. Do not mix clean runoff from a plastic covered slope with dirty runoff from a project.
- Other uses for plastic include:
    - Temporary ditch liner.
    - Pond liner in temporary sediment pond.
    - Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored.
    - Emergency slope protection during heavy rains.
    - Temporary drainpipe (“elephant trunk”) used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
    1. Run plastic up and down the slope, not across the slope.
    2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.

3. Provide a minimum of 8-inch overlap at the seams.
4. On long or wide slopes, or slopes subject to wind, tape all seams.
5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion.
8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.

- Plastic sheeting shall have a minimum thickness of 6 mil.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C140: Dust Control

Purpose

Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, into drainage systems, and into surface waters.

Wind erosion is a significant cause of soil movement from construction sites in eastern Washington. Although wind erosion can contribute to water quality impacts, dust control is regulated in some areas of eastern Washington primarily through local air quality authorities. Where such an entity exists, contact the local air quality authority for appropriate and required BMPs for dust control to implement at your project site.

Conditions of Use

Use dust control in areas (including roadways) subject to surface and air movement of dust where on-site or off-site impacts to roadways, drainage systems, or surface waters are likely.

Design and Installation Specifications

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until the surface is wet. Repeat as needed. To prevent carryout of mud onto the street, refer to BMP C105: Stabilized Construction Access and BMP C106: Wheel Wash.
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local jurisdictions may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection) added to water at a rate of 0.5 pounds per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to the increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may reduce the quantity of water needed for dust control.

Note that the application rate specified here applies to this BMP, and is not the same application rate that is specified in BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection, but the downstream protections still apply.

Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body. PAM use shall be reviewed and approved by the local permitting authority and discharge of PAM may be a basis for penalties per RCW 90.48.080.

- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP. See the following website for more information:

  https://ecology.wa.gov/About-us/Our-role-in-the-community/Partnerships-committees/Clean-air-agencies

- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Techniques that can be used for unpaved roads and lots include:
  - Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
  - Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
  - Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
  - Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
  - Encourage the use of alternate, paved routes, if available.
  - Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
  - Limit dust-generating work on windy days.
  - Pave unpaved permanent roads and other trafficked areas.

Maintenance Standards

Respray area as necessary to keep dust to a minimum.

BMP C150: Materials on Hand

Purpose

Keep quantities of erosion prevention and sediment control materials on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy rains. Having these materials on-site reduces the time needed to replace existing or implement new BMPs when inspections indicate that existing BMPs are not meeting the Construction SWPPP requirements. In addition, contractors can save money by buying some materials in bulk and storing them at their office or yard.

Conditions of Use

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible pipe, sandbags, geotextile fabric and steel “T” posts.
- Materials should be stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or project proponent could keep a stockpile of materials that are available for use on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

Design and Installation Specifications

Depending on project type, size, complexity, and length, materials and quantities will vary. A good minimum list of items that will cover numerous situations includes:

- Clear plastic, 6 mil
- Drainpipe, 6 or 8 inch diameter
- Sandbags, filled
- Straw bales for mulching
- Quarry spalls
- Washed gravel
- Geotextile fabric
- Catch basin inserts
- Steel "T" posts
- Silt fence material
- Straw wattles

Maintenance Standards

- All materials with the exception of the quarry spalls, steel “T” posts, and gravel should be kept covered and out of both sun and rain.
- Re-stock materials as needed.

BMP C151: Concrete Handling

Purpose

Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate concrete, concrete process water, and concrete slurry from entering waters of the State.

Conditions of Use

Any time concrete is used, utilize these management practices. Concrete construction project components include, but are not limited to:

- Curbs
- Sidewalks
- Roads
- Bridges
- Foundations
- Floors
- Runways

Disposal options for concrete, in order of preference are:

1. Off-site disposal
2. Concrete wash-out areas (see BMP C154: Concrete Washout Area)
3. De minimus washout to formed areas awaiting concrete

Design and Installation Specifications

- Wash concrete truck drums at an approved off-site location or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground (including formed areas awaiting concrete), or into storm drains, open ditches, streets, or streams. Refer to BMP C154: Concrete Washout Area for information on concrete washout areas.
    - Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas as allowed in BMP C154: Concrete Washout Area.

- Wash small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) into designated concrete washout areas or into formed areas awaiting concrete pour.
- At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow washwater from areas, such as concrete aggregate driveways, to drain directly (without detention or treatment) to natural or constructed stormwater conveyances.
- Contain washwater and leftover product in a lined container when no designated concrete washout areas (or formed areas, allowed as described above) are available. Dispose of contained concrete and concrete washwater (process water) properly.
- Always use forms or solid barriers for concrete pours, such as pilings, within 15-feet of surface waters.
- Refer to BMP C252: Treating and Disposing of High pH Water for pH adjustment requirements.
- Refer to the Construction Stormwater General Permit (CSWGP) for pH monitoring requirements if the project involves one of the following activities:
    - Significant concrete work (as defined in the CSWGP).
    - The use of soils amended with (but not limited to) Portland cement-treated base, cement kiln dust or fly ash.
    - Discharging stormwater to segments of water bodies on the 303(d) list (Category 5) for high pH.

Maintenance Standards

Check containers for holes in the liner daily during concrete pours and repair the same day.

BMP C152: Sawcutting and Surfacing Pollution Prevention

Purpose

Sawcutting and surfacing operations generate slurry and process water that contain fine particles and have a high pH (concrete cutting), both of which can violate the water quality standards in the receiving water. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate process water and slurry created by sawcutting or surfacing from entering waters of the State.

Conditions of Use

Utilize these management practices anytime sawcutting or surfacing operations take place. Sawcutting and surfacing operations include, but are not limited to:

- Sawing
- Coring
- Grinding
- Roughening
- Hydro-demolition
- Bridge and road surfacing

Design and Installation Specifications

- Vacuum slurry and cuttings during cutting and surfacing operations.
- Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.
- Slurry and cuttings shall not drain to any natural or constructed drainage conveyance including stormwater systems. This may require temporarily blocking catch basins.
- Dispose of collected slurry and cuttings in a manner that does not violate groundwater or surface water quality standards.
- Do not allow process water generated during hydro-demolition, surface roughening, or similar operations to drain to any natural or constructed drainage conveyance including stormwater systems. Dispose of process water in a manner that does not violate groundwater or surface water quality standards.
- Handle and dispose of cleaning waste material and demolition debris in a manner that does not cause contamination of water. Dispose of sweeping material from a pick-up sweeper at an appropriate disposal site.

Maintenance Standards

Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and/or vacuum trucks.

BMP C153: Material Delivery, Storage, and Containment

Purpose

Prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or watercourses from material delivery and storage. Minimize the storage of hazardous materials on-site, store materials in a designated area, and install secondary containment.

Conditions of Use

Use at construction sites with delivery and storage of the following materials:

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g., polyacrylamide)
- Fertilizers, pesticides, and herbicides
- Detergents
- Asphalt and concrete compounds
- Hazardous chemicals such as acids, lime, adhesives, paints, solvents, and curing compounds
- Any other material that may be detrimental if released to the environment

Design and Installation Specifications

- The temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (October 1 – June 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as an earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, within secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.
- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.

- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – June 30), each secondary containment facility shall be covered during non-working days.
- Secondary containment facilities shall be covered at all times, except when in active use.
- Keep material storage areas clean, organized, and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:
    - 1 - Water resistant nylon bag
    - 3 - Oil absorbent socks 3”x 4’
    - 2 - Oil absorbent socks 3”x 10’
    - 12 - Oil absorbent pads 17”x19”
    - 1 - Pair splash resistant goggles
    - 3 - Pairs nitrile gloves
    - 10 - Disposable bags with ties
    - Instructions

Maintenance Standards

- Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.
- Re-stock spill kit materials as needed.

BMP C154: Concrete Washout Area

Purpose

Prevent or reduce the discharge of pollutants from concrete waste to stormwater by conducting washout off-site, or performing on-site washout in a designated area.

Conditions of Use

Concrete washout areas are implemented on construction projects where:

- Concrete is used as a construction material
- It is not possible to dispose of all concrete wastewater and washout off-site (ready mix plant, etc.).

- Concrete truck drums are washed on-site.

  Note that auxiliary concrete truck components (e.g. chutes and hoses) and small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) may be washed into formed areas awaiting concrete pour.

At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.

Design and Installation Specifications

Implementation

- Perform washout of concrete truck drums at an approved off-site location or in designated concrete washout areas only.
- Do not wash out concrete onto non-formed areas, or into storm drains, open ditches, streets, or streams.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow excess concrete to be dumped on-site, except in designated concrete washout areas as allowed above.
- Concrete washout areas may be prefabricated concrete washout containers, or self-installed structures (above-grade or below-grade).
- Prefabricated containers are most resistant to damage and protect against spills and leaks. Companies may offer delivery service and provide regular maintenance and disposal of solid and liquid waste.
- If self-installed concrete washout areas are used, below-grade structures are preferred over above-grade structures because they are less prone to spills and leaks.
- Self-installed above-grade structures should only be used if excavation is not practical.
- Concrete washout areas shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

Education

- Discuss the concrete management techniques described in this BMP with the ready-mix concrete supplier before any deliveries are made.
- Educate employees and subcontractors on the concrete waste management techniques described in this BMP.
- Arrange for the contractor's superintendent or Certified Erosion and Sediment Control Lead (CESCL) to oversee and enforce concrete waste management procedures.
- A sign should be installed adjacent to each concrete washout area to inform concrete equipment operators to utilize the proper facilities.

Contracts

Incorporate requirements for concrete waste management into concrete supplier and subcontractor agreements.

Location and Placement

- Locate concrete washout areas at least 50 feet from sensitive areas such as storm drains, open ditches, water bodies, or wetlands.
- Allow convenient access to the concrete washout area for concrete trucks, preferably near the area where the concrete is being poured.
- If trucks need to leave a paved area to access the concrete washout area, prevent track-out with a pad of rock or quarry spalls (see BMP C105: Stabilized Construction Access). These areas should be far enough away from other construction traffic to reduce the likelihood of accidental damage and spills.
- The number of concrete washout areas you install should depend on the expected demand for storage capacity.
- On large sites with extensive concrete work, concrete washout areas should be placed in multiple locations for ease of use by concrete truck drivers.

Concrete Truck Washout Procedures

- Washout of concrete truck drums shall be performed in designated concrete washout areas only.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated concrete washout areas or properly disposed of off-site.

Concrete Washout Area Installation

- Concrete washout areas should be constructed as shown in the figures below, with a recommended minimum length and minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
- Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
- Lath and flagging should be commercial type.
- Liner seams shall be installed in accordance with manufacturers' recommendations.
- Soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.

Maintenance Standards

Inspection and Maintenance

- Inspect and verify that concrete washout areas are in place prior to the commencement of concrete work.
- Once concrete wastes are washed into the designated washout area and allowed to harden, the concrete should be broken up, removed, and disposed of per applicable solid waste regulations. Dispose of hardened concrete on a regular basis.
- During periods of concrete work, inspect the concrete washout areas daily to verify continued performance.
    - Check overall condition and performance.
    - Check remaining capacity (% full).
    - If using self-installed concrete washout areas, verify plastic liners are intact and sidewalls are not damaged.
    - If using prefabricated containers, check for leaks.
- Maintain the concrete washout areas to provide adequate holding capacity with a minimum freeboard of 12 inches.
- Concrete washout areas must be cleaned, or new concrete washout areas must be constructed and ready for use once the concrete washout area is 75% full.
- If the concrete washout area is nearing capacity, vacuum and dispose of the waste material in an approved manner.
    - Do not discharge liquid or slurry to waterways, storm drains or directly onto ground.
    - Do not discharge to the sanitary sewer without local approval.
    - Place a secure, non-collapsing, non-water collecting cover over the concrete washout area prior to predicted wet weather to prevent accumulation and overflow of precipitation.
    - Remove and dispose of hardened concrete and return the structure to a functional condition. Concrete may be reused on-site or hauled away for disposal or recycling.
- When you remove materials from a self-installed concrete washout area, build a new structure; or, if the previous structure is still intact, inspect for signs of weakening or damage, and make any necessary repairs. Re-line the structure with new plastic after each cleaning.

Removal of Concrete Washout Areas

- When concrete washout areas are no longer required for the work, the hardened concrete, slurries and liquids shall be removed and properly disposed of.

- Materials used to construct concrete washout areas shall be removed from the site of the work and disposed of or recycled.
- Holes, depressions or other ground disturbance caused by the removal of the concrete washout areas shall be backfilled, repaired, and stabilized to prevent erosion.

Figure 7.8: Concrete Washout Area with Wood Planks

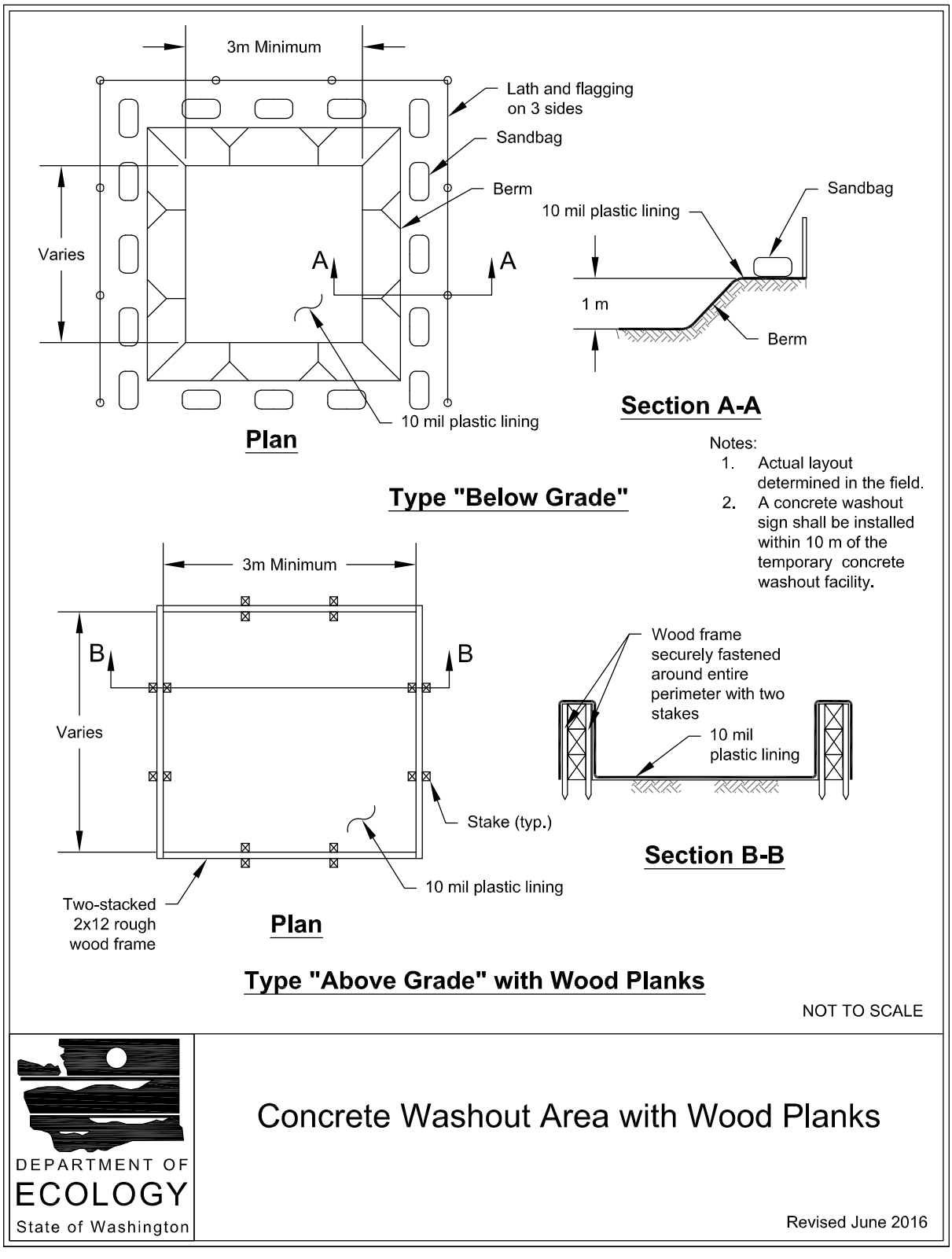


Figure 7.9: Concrete Washout Area with Straw Bales

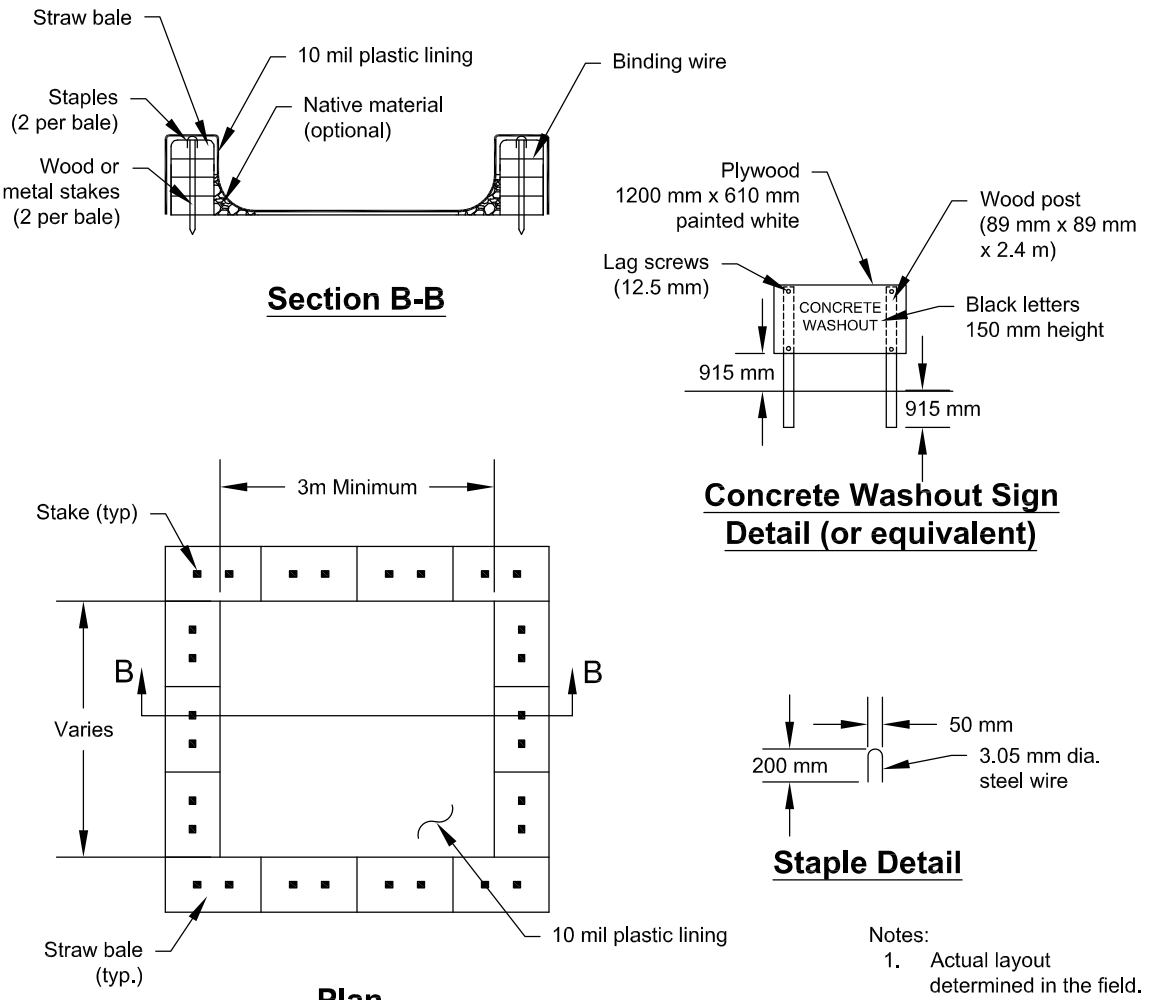
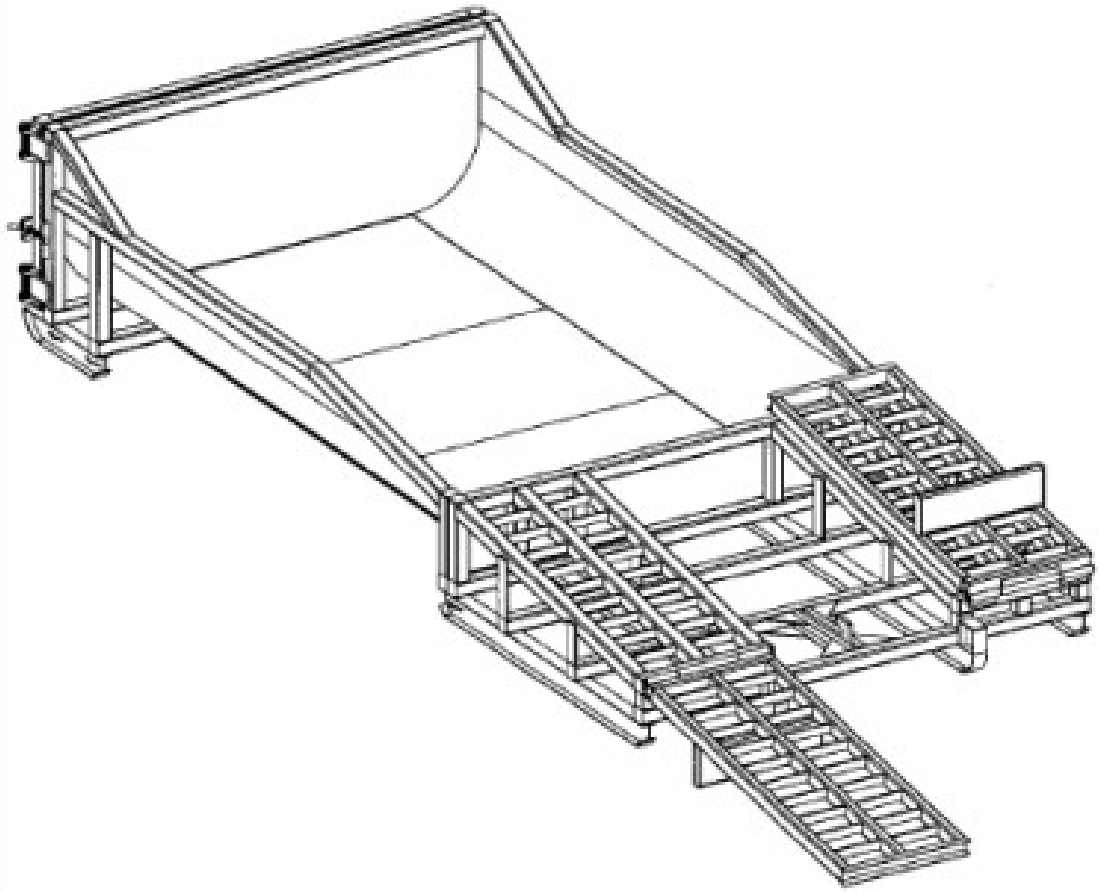


Figure 7.10: Prefabricated Concrete Washout Container with Ramp



NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Prefabricated Concrete Washout Container with Ramp

Revised June 2016

BMP C160: Certified Erosion and Sediment Control Lead

Purpose

The project proponent designates at least one person as the responsible representative in charge of erosion and sediment control (ESC) and water quality protection. The designated person shall be responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements. Construction sites one acre or larger that discharge to waters of the State must designate a Certified Erosion and Sediment Control Lead (CESCL) as the responsible representative.

Conditions of Use

A CESCL shall be made available on projects one acre or larger that discharge stormwater to surface waters of the state. Sites less than one acre may have a person without CESCL certification conduct inspections.

The CESCL shall:

- Have a current certificate proving attendance in an ESC training course that meets the minimum ESC training and certification requirements established by Ecology.

  Ecology has provided the minimum requirements for CESCL course training, as well as a list of ESC training and certification providers at:

  https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Certified-erosion-sediment-control

  OR

- Be a Certified Professional in Erosion and Sediment Control (CPESC). For additional information go to:

  http://www.envirocertintl.org/cpesc/

Specifications

- CESCL certification shall remain valid for three years.
- The CESCL shall have authority to act on behalf of the contractor or project proponent and shall be available, or on-call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL. See 7.3 Construction Stormwater Pollution Prevention Plans (Construction SWPPPs).
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region, but must be on site whenever earthwork activities are occurring that could generate release of turbid water.
- Duties and responsibilities of the CESCL shall include, but are not limited to, the following:

- Maintaining a permit file on site at all times which includes the Construction SWPPP and any associated permits and plans.
- Directing BMP installation, inspection, maintenance, modification, and removal.
- Updating all project drawings and the Construction SWPPP with changes made.
- Completing any sampling requirements including reporting results using electronic Discharge Monitoring Reports (WebDMR).
- Facilitating, participating in, and taking corrective actions resulting from inspections performed by outside agencies or the owner.
- Keeping daily logs and inspection reports. Inspection reports should include:
    - Inspection date/time.
    - Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
    - Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
    - Any water quality monitoring performed during inspection.
    - General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
    - A summary or list of all BMPs implemented, including observations of all ESC structures or practices. The following shall be noted:
        1. Locations of BMPs inspected.
        2. Locations of BMPs that need maintenance.
        3. Locations of BMPs that failed to operate as designed or intended.
        4. Locations of where additional or different BMPs are required.

BMP C162: Scheduling

Purpose

Sequencing a construction project can reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

Conditions of Use

The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sediment control (ESC) measures planned for the project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of ground cover leaves a site vulnerable to erosion. Construction sequencing that limits land clearing, provides timely installation of ESC BMPs, and restores protective cover quickly can significantly reduce the erosion potential of a site.

Design Considerations

- Minimize construction during rainy periods.
- Schedule projects to disturb only small portions of the site at any one time. Complete grading as soon as possible. Immediately stabilize the disturbed portion before grading the next portion. Practice staged seeding in order to revegetate cut and fill slopes as the work progresses.

7.4.3 Construction Runoff BMPs

BMP C200: Interceptor Dike and Swale

Purpose

Provide a dike of compacted soil or a swale at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. Use the dike and/or swale to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This can prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

Conditions of Use

Use an interceptor dike or swale where runoff from an exposed site or disturbed slope must be conveyed to an erosion control BMP that can safely convey the stormwater.

- Locate upslope of a construction site to prevent runoff from entering the disturbed area.
- When placed horizontally across a disturbed slope, it reduces the amount and velocity of runoff flowing down the slope.
- Locate downslope to collect runoff from a disturbed area and direct it to a sediment trapping BMP (e.g. BMP C240: Sediment Trap or BMP C241: Sediment Pond (Temporary)).

Design and Installation Specifications

- Dike and/or swale and channel must be stabilized with temporary or permanent vegetation or other channel protection during construction.
- Steep grades require channel protection and check dams.
- Review construction for areas where overtopping may occur.
- Can be used at the top of new fill before vegetation is established.
- May be used as a permanent diversion channel to carry the runoff.

- Contributing area for an individual dike or swale should be one acre or less.
- Design the dike and/or swale to contain flows calculated by one of the following methods:
    - Temporary interceptor dikes: Sized to handle the expected peak flow rate from a 6-month, 3-hour storm (referred to as the short-duration storm) for the worst-case land cover condition.
    - Permanent interceptor dikes: The peak volumetric flow rate is calculated using a 10-minute time step for a 25-year, 24-hour frequency storm for the developed condition.

  Worst-case land cover conditions (i.e. producing the most runoff) should be used for temporary interceptor dike analysis. In most cases, this would be the land cover conditions just prior to final landscaping.

Interceptor Dikes

Interceptor dikes shall meet the following criteria:

- Top Width: 2 feet minimum.
- Height: 1.5 feet minimum on berm.
- Side Slope: 2H:1V or flatter.
- Grade: Depends on topography; however, dike system minimum is 0.5%, and maximum is 1%.
- Compaction: Minimum of 90% ASTM D698 standard proctor.
- Stabilization: Depends on velocity and reach. Inspect regularly to ensure stability.
- Ground Slopes less than 5%: Seed and mulch applied within 5 days of dike construction (see BMP C121: Mulching).
- Ground Slopes from 5% to 40%: Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap, or other measures to avoid erosion.
- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping BMP.
- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.
- See Table 7.9: Horizontal Spacing of Interceptor Dikes Along Ground Slope for recommended horizontal spacing between dikes.

Table 7.9: Horizontal Spacing of Interceptor Dikes Along Ground Slope

Average Slope	Slope Percent	Flowpath Length
20H:1V or less	3 - 5%	300 feet
(10 to 20)H:1V	5 - 10%	200 feet
(4 to 10)H:1V	10 - 25%	100 feet
(2 to 4)H:1V	25 - 50%	50 feet

Interceptor Swales

Interceptor swales shall meet the following criteria:

- Bottom Width: 2 feet minimum; the cross-section bottom shall be level.
- Depth: 1 foot minimum.
- Side Slope: 2H:1V or flatter.
- Grade: Maximum 5%, with positive drainage to a suitable outlet (such as BMP C241: Sediment Pond (Temporary)).
- Stabilization: Seed per BMP C120: Temporary and Permanent Seeding, or BMP C202: Riprap Channel Lining, 12 inches thick riprap pressed into the bank and extending at least 8 inches vertical from the bottom.

Maintenance Standards

- Inspect diversion dikes and interceptor swales once a week and after every rainfall. Immediately remove sediment from the flow area.
- Damage caused by construction traffic or other activity must be repaired before the end of each working day.
- Check outlets and make timely repairs as needed to avoid gully formation. When the area below the temporary diversion dike is permanently stabilized, remove the dike and fill and stabilize the channel to blend with the natural surface.

BMP C207: Check Dams

Purpose

Construction of check dams across a swale or ditch reduces the velocity of concentrated flow and dissipates energy at the check dam.

Conditions of Use

Use check dams where temporary or permanent channels are not yet vegetated, channel lining is infeasible, and/or velocity checks are required.

- Check dams may not be placed in streams unless approved by the State Department of Fish and Wildlife.
- Check dams may not be placed in wetlands without approval from a permitting agency.
- Do not place check dams below the expected backwater from any salmonid bearing water between October 1 and May 31 to ensure that there is no loss of high flow refuge habitat for overwintering juvenile salmonids and emergent salmonid fry.

Design and Installation Specifications

- Construct rock check dams from appropriately sized rock. The rock used must be large enough to stay in place given the expected design flow through the channel. The rock must be placed by hand or by mechanical means (do not dump the rock to form the dam) to achieve complete coverage of the ditch or swale and to ensure that the center of the dam is lower than the edges.
- Check dams may also be constructed of either rock or pea-gravel filled bags. Numerous new products are also available for this purpose. They tend to be re-usable, quick and easy to install, effective, and cost efficient.
- Place check dams perpendicular to the flow of water.
- The check dam should form a triangle when viewed from the side. This prevents undercutting as water flows over the face of the check dam rather than falling directly onto the ditch bottom.
- Before installing check dams, impound and bypass upstream water flow away from the work area. Options for bypassing include pumps, siphons, or temporary channels.
- Check dams combined with sumps work more effectively at slowing flow and retaining sediment than a check dam alone. A deep sump should be provided immediately upstream of the check dam.
- In some cases, if carefully located and designed, check dams can remain as permanent installations with very minor regrading. They may be left as either spillways, in which case accumulated sediment would be graded and seeded, or as check dams to prevent further sediment from leaving the site.

- The maximum spacing between check dams shall be such that the downstream toe of the upstream dam is at the same elevation as the top of the downstream dam.
- Keep the maximum height at 2 feet at the center of the check dam.
- Keep the center of the check dam at least 12 inches lower than the outer edges at natural ground elevation.
- Keep the side slopes of the check dam at 2H:1V or flatter.
- Key the stone into the ditch banks and extend it beyond the abutments a minimum of 18 inches to avoid washouts from overflow around the dam.
- Use filter fabric foundation under a rock or sand bag check dam. If a blanket ditch liner is used, filter fabric is not necessary. A piece of organic or synthetic blanket cut to fit will also work for this purpose.
- In the case of grass-lined ditches and swales, all check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale - unless the slope of the swale is greater than 4%. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
- Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones.
- See Figure 7.17: Rock Check Dam.

Maintenance Standards

Check dams shall be monitored for performance and sediment accumulation during and after each rainfall that produces runoff. Sediment shall be removed when it reaches one half the sump depth.

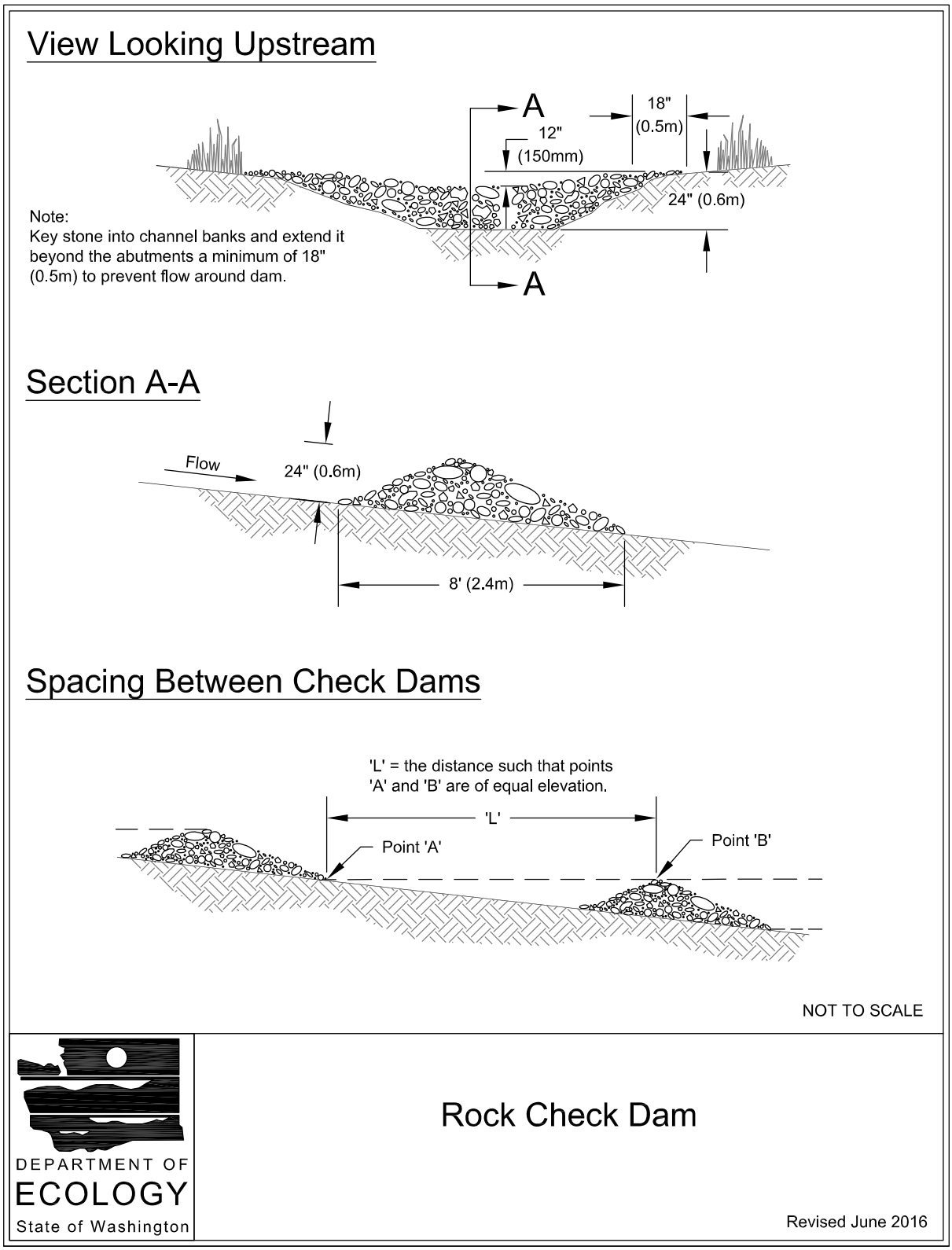
- Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the dam.
- If significant erosion occurs between dams, install a protective riprap liner in that portion of the channel. See BMP C202: Riprap Channel Lining.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

Figure 7.17: Rock Check Dam



BMP C220: Inlet Protection

Purpose

Inlet protection prevents coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

Use inlet protection at inlets that are operational before permanent stabilization of the disturbed areas that contribute runoff to the inlet. Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless those inlets are preceded by a sediment trapping BMP.

Also consider inlet protection for lawn and yard drains on new home construction. These small and numerous drains coupled with lack of gutters can add significant amounts of sediment into the roof drain system. If possible, delay installing lawn and yard drains until just before landscaping, or cap these drains to prevent sediment from entering the system until completion of landscaping. Provide 18-inches of sod around each finished lawn and yard drain.

Table 7.11: Storm Drain Inlet Protection (continued) lists several options for inlet protection. All of the methods for inlet protection tend to plug and require a high frequency of maintenance. Limit contributing drainage areas for an individual inlet to one acre or less. If possible, provide emergency overflows with additional end-of-pipe treatment where stormwater ponding would cause a hazard.

Table 7.11: Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved / Earthen Surfaces	Conditions of Use
Drop Inlet Protection			
Excavated drop	Yes, temporary	Earthen	Applicable for heavy flows. Easy

Table 7.11: Storm Drain Inlet Protection (continued)

Type of Inlet Protection	Emergency Overflow	Applicable for Paved / Earthen Surfaces	Conditions of Use
inlet protection	flooding may occur		to maintain. Large area requirement: 30'x30'/acre
Block and gravel drop inlet protection	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet protection	No	Paved or Earthen	Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or Earthen	Frequent maintenance required.
Curb Inlet Protection			
Curb inlet protection with wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Paved	Sturdy, but limited filtration.
Culvert Inlet Protection			
Culvert inlet sediment trap	N/A	N/A	18 month expected life.

Design and Installation Specifications

Excavated Drop Inlet Protection

Excavated drop inlet protection consists of an excavated impoundment around the storm drain inlet. Sediment settles out of the stormwater prior to entering the storm drain. Design and installation specifications for excavated drop inlet protection include:

- Provide a depth of 1 to 2 feet as measured from the crest of the inlet structure.
- Side slopes of excavation should be no steeper than 2H:1V.
- Minimum volume of excavation is 35 cubic yards.
- Shape the excavation to fit the site, with the longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water.
- Clear the area of all debris.
- Grade the approach to the inlet uniformly.

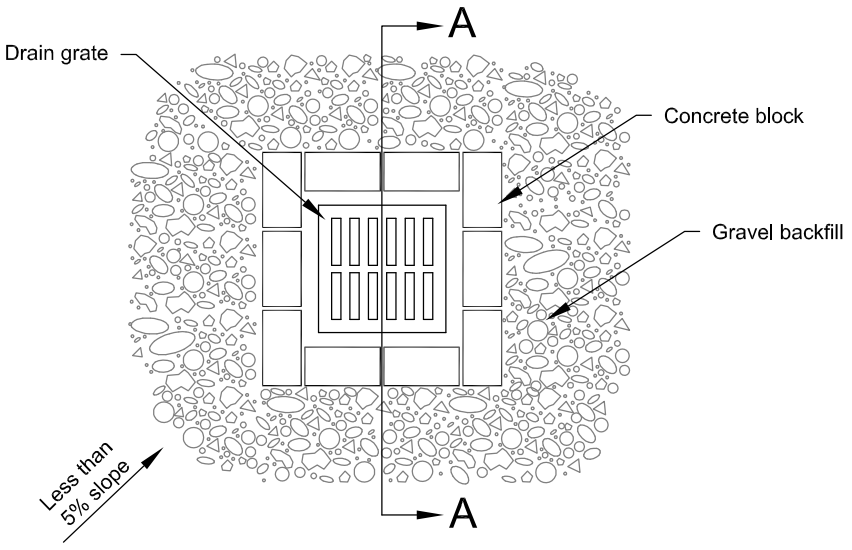
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- Build a temporary dike, if necessary, to the down slope side of the structure to prevent bypass flow.

Block and Gravel Filter

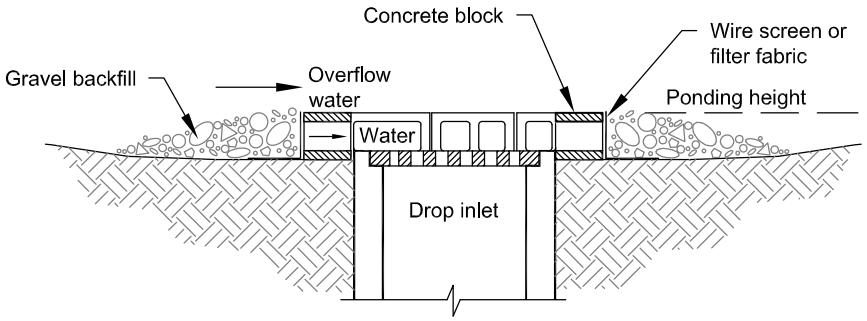
A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See Figure 7.18: Block and Gravel Filter. Design and installation specifications for block and gravel filters include:

- Provide a height of 1 to 2 feet above the inlet.
- Recess the first row of blocks 2-inches into the ground for stability.
- Support subsequent courses by placing a pressure treated wood (2x4) through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side to allow for dewatering the pool.
- Place hardware cloth or comparable wire mesh with 0.5-inch openings over all block openings.
- Place gravel to just below the top of blocks on slopes of 2H:1V or flatter.
- An alternative design is a gravel berm surrounding the inlet, as follows:
    - Provide a slope of 3H:1V on the upstream side of the berm.
    - Provide a slope of 2H:1V on the downstream side of the berm.
    - Provide a 1-foot wide level rock area between the gravel berm and the inlet.
    - Use rocks 3 inches in diameter or larger on the upstream slope of the berm.
    - Use gravel 0.5 to 0.75 inch at a minimum thickness of 1-foot on the downstream slope of the berm.

Figure 7.18: Block and Gravel Filter



Plan View



Section A-A

Notes:

1. Drop inlet sediment barriers are to be used for small, nearly level drainage areas. (less than 5%)
2. Excavate a basin of sufficient size adjacent to the drop inlet.
3. The top of the structure (ponding height) must be well below the ground elevation downslope to prevent runoff from bypassing the inlet. A temporary dike may be necessary on the downslope side of the structure.

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State of Washington

Block and Gravel Filter

Revised June 2016

Gravel and Wire Mesh Filter

Gravel and wire mesh filters are gravel barriers placed over the top of the inlet. This method does not provide an overflow. Design and installation specifications for gravel and wire mesh filters include:

- Use a hardware cloth or comparable wire mesh with 0.5 inch openings.
    - Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
    - Overlap the strips if more than one strip of mesh is necessary.
- Place coarse aggregate over the wire mesh.
    - Provide at least a 12-inch depth of aggregate over the entire inlet opening and extend at least 18-inches on all sides.

Catch Basin Filters

Catch basin filters are designed by manufacturers for construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. To reduce maintenance requirements, combine a catch basin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way. Design and installation specifications for catch basin filters include:

- Provides 5 cubic feet of storage.
- Requires dewatering provisions.
- Provides a high-flow bypass that will not clog under normal use at a construction site.
- Insert the catch basin filter in the catch basin just below the grating.

Curb Inlet Protection with Wooden Weir

Curb inlet protection with wooden weir is an option that consists of a barrier formed around a curb inlet with a wooden frame and gravel. Design and installation specifications for curb inlet protection with wooden weirs include:

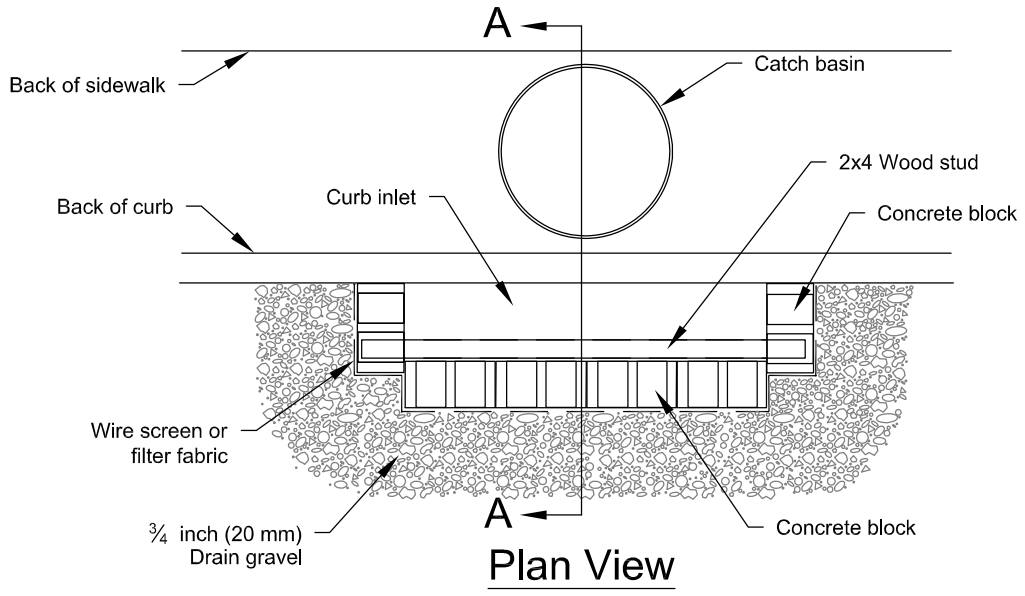
- Use wire mesh with 0.5 inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

Block and Gravel Curb Inlet Protection

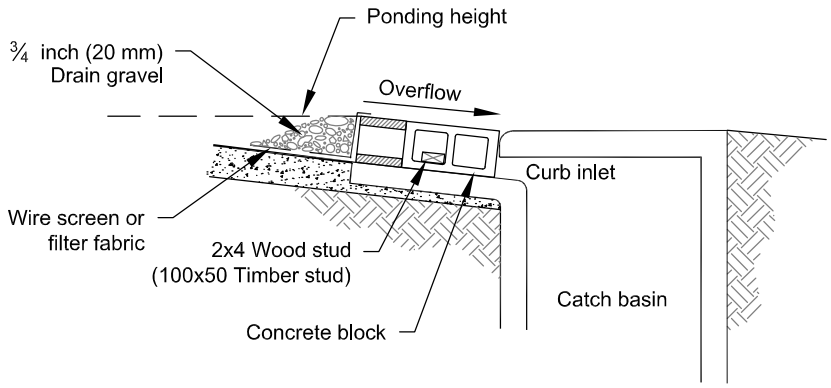
Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See Figure 7.19: Block and Gravel Curb Inlet Protection. Design and installation specifications for block and gravel curb inlet protection include:

- Use wire mesh with 0.5 inch openings.
- Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
- Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- Place wire mesh over the outside vertical face.
- Pile coarse aggregate against the wire to the top of the barrier.

Figure 7.19: Block and Gravel Curb Inlet Protection



Plan View



Section A-A

Notes:

1. Use block and gravel type sediment barrier when curb inlet is located in gently sloping street segment, where water can pond and allow sediment to separate from runoff.
2. Barrier shall allow for overflow from severe storm event.
3. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

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Block and Gravel Curb Inlet Protection

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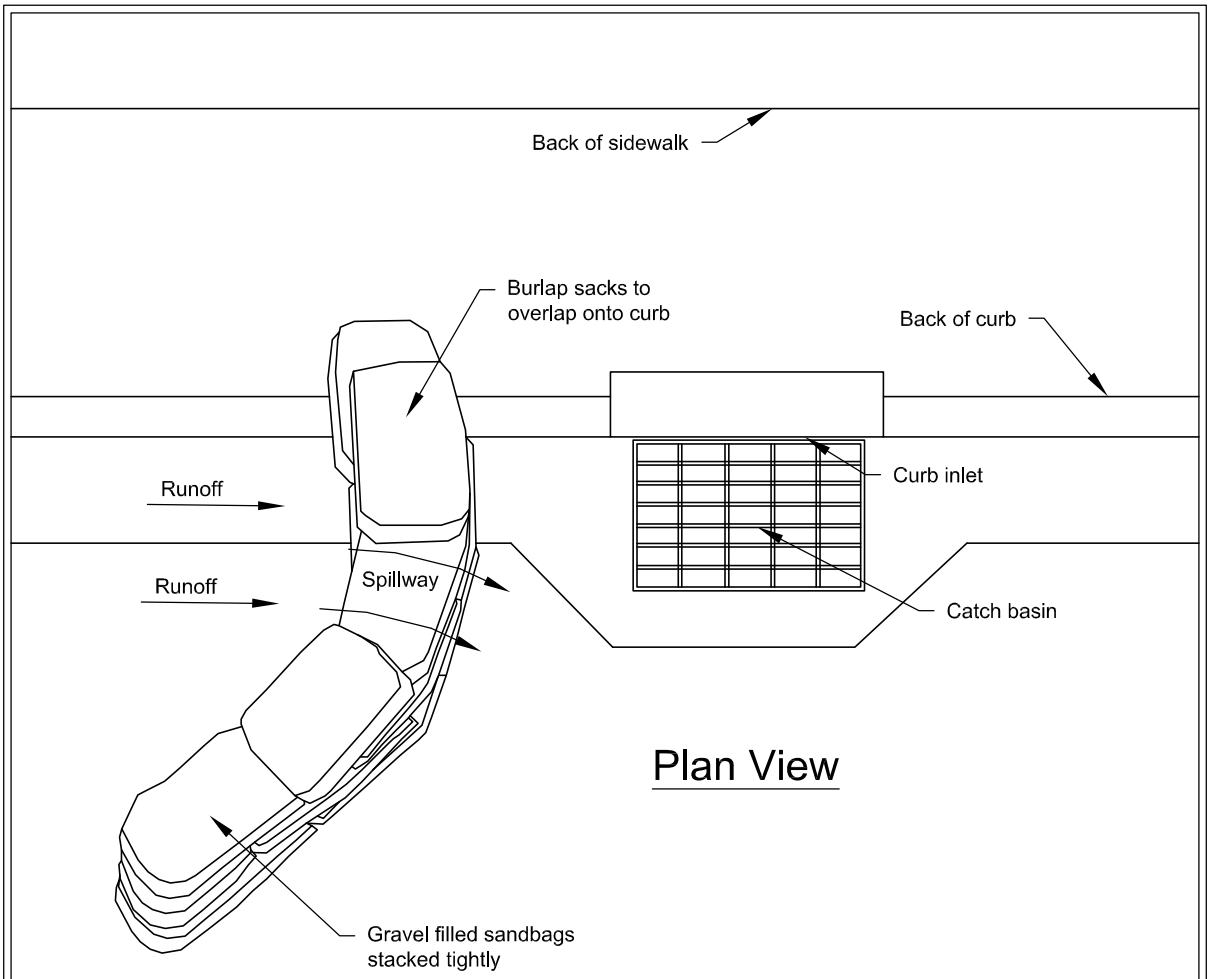
Curb and Gutter Sediment Barrier

A curb and gutter sediment barrier is a sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure 7.20: Curb and Gutter Barrier. Design and installation specifications for curb and gutter sediment barriers include:

- Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- Construct a horseshoe shaped sedimentation trap on the upstream side of the berm. Size the trap to sediment trap standards for protecting a culvert inlet.

Figure 7.20: Curb and Gutter Barrier



Notes:

1. Place curb type sediment barriers on gently sloping street segments, where water can pond and allow sediment to separate from runoff.
2. Sandbags of either burlap or woven 'geotextile' fabric, are filled with gravel, layered and packed tightly.
3. Leave a one sandbag gap in the top row to provide a spillway for overflow.
4. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

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Curb and Gutter Barrier

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Maintenance Standards

- Inspect all forms of inlet protection frequently, especially after storm events. Clean and replace clogged catch basin filters. For rock and gravel filters, pull away the rocks from the inlet and clean or replace. An alternative approach would be to use the clogged rock as fill and put fresh rock around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C233: Silt Fence

Purpose

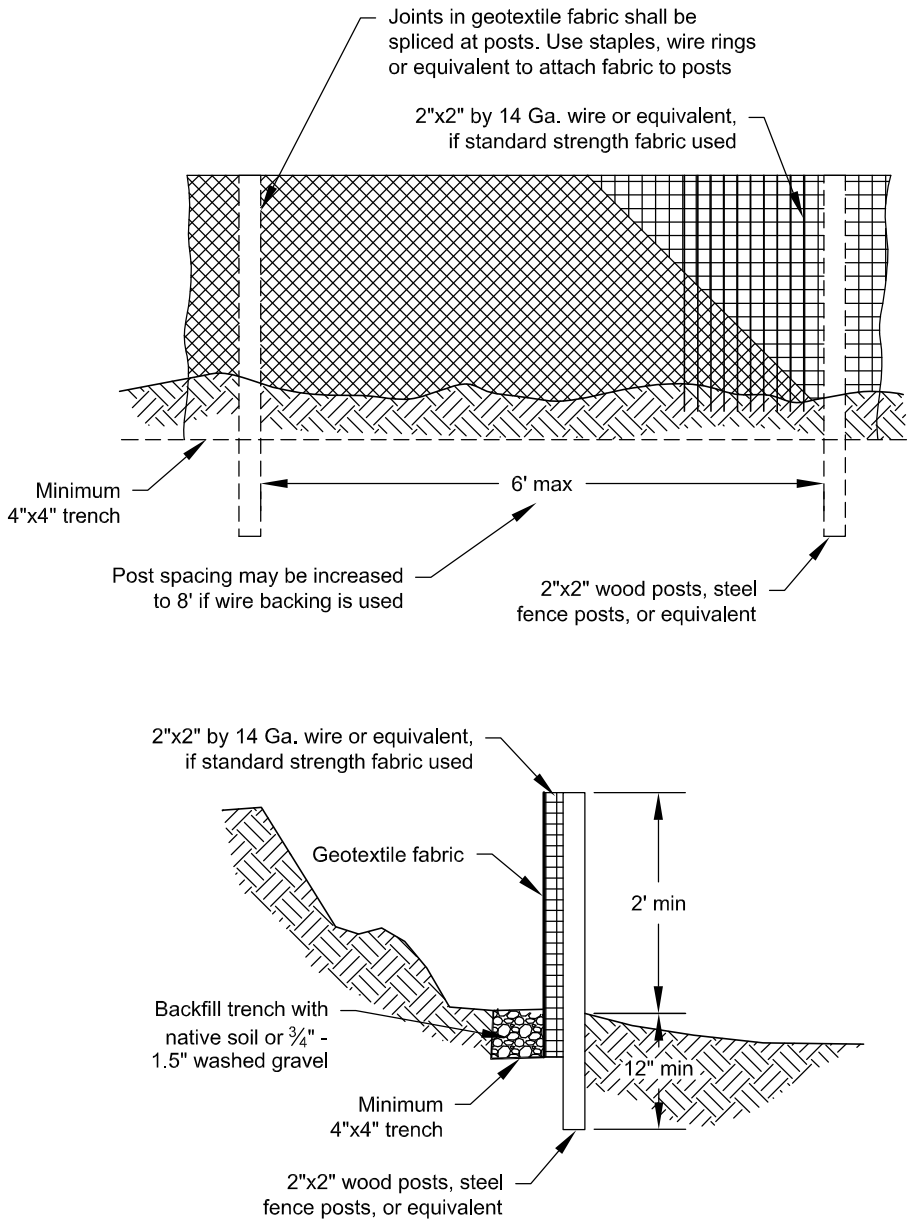
Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

Silt fence may be used downslope of all disturbed areas.

- Silt fence shall prevent sediment carried by runoff from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment trapping BMP.
- Do not construct silt fences in streams or use in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

Figure 7.23: Silt Fence



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Silt Fence

Revised July 2017

Design and Installation Specifications

- Use in combination with other construction stormwater BMPs.
- Maximum slope steepness (perpendicular to the silt fence line) 1H:1V.
- Maximum sheet or overland flow path length to the silt fence of 100 feet.
- Do not allow flows greater than 0.5 cfs.
- Use geotextile fabric that meets the following standards. All geotextile properties listed below are minimum average roll values (i.e. the test result for any sampled roll in a lot shall meet or exceed the values shown in Table 7.12: Geotextile Fabric Standards for Silt Fence):

Table 7.12: Geotextile Fabric Standards for Silt Fence

Geotextile Property	Minimum Average Roll Value
Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for slit film woven (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec^{-1} minimum
Grab Tensile Strength (ASTM D4632)	180 lbs minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

- Support standard strength geotextiles with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the geotextile. Silt fence materials are available that have synthetic mesh backing attached.
- Silt fence material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.
- 100% biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by the local jurisdiction.
- Refer to Figure 7.23: Silt Fence for standard silt fence details. Include the following Standard Notes for silt fence on construction plans and specifications:

    1. The Contractor shall install and maintain temporary silt fences at the locations shown in the Plans.

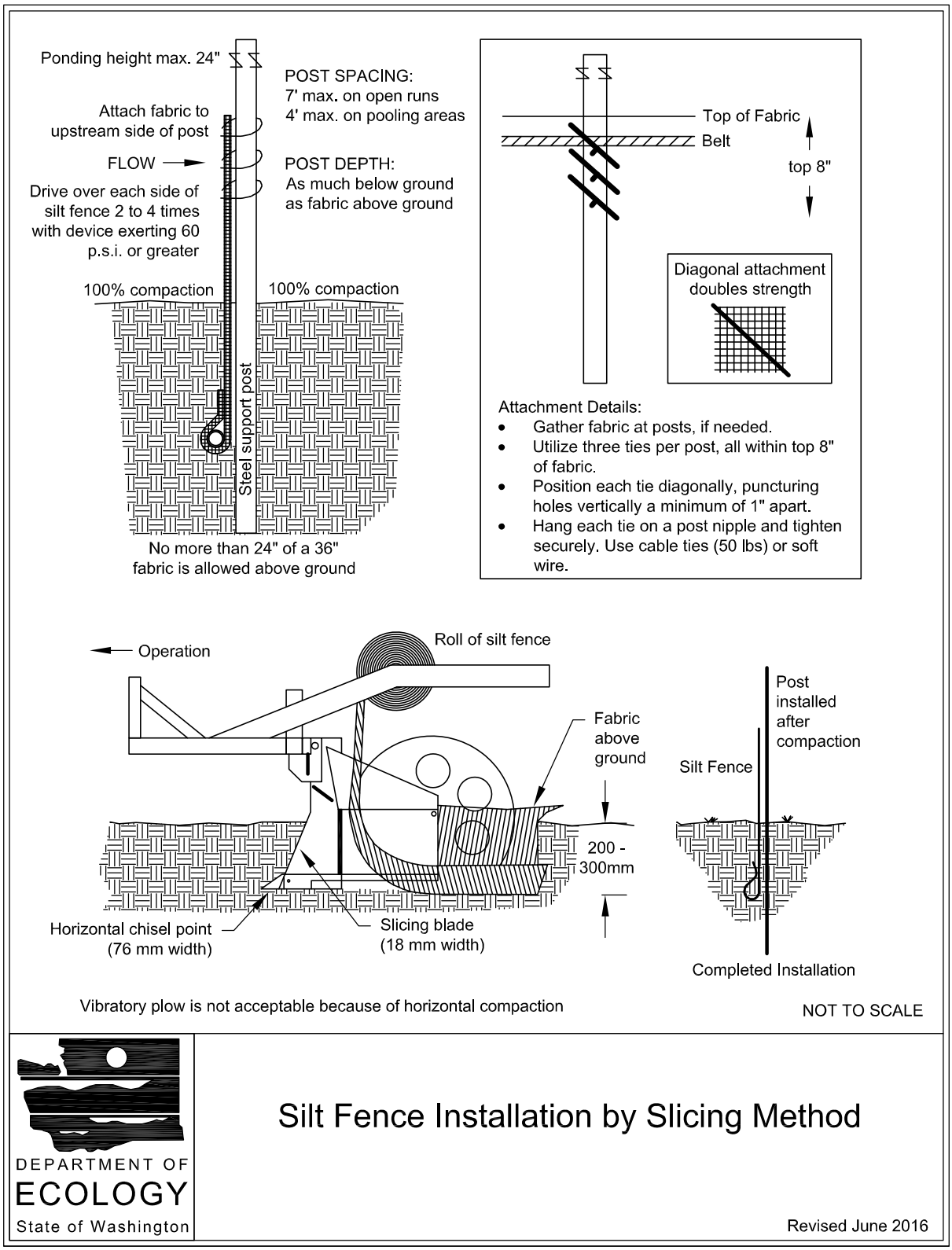
2. Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.
3. The silt fence shall have a 2-foot min. and a 2.5-feet max. height above the original ground surface.
4. The geotextile fabric shall be sewn together at the point of manufacture to form fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided that the overlap is long enough and that the adjacent silt fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
5. Attach the geotextile fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the geotextile fabric to the posts in a manner that reduces the potential for tearing.
6. Support the geotextile fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the geotextile fabric up-slope of the mesh.
7. Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2-inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 lbs grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the geotextile fabric it supports.
8. Bury the bottom of the geotextile fabric 4-inches min. below the ground surface. Backfill and tamp soil in place over the buried portion of the geotextile fabric, so that no flow can pass beneath the silt fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the ground 3-inches min.
9. Drive or place the silt fence posts into the ground 18-inches min. A 12–inch min. depth is allowed if topsoil or other soft subgrade soil is not present and 18-inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.
10. Use wood, steel or equivalent posts. The spacing of the support posts shall be a maximum of 6 feet. Posts shall consist of one of the following:
    - Wood with minimum dimensions of 2 inches by 2 inches by 3 feet. Wood shall be free of defects such as knots, splits, or gouges.
    - No. 6 steel rebar or larger.
    - ASTM A 120 steel pipe with a minimum diameter of 1-inch.
    - U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft.

- Other steel posts having equivalent strength and bending resistance to the post sizes listed above.

11. Locate silt fences on contour as much as possible, except at the ends of the fence, where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.
12. If the fence must cross contours, with the exception of the ends of the fence, place check dams perpendicular to the back of the fence to minimize concentrated flow and erosion. The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.
    - Check dams shall be approximately 1 foot deep at the back of the fence. Check dams shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence.
    - Check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Check dams shall be located every 10 feet along the fence where the fence must cross contours.

- Refer to Figure 7.24: Silt Fence Installation by Slicing Method for slicing method details. The following are specifications for silt fence installation using the slicing method:
    1. The base of both end posts must be at least 2 to 4 inches above the top of the geotextile fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.
    2. Install posts 3 to 4 feet apart in critical retention areas and 6 to 7 feet apart in standard applications.
    3. Install posts 24 inches deep on the downstream side of the silt fence, and as close as possible to the geotextile fabric, enabling posts to support the geotextile fabric from upstream water pressure.
    4. Install posts with the nipples facing away from the geotextile fabric.
    5. Attach the geotextile fabric to each post with three ties, all spaced within the top 8 inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1-inch vertically apart. Each tie should be positioned to hang on a post nipple when tightening to prevent sagging.
    6. Wrap approximately 6 inches of the geotextile fabric around the end posts and secure with 3 ties.
    7. No more than 24 inches of a 36 inch geotextile fabric is allowed above ground level.
    8. Compact the soil immediately next to the geotextile fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips. Check and correct the silt fence installation for any deviation before compaction. Use a flat-bladed shovel to tuck the fabric deeper into the ground if necessary.

Figure 7.24: Silt Fence Installation by Slicing Method



Maintenance Standards

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment trapping BMP.
- Check the uphill side of the silt fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence and remove the trapped sediment.
- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace geotextile fabric that has deteriorated due to ultraviolet breakdown.

BMP C235: Wattles

Purpose

Wattles are temporary erosion and sediment control barriers consisting of straw, compost, or other material that is wrapped in netting made of natural plant fiber or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment.

Conditions of Use

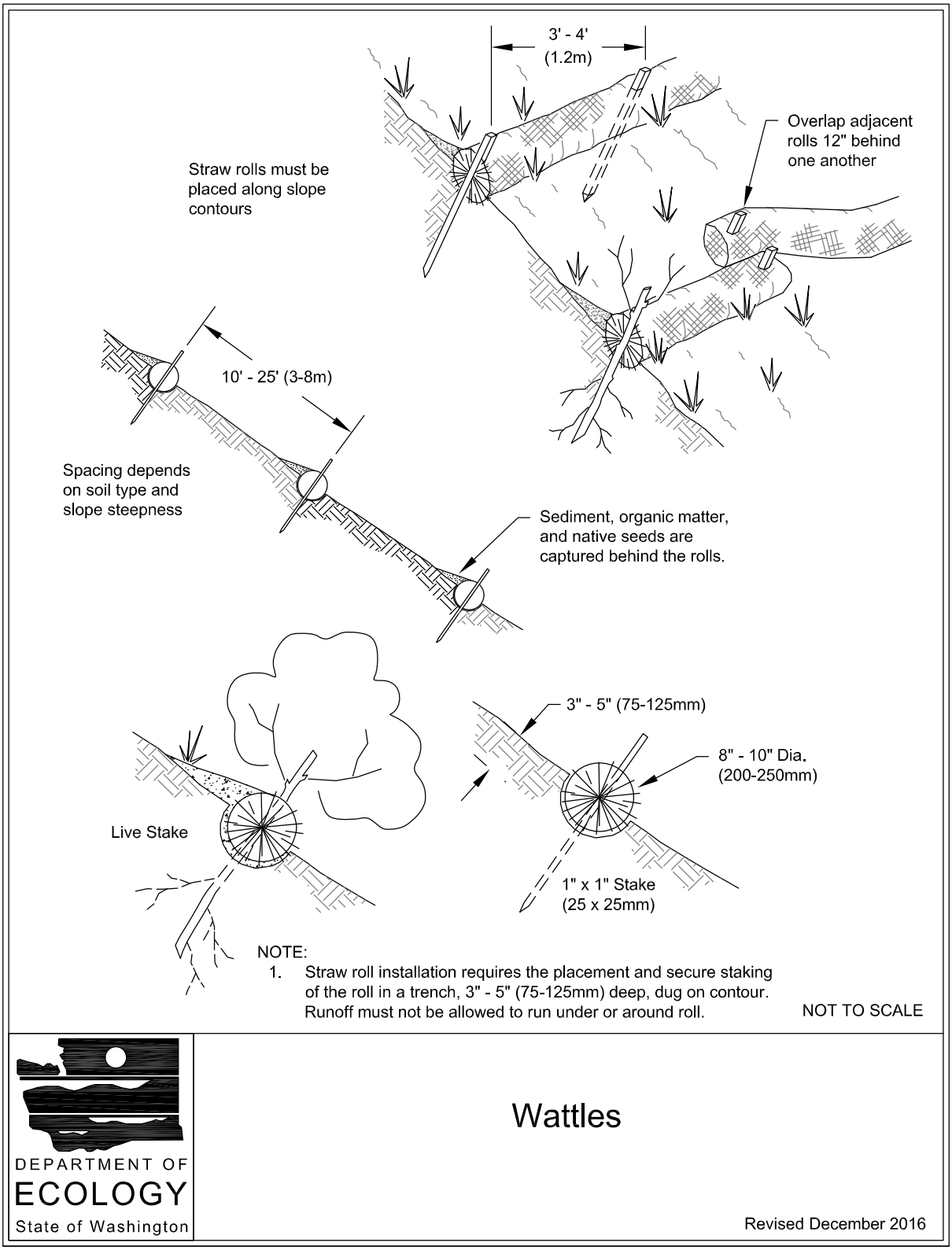
- Use wattles:
    - In disturbed areas that require immediate erosion protection.
    - On exposed soils during the period of short construction delays, or over winter months.
    - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Generally, wattles are effective for one to two seasons.
- Prevent rilling beneath wattles by entrenching and overlapping wattles to prevent water from passing between them.

Design Criteria

- Wattles shall consist of cylinders of plant material such as weed-free straw, coir, wood chips, excelsior, or wood fiber or shavings encased within netting made of natural plant fibers unaltered by synthetic materials.
- See Figure 7.25: Wattles for typical construction details.
- Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length.

- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Place wattles in shallow trenches, staked along the contour of disturbed or newly constructed slopes. Dig narrow trenches across the slope (on contour) to a depth of 3 to 5 inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5 to 7 inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compact it using hand tamping or other methods.
- Construct trenches at intervals of 10 to 25 feet depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches.
- Install the wattles snugly into the trenches and overlap the ends of adjacent wattles 12 inches behind one another.
- Install stakes at each end of the wattle, and at 4 foot centers along entire length of wattle.
- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.
- Wooden stakes should be approximately 0.75 x 0.75 x 24 inches minimum. Willow cuttings or 3/8 inch rebar can also be used for stakes.
- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

Figure 7.25: Wattles



Maintenance Standards

- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.
- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C241: Sediment Pond (Temporary)

Purpose

Sediment ponds are temporary ponds used during construction to remove sediment from runoff originating from disturbed areas of the project site. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). Consequently, they usually reduce turbidity only slightly.

Conditions of Use

- Use a sediment pond where the contributing drainage area to the pond is 3 acres or more. Ponds must be used in conjunction with other Construction Stormwater BMPs to reduce the amount of sediment flowing into the pond. For drainage areas smaller than 3 acres, use the guidance in BMP C240: Sediment Trap.
- Do not install sediment ponds on sites where failure of the BMP would result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. Also, sediment ponds are attractive to children and can be dangerous. Compliance with local ordinances regarding health and safety must be addressed. If fencing of the pond is required, show the type of fence and its location on the drawings in the Construction SWPPP.
- Sediment ponds that can impound 10 acre-ft (435,600 cu-ft, or 3.26 million gallons) or more are subject to the Washington Dam Safety Regulations (Chapter 173-175 WAC). See BMP F6.10: Detention Ponds for more information regarding dam safety considerations for detention ponds.
- Projects that are constructing permanent Flow Control BMPs or Runoff Treatment BMPs that use ponding for treatment may use the rough-graded or final-graded permanent BMP footprint for the temporary sediment pond. When permanent BMP footprints are used as temporary sediment ponds, the surface area requirement of the temporary sediment pond must be met. If the surface area requirement of the sediment pond is larger than the surface area of the permanent BMP, then the sediment pond shall be enlarged beyond the permanent BMP footprint to comply with the surface area requirement.

  The permanent control structure must be temporarily replaced with a control structure that only allows water to leave the temporary sediment pond from the surface or by pumping. Alternatively, the permanent control structure may be used if it is temporarily modified by plugging any outlet holes below the riser. The permanent control structure must be installed as part of the permanent BMP after the site is fully stabilized.

Design and Installation Specifications

General

- See Figure 7.29: Sediment Pond Plan View, Figure 7.30: Sediment Pond Cross Section, and Figure 7.31: Sediment Pond Riser Detail for details.

- Use of permanent infiltration BMP footprints for temporary sediment ponds during construction tends to clog the soils and reduce their capacity to infiltrate. If permanent infiltration BMP footprints are used, the sides and bottom of the temporary sediment pond must only be rough excavated to a minimum of 2 feet above final grade of the permanent infiltration BMP. Final grading of the permanent infiltration BMP shall occur only when all contributing drainage areas are fully stabilized. Any proposed permanent pretreatment BMP prior to the infiltration BMP should be fully constructed and used with the temporary sediment pond to help prevent clogging of the soils.

  See 7.2.13 Element 13: Protect Infiltration BMPs for more information about protecting permanent infiltration BMPs.

- The pond shall be divided into two roughly equal volume cells by a permeable divider that will reduce turbulence while allowing movement of water between the cells. The divider shall be at least one-half the height of the riser, and at least one foot below the top of the riser. Wire-backed, 2 to 3 foot high, high strength geotextile fabric supported by treated 4x4s can be used as a divider. Alternatively, staked straw bales wrapped with geotextile fabric may be used. If the pond is more than 6 feet deep, a different divider design must be proposed. A riprap embankment is one acceptable method of separation for deeper ponds. Other designs that satisfy the intent of this provision are allowed as long as the divider is permeable, structurally sound, and designed to prevent erosion under and around the divider.

- The most common structural failure of sediment ponds is caused by piping. Piping refers to two phenomena:

  1. Water seeping through fine-grained soil, eroding the soil grain by grain and forming pipes or tunnels; and,
  2. Water under pressure flowing upward through a granular soil with a head of sufficient magnitude to cause soil grains to lose contact and capability for support.

  The most critical construction practices to prevent piping are:

  - Tight connections between the riser and outlet pipe, and other pipe connections.
  - Adequate anchoring of the riser.
  - Proper soil compaction of the embankment and riser footing.
  - Proper construction of anti-seep devices.

Sediment Pond Geometry

To determine the sediment pond geometry, first calculate the design surface area (SA) of the pond, measured at the top of the riser pipe. Use the following equation:

$$SA = 2 \times Q_2 / 0.00096$$

or

2,080 square feet per cfs of inflow

where:

SA = design surface area of the pond (sf)

Q_2 = Peak volumetric flow rate (cfs)

See BMP C240: Sediment Trap for more information on the above equation.

The basic geometry of the pond can now be determined using the following design criteria:

- Required surface area SA (from the equation above) at the top of the riser.
- Minimum 3.5 foot depth from the top of the riser to the bottom of the pond.
- Maximum 3H:1V interior side slopes and maximum 2H:1V exterior slopes. The interior slopes can be increased to a maximum of 2H:1V if fencing is provided at or above the maximum water surface.
- One foot of freeboard between the top of the riser and the crest of the emergency spillway.
- Flat bottom.
- Minimum 1 foot deep spillway.
- Length-to-width ratio between 3:1 and 6:1.

Sediment Pond Discharge

The outlet for the pond consists of a combination of principal and emergency spillways. These outlets must pass the peak runoff expected from the contributing drainage area for a 100-year storm. If, due to site conditions and basin geometry, a separate emergency spillway is not feasible, the principal spillway must pass the entire peak runoff expected from the 100-year storm. However, an attempt to provide a separate emergency spillway should always be made. Base the runoff calculations on the site conditions during construction. The flow through the dewatering orifice cannot be utilized when calculating the 100-year storm elevation because of its potential to become clogged; therefore, available spillway storage must begin at the principal spillway riser crest.

The principal spillway designed by the procedures described below will result in some reduction in the peak rate of runoff. However, the design will not control the discharge flow rates to the extent required to comply with 2.4.6 CE6: Flow Control. The size of the contributing basin, the expected life of the construction project, the anticipated downstream effects, and the anticipated weather conditions during construction should be considered to determine the need for additional discharge control.

Principal Spillway: Determine the required diameter for the principal spillway (riser pipe). The diameter shall be the minimum necessary to pass the peak volumetric flow rate using a 10-minute time step from a 10-year, 24-hour frequency storm for the developed condition. Use Figure 7.32: Riser Inflow Curves to determine the riser diameter.

To aid in determining sediment depth, 1 foot intervals shall be prominently marked on the riser.

Emergency Overflow Spillway: Size the emergency overflow spillway for the peak volumetric flow rate using a 10-minute time step from a Type 1A, 100-year, 24-hour frequency storm for the developed condition. See BMP F6.10: Detention Ponds for additional guidance for Emergency Overflow Spillway design

Dewatering Orifice: Size the dewatering orifice(s) (minimum 1-inch diameter) using a modified version of the discharge equation for a vertical orifice and a basic equation for the area of a circular orifice. Determine the required area of the orifice with the following equation:

$$A_o = \frac{A_s * (2h)^{0.5}}{0.6 * 3600 * T * g^{0.5}}$$

where:

A_o = orifice area (square feet)

A_s = pond surface area (square feet)

h = head of water above orifice (height of riser in feet)

T = dewatering time (24 hours)

g = acceleration of gravity (32.2 feet/second^2)

Convert the orifice area (in square feet) to the orifice diameter D (in inches):

$$D = 24 \times \sqrt{\frac{A_o}{\pi}} = 13.54 \times \sqrt{A_o}$$

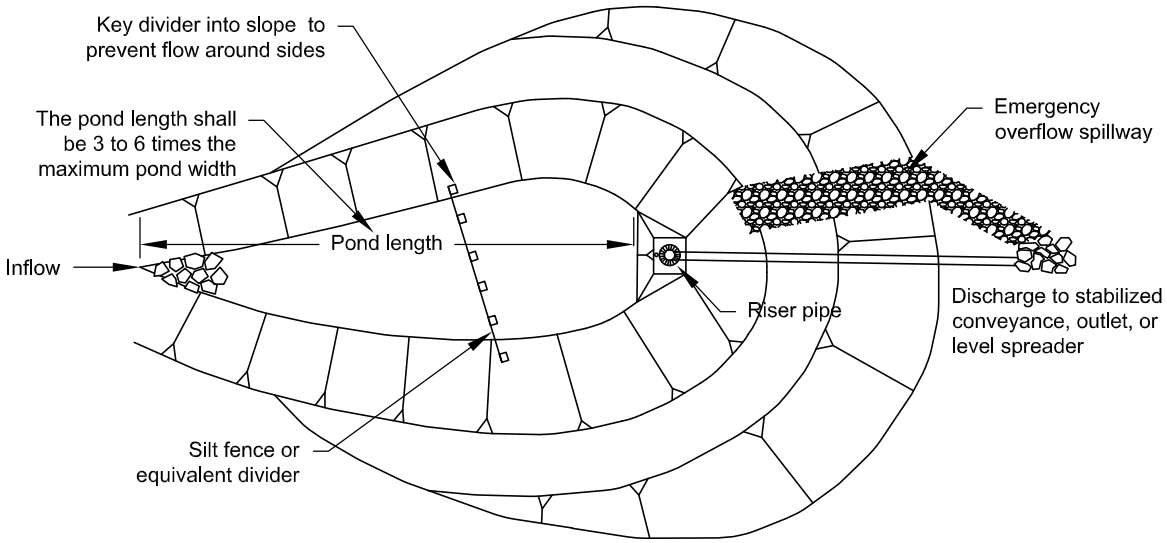
where:

D = orifice diameter (inches)

A_o = orifice area (sf)

The vertical, perforated tubing connected to the dewatering orifice must be at least 2 inches larger in diameter than the orifice to improve flow characteristics. The size and number of perforations in the tubing should be large enough so that the tubing does not restrict flow. The orifice should control the flow rate.

Figure 7.29: Sediment Pond Plan View



Note: Pond may be formed by berm or by partial or complete excavation

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Sediment Pond Plan View

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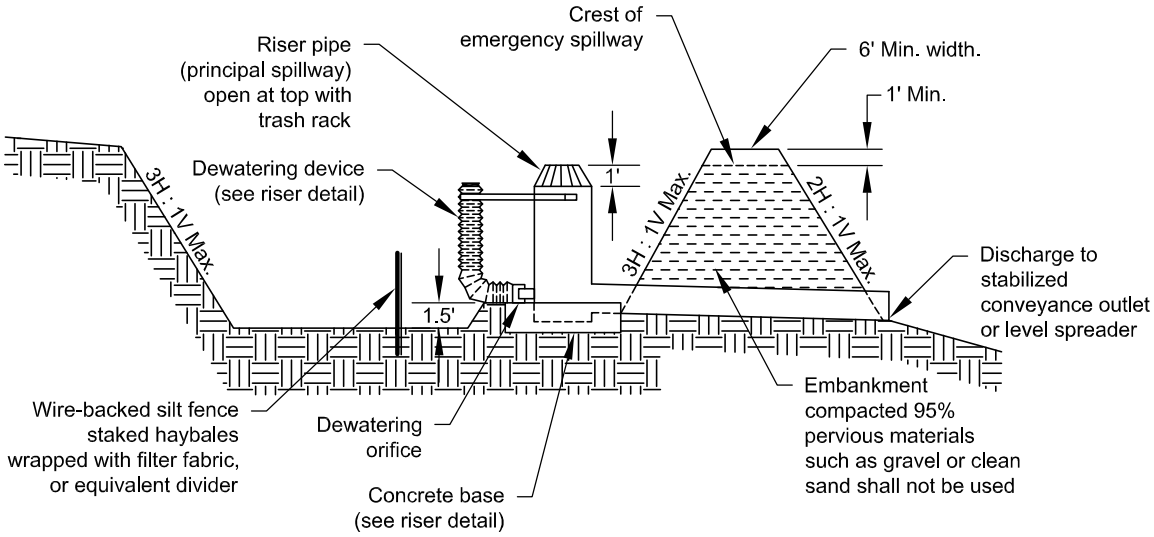
Figure 7.30: Sediment Pond Cross Section



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Sediment Pond Cross Section

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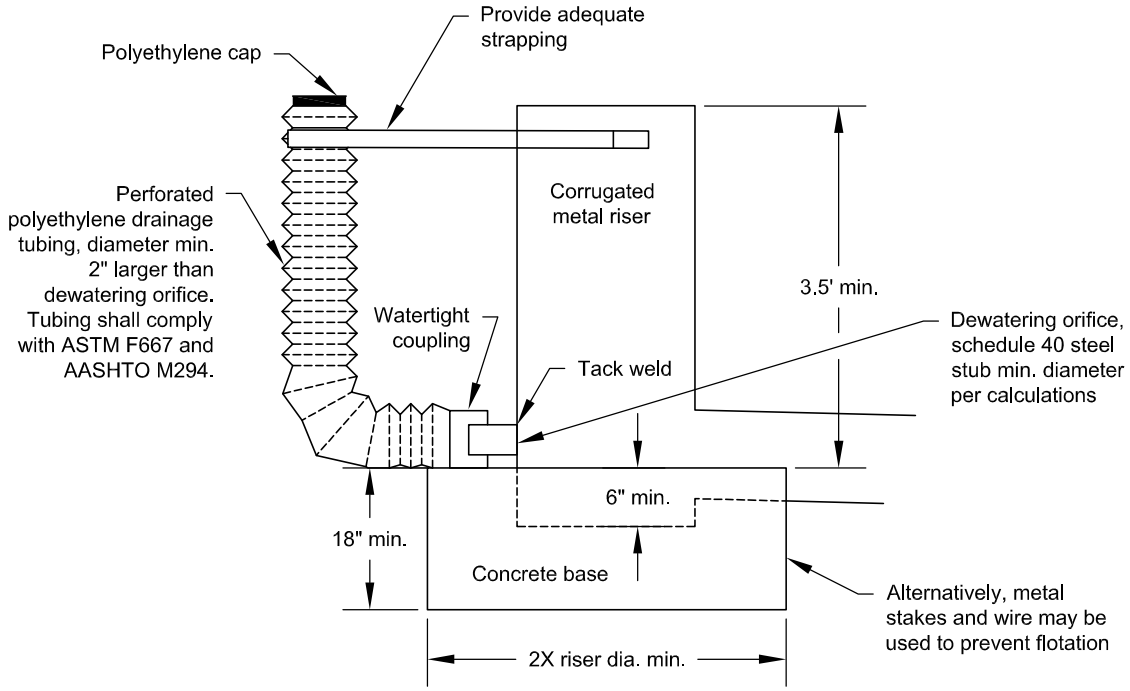
Figure 7.31: Sediment Pond Riser Detail



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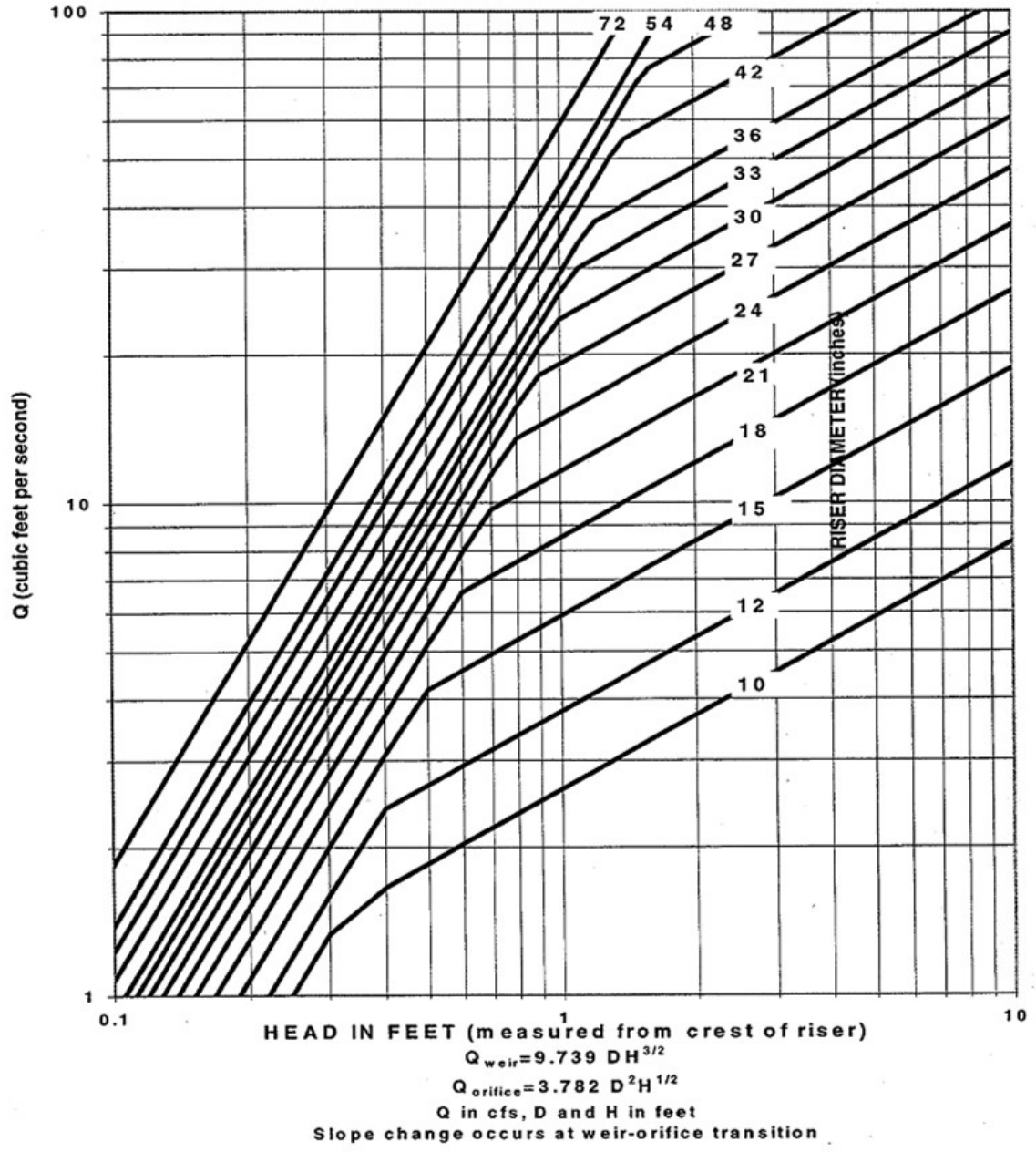
Sediment Pond Riser Detail

Revised June 2016

Figure 7.32: Riser Inflow Curves



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Riser Inflow Curves

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Maintenance Standards

- Remove sediment from the pond when it reaches 1 foot in depth.
- Repair any damage to the pond embankments or slopes.

Appendix C – Site Inspection Form

Construction Stormwater Site Inspection Form

Project Name Nixon Rpds Ln Permit # _____ Inspection Date _____ Time _____

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*
Print Name: _____

Approximate rainfall amount since the last inspection (in inches): _____

Approximate rainfall amount in the last 24 hours (in inches): _____

Current Weather Clear ☐ Cloudy ☐ Mist ☐ Rain ☐ Wind ☐ Fog ☐

A. Type of inspection: Weekly ☐ Post Storm Event ☐ Other ☐

B. Phase of Active Construction (*check all that apply*):

Pre Construction/installation of erosion/sediment controls	☐	Clearing/Demo/Grading	☐	Infrastructure/storm/roads	☐
Concrete pours	☐	Vertical Construction/buildings	☐	Utilities	☐
Offsite improvements	☐	Site temporary stabilized	☐	Final stabilization	☐

C. Questions:

1. Were all areas of construction and discharge points inspected? Yes ___ No ___
2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen Yes ___ No ___
3. Was a water quality sample taken during inspection? (*refer to permit conditions S4 & S5*) Yes ___ No ___
4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?* Yes ___ No ___
5. If yes to #4 was it reported to Ecology? Yes ___ No ___
6. Is pH sampling required? pH range required is 6.5 to 8.5. Yes ___ No ___

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

_____

_____

_____

_____

*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: Date: _____

Parameter	Method (circle one)	Result			Other/Note
		NTU	cm	pH	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required "details and dates.

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						
	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐
All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) _____ (Signature) _____ Date: _____

Title/Qualification of Inspector: _____

Appendix D – Engineering Calculations

Project: Nixon Rpds Ln in Chelan County

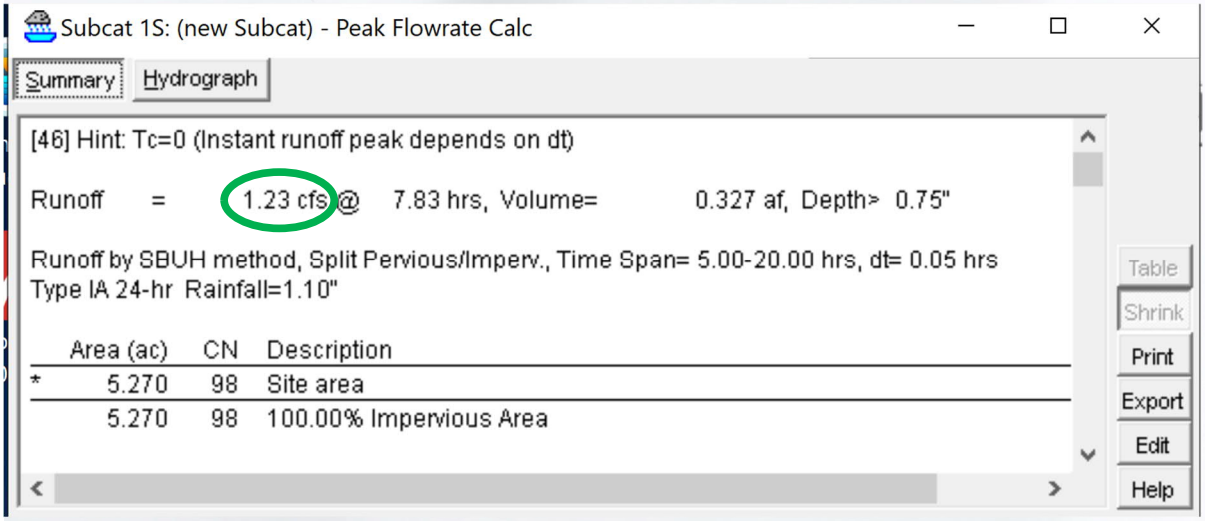
Sediment Pond calculation

$SA = \frac{2 \times Q_2}{0.00096}$

$Q_2 = 1.23$ CFS (using SBUH method), assuming entire site is impervious

$SA = 2,563$ SF (minimum surface area for sediment pond)

Proposed surface area = 2,640 SF > 2,563 SF ✓



APPENDIX E – OPERATION AND MAINTENANCE MANUAL

6.A.3 Maintenance Standards - Infiltration

Table 6.44: Maintenance Standards - Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See 6.A.2 Maintenance Standards - Detention Ponds	
	Poisonous/Noxious Vegetation	See 6.A.2 Maintenance Standards - Detention Ponds	

Table 6.44: Maintenance Standards - Infiltration (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Contaminants and Pollution	See 6.A.2 Maintenance Standards - Detention Ponds	
	Rodent Holes	See 6.A.2 Maintenance Standards - Detention Ponds	
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. (A percolation test pit or test of the pond indicates that the pond is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	Sediment is removed and/or pond is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Filled With Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See 6.A.2 Maintenance Standards - Detention Ponds	
Emergency Overflow Spillway and Berms over 4 feet in height	Tree Growth	See 6.A.2 Maintenance Standards - Detention Ponds	
	Piping	See 6.A.2 Maintenance Standards - Detention Ponds	
Emergency Overflow Spillway	Rock Missing	See 6.A.2 Maintenance Standards - Detention Ponds	
	Erosion	See 6.A.2 Maintenance Standards - Detention Ponds	
Pre-settling Ponds and Vaults	Facility of Sump Filled with Sediment and/or Debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

6.A.7 Maintenance Standards - Catch Basins

Table 6.48: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60% of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g. methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60% of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e. separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached.	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.

Table 6.48: Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
		Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth present.
	Contamination and Pollution	See 6.A.2 Maintenance Standards - Detention Ponds	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (if applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

6.A.20 Maintenance Standards - Catch Basin Inserts

Table 6.61: Maintenance Standards - Catch Basin Inserts

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.

6.A.29 Maintenance Standards - Post-Construction Soil Quality and Depth

Table 6.70: Maintenance Standards - Post-Construction Soil Quality and Depth

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Soil media (maintain high organic soil content)	A		Vegetation not fully covering ground surface or vegetation health is poor	• Maintain 2 to 3 inches of mulch over bare areas in landscape beds • Add plants if sufficient space • Re-seed bare turf areas until the vegetation fully covers ground surface
		Ongoing	None (routine maintenance)	Return leaf fall and shredded woody materials from the landscape to the site when possible in order to replenish soil nutrients and structure
		Ongoing	None (routine maintenance)	On turf areas, “grasscycle” (mulch-mow or leave the clippings) to build turf health
		Ongoing	None (routine maintenance)	Avoiding use of pesticides (bug and weed killers), like “weed & feed”, which damage the soil
		A	None (routine maintenance)	• Where fertilization is needed (mainly turf and annual flower beds), a moderate fertilization program should be used which relies on compost, natural fertilizers or slow-release synthetic balanced fertilizers • Follow IPM protocols for fertilization procedures

Table 6.70: Maintenance Standards - Post-Construction Soil Quality and Depth (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Soil media (maintain infiltration)	A[b]		Soils become waterlogged, do not appear to be infiltrating	• To remediate compaction, aerate soil, till to at least 8-inch depth, or further amend soil with compost and re-till • If areas are turf, aerate compacted areas and topdress them with 1/4 to 1/2 inch of compost to renovate them • If drainage is still slow, consider investigating alternative causes (e.g. high wet season groundwater levels, low permeability soils) • Also consider site use and protection from compacting activities
Erosion / Scouring	A, W, S		Areas of potential erosion are visible	• Identify and address cause of erosion (e.g. concentrate flow entering area, channelization of runoff) and stabilize damaged area (regrade, rock, vegetation, erosion control matting) • For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made.
Grass / Vegetation		A	Less than 75% of planted vegetation is healthy with a generally good appearance	• Take appropriate maintenance actions (e.g. remove/ replace plants) • If problem persists, evaluate if vegetation is appropriate for the location (e.g. exposure, soil, soil moisture)
Noxious weeds		M (March – October, preceding seed dispersal)	Listed noxious vegetation is present (refer to current county noxious weed list)	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately • Reasonable attempts must be made to remove and dispose of class C noxious weeds • Watch for and respond to new occurrences of especially aggressive weeds such as Himalayan blackberry, Japanese knotweed, morning glory, English ivy, and reed canary grass to avoid invasions • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions
Weeds		M (March – October, preceding seed dispersal)	Weeds are present	• Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate • Follow IPM protocols for weed management

Note that the inspection and routine maintenance frequencies listed above are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities".

a) Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

b) Inspection should occur during a storm event.

Table 6.70: Maintenance Standards - Post-Construction Soil Quality and Depth (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
IPM - Integrated Pest Management				
Source: (Herrera and WSC, 2013)				